LPS11

TEST #1

MD-11-DZLPC-C

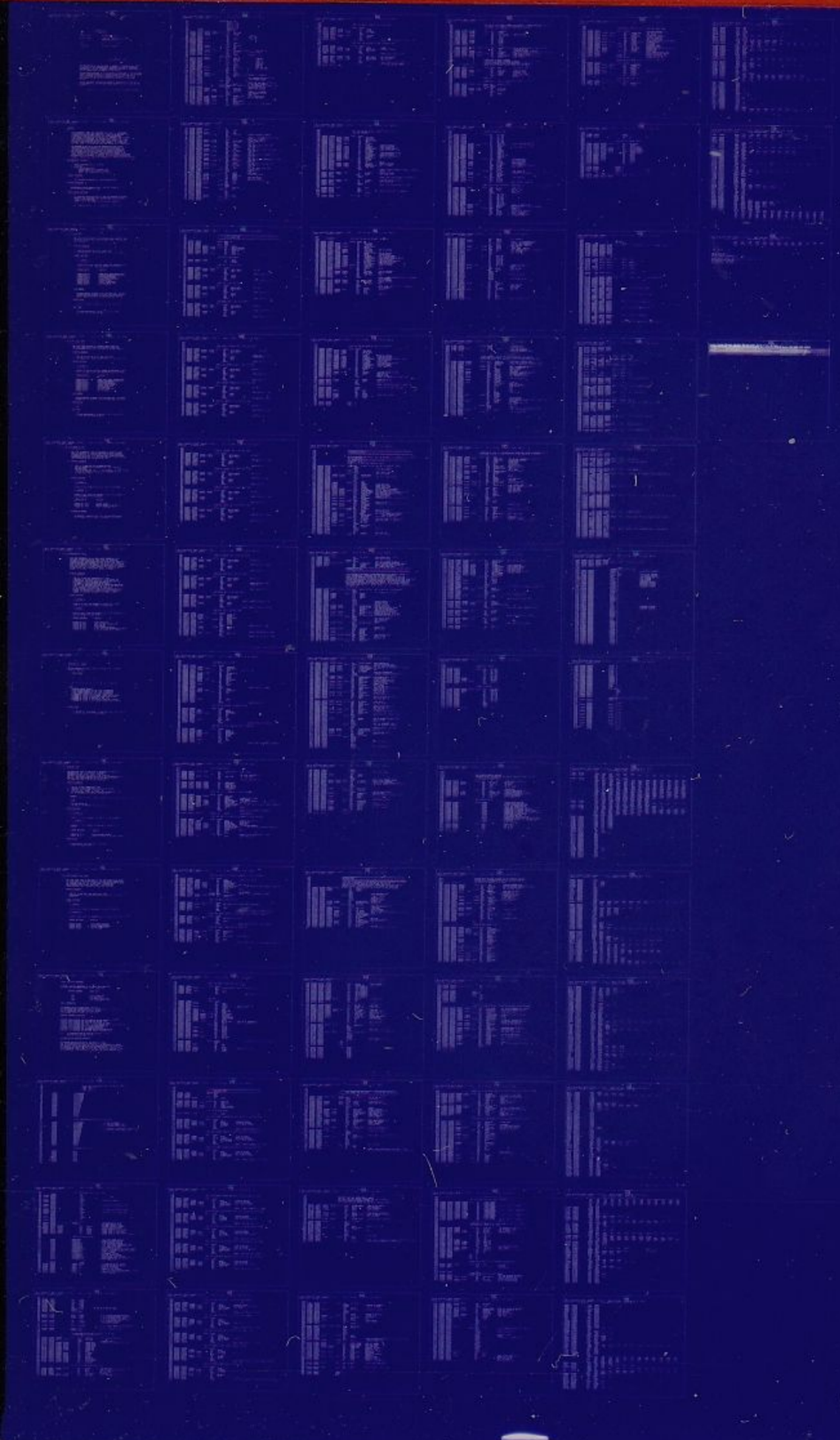
EP-DZLPS-C-DL-A

OCT 1976

FICHE 1 OF 1

digital

Made In U.S.A.



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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZLPC-C

PRODUCT NAME: LABORATORY PERIPHERAL SYSTEM
DIAGNOSTIC TEST I

DATE: MAY 21, 1976

MAINTAINER: DIAGNOSTIC GROUP

FIRST PRINTING, 1973

1. ABSTRACT

THIS DIAGNOSTIC TESTS AND EXERCISES THE "LPS-11". THE PROGRAM
IS SELF-STARTING AND WHEN LOADED WILL TYPE OUT THE PROGRAM TITLE.
A MESSAGE IS THEN PRINTED GIVING THE LETTER DESIGNATORS
TO BE TYPED TO RUN ANY ONE OF THE SIX (6) SEPERATE TESTS OF WHICH
THIS PROGRAM IS COMPRISED. THE PROGRAM THEN TYPES A 'CR .' AND
THEN WAITS IN A KEYBOARD MONITOR MODE FOR A LETTER TO BE TYPED.
ALTHOUGH THESE TESTS MAY BE RUN IN ANY ORDER IT IS IMPERATIVE
THAT THE 'LOGIC' TESTS ARE RUN FIRST AND PROVED FULLY OPERATIONAL.

THE PROGRAM IS SET UP TO GIVE THE OPERATOR AS MUCH CONTROL
OVER THE PROGRAM AS POSSIBLE VIA THE TELETYPE.TYPING A '↑C'
(OBTAINED VIA TYPING THE 'CNTR' AND 'C' KEYS SIMULTANEOUSLY)
WHILE RUNNING ANY TEST WILL ENABLE THE PROGRAM TO RETURN TO
THE KEYBOARD MONITOR AND AWAIT A NEW LETTER DESIGNATOR TO BE
TYPED. TYPING A '↑A' WHILE IN MONITOR MODE WILL ENABLE THE LETTER
DESIGNATORS TO BE RETYPED. IF RUNNING ON A NON-SWITCH REGISTER CPU,
TYPING A 'CTRL G' WILL ALLOW THE CHANGING OF A SOFTWARE SWITCH REGISTER.

2. REQUIREMENTS (EQUIPMENT)

A. PDP-11 COMPUTER WITH 4K OF MEMORY
B. TELETYPE
C. LPS11 OPTION BOX WITH:
    LPSAD12 SIMPLE A TO D CONTROL AND
    LPSADNP DMA A TO D CONTROL AND/OR
    LPSSH   DUAL SAMPLE AND HOLD CONTROL.

3. LOADING PROCEDURE

A. USE STANDARD PROCEDURE FOR LOADING BINARY TAPES.

4. STARTING PROCEDURE

THE PROGRAM IS SELF STARTING WITH A RESTART ADDRESS OF '174'
RE-INITALIZATION ADDRESS OF '200'.

5. CONSOLE SWITCH SETTINGS

A. ALL SWITCHES SHOULD BE DOWN (0) WHEN THE PROGRAM IS STARTED.
B. REFER TO THE INDIVIDUAL TEST DESCRIPTIONS FOR APPLICABLE
   CONSOLE SWITCH SETTINGS
C. REFER TO 15. FOR SOFTWARE SWITCH REGISTER OPERATION.

* TYPE 'CARRIAGE RETURN' (CR) TO TERMINATE ALL INPUT DATA.

6. A TO D LOGIC TEST

A. THE LOGIC TEST CONSISTS OF 26 SUBTESTS WHICH CHECK OUT THE 'LPS A TO D' LOGIC. EACH TEST IS LOOPED '2048' TIMES TO TEST LOGIC RELIABILTY.

B. STARTING SEQUENCE

1. TYPE 'A' TO RUN THE A TO D LOGIC' TEST.
2. THE PROGRAM WILL THEN EXECUTE THE A TO D LOGIC TEST.

C. CONTROL SWITCHES

1. ↑C (CONTROL C)

TYPING A ↑C AT ANY TIME WILL ENABLE THE PROGRAM TO EXIT THE 'A TO D LOGIC' TEST AND RETURN TO THE MONITOR.

2.

CONSOLE SWITCH	FUNCTION
CONSOLE SW11=0	NORMAL RUN (2048 PASSES/TEST)
CONSOLE SW11=1	SUPPRESS SUBPROGRAM ITERATIONS
CONSOLE SW13=0	PRINT ERROR MESSAGE
CONSOLE SW13=1	INHIBIT ERROR MESSAGES
CONSOLE SW14=1	RUN SCOPE MODE
CONSOLE SW14=0	INHIBIT SCOPE MODE
CONSOLE SW15=0	CONTINUE AFTER ERROR
CONSOLE SW15=1	HALT ON ERROR

D. LOGIC ERRORS

ON ENCOUNTERING AN ERROR (DATA SWITCHES DOWN) THE ERROR ADDRESS AND THE CONTENTS OF THE A/D STATUS REGISTER AND A/D BUFFER AND DMA STATUS REGISTER ARE TYPED OUT.

E. RESTRICTIONS

DO 'NOT' CONNECT EXTERNAL SYNC FOR THE LOGIC TEST.

F. TEST TIME

IT TAKES APPROXIMATELY 90 SEC. TO RUN THE LOGIC TEST AND RING THE TELETYPE BELL.

7. A TO D DMA LOGIC TEST

A. THE LOGIC TEST CONSISTS OF 18 PARTS WHICH CHECK OUT THE LOGIC USED ONLY IN THE DIRECT MEMORY ACCESS MODE. IT IS IMPORTANT THAT THE A TO D BASIC LOGIC TEST ALSO RUN

B. STARTING SEQUENCE

1. TYPE 'B' TO RUN THE A TO D DMA LOGIC TEST.
2. THE PROGRAM WILL THEN EXECUTE THE A TO D DMA LOGIC TEST.

C. CONTROL SWITCHES

1. ↑C (CONTROL C)

TYPING A ↑C AT ANY TIME WILL ENABLE THE PROGRAM TO EXIT THE 'A TO D DMA LOGIC' TEST AND RETURN TO THE MONITOR.

2.

CONSOLE SWITCH	FUNCTION
CONSOLE SW11=0	NORMAL RUN (2048) PASSES/TEST)
CONSOLE SW11=1	SUPRESS SUBPROGRAM INTERATIONS
CONSOLE SW13=0	PRINT ERROR MESSAGE
CONSOLE SW13=1	INHIBIT ERROR MESSAGES
CONSOLE SW14=0	INHIBIT SCOPE MODE
CONSOLE SW14=1	RUN SCOPE MODE
CONSOLE SW15=0	CONTINUE AFTER ERROR
CONSOLE SW15=1	HALT ON ERROR

D. LOGIC ERRORS

ON ENCOUNTERING AN ERROR (DATA SWITCHES DOWN) THE ERROR ADDRESS AND THE CONTENTS OF THE DMA REGISTER ARE TYPED OUT.

E. RESTRICTIONS

NONE

F. TEST TIME

IT TAKES APPROXIMATELY 10 SECONDS TO RUN THE DMA LOGIC TEST AND RING THE TELETYPE BELL.

B. A TO D CALIBRATION TEST

A. THE 'A/D CALIBRATION' TEST IS DESIGNED TO ACCEPT AN INPUT FROM THE TELETYPE TO INDICATE THE TYPE OF SYNC (EXTERNAL, INTERNAL OR LPS CLOCK TO BE USED AND THEN TAKES CONTINUOUS CONVERSIONS USING THE 'CH.' SELECTED VIA THE CONSOLE SWITCHES. THESE SETTINGS MAY BE CHANGED AT ANY TIME.

B. STARTING SEQUENCE

1. TYPE 'C' TO RUN THE A/D CALIBRATION TEST.
2. THE TEST HEADER PLUS A REQUEST FOR A SYNC TYPE WILL THEN BE TYPED.
3. TYPE IN THE DESIRED SYNC, 'I' FOR INTERNAL, 'E' FOR EXTERNAL 'C' FOR LPS CLOCK (IF INSTALLED) FOLLOWED BY 'CR'.
4. THE TEST WILL START.

C. CONTROL SWITCHES

1. ↑A (CONTROL A)

TYPING ↑A WILL ENABLE A NEW SYNC TYPE TO BE ENTERED.

2. ↑C (CONTROL C)

TYPING ↑C WILL CAUSE THE PROGRAM TO EXIT THE CALIBRATION TEST AND RETURN TO THE MONITOR.

3.

CONSOLE SWITCH	FUNCTION
CONSOLE SW '0-5'	CHANNEL SELECT
CONSOLE SW '10=0'	DISPLAY VALUE IN LED DISPLAY
CONSOLE SW '10=1'	PRINT CONVERSION VALUE

D. CALIBRATION ERRORS

THE PRINTOUT 'ERROR BIT SET' WILL OCCUR WHILE RUNNING WITH EXTERNAL SYNC IF THE SYNC FREQUENCY IS TO FAST.

9. A TO D REPEATIBILITY TEST

A. THIS TEST REQUESTS A CH.(S) AND A COUNT SPREAD OF '1-4'
AND MODE OF OPERATION TO BE TYPED IN BY THE OPERATOR.
A SERIES OF'512' CONVERSIONS ARE THEN TAKEN ON THE INPUT CH.(S)
CONVERSIONS ARE THEN AVERAGED OUT AND IF THE COUNT SPREAD IS
FOUND TO BE GREATER THAN REQUEST, THE RESULTS OF THE CONVER-
SIONS ARE TYPED OUT. A SINGLE CHANNEL OR A SERIES OF CHANNELS
MAY BE TESTED VIA TYPING EITHER 'N(CR)' TO SELECT A SINGLE
CHANNEL OR 'N,N(CR)' TO TEST A SERIES OF CHANNELS.

B. STARTING SEQUENCE

1. TYPE 'D' TO RUN THE 'REPEATIBILITY' TEST.
2. A REQUEST IS THEN MADE FOR CH.(S) TO BE TESTED AND
COUNT SPREAD (RANGE IN WHICH ALL 512 COUNTS MUST FALL
FOR THE CH. TO BE CONSIDERED ACCEPTABLE).
3. A REQUEST IS THEN MAKE FOR MODE OF OPERATION (NPR OR BR)
TYPE 'I' FOR PROGRAM SAMPLING OR TYPE 'B' FOR BURST NPR
OR 'D' FOR DUAL MODE SAMPLING IF INSTALLED.
4. IF THE CHANNEL IS FOUND TO BE WITHIN THE SELECTED COUNT
SPREAD, THE PROGRAM WILL EITHER CONTINUE TO THE NEXT
CHANNEL IF SELECTED OR RETEST THE CURRENT CHANNEL.

C. CONTROL SWITCHES

1. ↑A (CONTROL A)

TYPING A ↑A WHILE THE PROGRAM IS RUNNING WILL ENABLE
A NEW CH.(S) AND COUNT SPREAD TO BE SELECTED.

2. ↑C (CONTROL)

TYPING ↑C WILL CAUSE THE PROGRAM TO EXIT THE 'REPEATIBILITY'
TEST AND RETURN TO THE MONITOR.

3.

CONSOLE SWITCHES	FUNCTION
CONSOLE SW 10=0	PRINT ERRORS ONLY
CONSOLE SW 10=1	PRINT OUT ALL CONVERSIONS
CONSOLE SW 13=0	PRINT ERRORS
CONSOLE SW 13=1	INHIBIT ERROR PRINTOUTS
CONSOLE SW 15=0	DO NOT HALT UPON REPEATIBILITY REPORT
CONSOLE SW 15=1	HALT UPON REPEATIBILITY REPORT

D. REPEATIBILITY ERRORS

ON ENCOUNTERING AN ERROR (CONSOLE SWITCHES DOWN) THE ERROR DATA IS TYPED OUT.

1. ERROR FORMAT

CH.	HI	AV	LO
A	B	C	D

LO	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	HI
E	F	G	H	I	J	K	L	M	N	O	P	Q

WHERE:
A=CHANNEL BEING TESTED
B=THE HIGHEST READING OF THE '512' CONVERSIONS
C=THE AVERAGE READING OF THE '512' CONVERSIONS
D=THE LOWEST READING OF THE '512' CONVERSIONS
E=NUMBER OF COUNTS 'OUT OF RANGE' LOWER THAN 5 COUNTS
F-J=NUMBER OF COUNTS IN EACH PART LOWER THAN AVERAGE.
K=NUMBER OF COUNTS AT AVERAGE OF THE '512'
L-P=NUMBER OF COUNTS IN EACH PART HIGHER THAN AVERAGE.
Q=NUMBER OF COUNTS 'OUT OF RANGE' HIGHER THAN 5 COUNTS

E. RESTRICTIONS

1. IF A SECOND CH. IS ENTERRED, IT MUST BE LARGER THAN THE FIRST CH. OR THE INPUT WILL NOT BE ACCEPTED.

10. A TO D RECOVERY TEST

A. THE "RECOVERY TEST" IS DESIGNED TO DETERMINE THE RECOVERY CAPABILITY OF THE 'LPS A TO D'. THE TEST REQUESTS FOR TWO (2) CH. INPUTS TO BE TYPED IN. THE TEST THEN TAKES A SERIES OF SIXTEEN (16) CONVERSIONS (8 ON EACH CH.) AND THEN TYPES OUT THE '8' CONVERSION VALUES IN THE ORDER THEY WERE TAKEN ON THE SECOND CH.

B. STARTING SEQUENCE

1. TYPE 'E' TO RUN THE RECOVERY TEST.
2. A REQUEST IS THEN MADE FOR THE CH.S TO BE TESTED.
3. TYPE 'N,N (CR)' WHERE 'N' IS ANY CH.
4. THE PROGRAM WILL THEN TAKE CONTINUOUS CONVERSIONS TYPING OUT THE CONVERSION VALUES FOR THE SECOND CH.

EXAMPLE:
CH. A XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX XXXXXX

WHERE:

A=TO THE SECOND CH.
X=TO THE '8' CONVERSIONS TAKEN ON THAT CH.

C. CONTROL SWITCHES

1. ↑A (CONTROL A)

TYPING A '↑A' WILL ENABLE A NEW SET OF CH.S BE ENTERED.

2. ↑ C (CONTROL C)

TYPING A '↑C' WILL ENABLE THE PROGRAM TO RETURN TO THE MONITOR.

3.

CONSOLE SWITCHES	FUNCTION
CONSOLE SW 10 = 0	PRINT RECOVERY REPORT
CONSOLE SW 10 = 1	INHIBIT PRINTING OF RECOVERY REPORT

D. RESTRICTIONS

DO NOT EXECUTE THIS TEST IF THE WIDE BAND JUMPERS HAVE BEEN REMOVED.

11. DUAL MODE DYNAMIC LOGIC TEST

A. THE 'DUAL MODE' TEST IS DESIGNED TO TEST THE DYNAMIC DUAL SAMPLE AND HOLD LOGIC OF THE LPS. A SAMPLE IS TAKEN FROM A CHANNEL PAIR (IE. CHANNEL 0 AND 10) NOT IN DUAL MODE. ANOTHER SAMPLE IS TAKEN FROM A CHANNEL PAIR USING 'DUAL MODE'. THE RESULTING CONVERSIONS ARE THEN COMPARED FOR VALUE AND SIMILARITY.

B. STARTING SEQUENCE

1. TYPE 'F' TO RUN THE 'DUAL MODE LOGIC TEST'.
2. THE PROGRAM WILL THEN EXECUTE THE DUAL MODE TEST ON CHANNEL PAIRS 0-3.

C. CONTROL SWITCHES

1. ↑C (CONTROL C)

   TYPING ↑C WILL CAUSE THE PROGRAM TO EXIT TO THE MONITOR.

2. ↑A (CONTROL A)

   TYPING ↑A WILL CAUSE THE RESTARTING OF THE DUAL MODE LOGIC TEST.

3.

CONSOLE SWITCHES	FUNCTION
CONSOLE SW13=0	PRINT ERROR MESSAGES
CONSOLE SW13=1	INHIBIT ERROR MESSAGES
CONSOLE SW15=0	CONTINUE AFTER ERROR
CONSOLE SW15=1	HALT ON ERROR

12. MANUAL STARTING ADDRESSES

EXTERNAL STARTING ADDRESSES OF THE BASIC TEST HAVE BEEN
PROVIDED FOR THE USER TO MANUAL START THESE TESTS.

STARTING ADDRESS	BASIC TEST
204	A TO D LOGIC TEST
210	DMA LOGIC TEST
214	DUAL SAMPLE LOGIC TEST
220	A TO D CALIBRATION TEST

13. MISC. INFORMATION

THE PROGRAM CAN BE CHAINED UNDER XXDP/ACT-11
IF THE PROGRAM WAS LOADED FROM ACT-11 OR DDP, THE A TO D LOGIC TEST
AND (IF INSTALLED) DMA LOGIC TEST WILL BE RUN.
THIS PROGRAM DOES NOT HAVE THE "APT" HOOKS.

14. OPERATOR VARIABLE LOCATIONS

LOCATION 1000 CONTAINS THE LPS STARTING DEVICE ADDRESS <170400>
LOCATION 1002 CONTAINS THE LPS STARTING VECTOR <340>
LOCATION 1004 CONTAINS THE LPS A TO D BR LEVEL <6><300>
LOCATION 1010 CONTAINS THE + OR - 37 COUNT SPREAD FOR THE DUAL SAMPLE TEST.
LOCATION 1012 CONTAINS THE TTY FILLER CHARACTER COUNT
LOCATION 1014 CONTAINS THE TTY FILLER CHARACTER
LOCATION 170 CONTAINS THE SOFTWARE SWITCH REGISTER VALUE
LOCATION 172 CONTAINS THE SOFTWARE DISPLAY REGISTER VALUE.

NOTE: IF LOCATIONS 1000 OR 1002 ARE CHANGED, THE TEST
       MUST BE RE-INITILIZED AT 200.

15. SOFTWARE SWITCH REGISTER OPERATION

THE PROGRAM SUPPORTS NON-SWITCH REGISTER CPU TYPES.
THIS IS ACCOMPLISHED BY TYPING A "CTRL G". THE RESPONSE WILL REPORT
THE VALUE OF THE OLD SOFTWARE SWITCH REGISTER AND WAIT FOR A NEW VALUE.
THE OPERATOR NOW INPUTS THE NEW VALUE AND TERMINATES IT WITH A "CR".
IF THE OPERATOR TYPES A "CR" WITH NO INPUT, THE SWITCH REGISTER IS SET TO 0.
UPON TERMINATING, THE PROGRAM WILL RESUME RUNNING THE APPROPATE TEST.

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                                        .TITLE LPS-11 DIAGNOSTIC TEST I MAINDEC-11-DZLPC-C
                                        .ENABL  ABS,AMA
                                        .LIST   ME
                                        .NLIST  MD,MC,CND

            100000              BIT15=100000
            040000              BIT14=40000
            020000              BIT13=20000
            010000              BIT12=10000
            004000              BIT11=4000
            002000              BIT10=2000
            001000              BIT9=1000
            000400              BIT8=400
            000200              BIT7=200
            000100              BIT6=100
            000040              BIT5=40
            000020              BIT4=20
            000010              BIT3=10
            000004              BIT2=4
            000002              BIT1=2
            000001              BIT0=1

                                ;SWITCH REGISTER DEFINITIONS AND FUNCTIONS:

            100000              SW15=100000                 ;=1, HALT ON ERROR
            040000              SW14=40000                  ;=1, LOOP ON CURRENT TEST
            020000              SW13=20000                  ;=1, SUPPRESS ERROR TYPEOUT
            010000              SW12=10000
            004000              SW11=4000                   ;=1, SUPPRESS 'SUBPROGRAM' ITERATIONS
            002000              SW10=2000                   ;=1, FORCE TYPEOUT (REPEATIBILITY)
            001000              SW09=1000
            000400              SW08=400
            000200              SW07=200
            000100              SW06=100
            000040              SW05=40
            000020              SW04=20
            000010              SW03=10
            000004              SW02=4
            000002              SW01=2
            000001              SW00=1

                                ;REGISTER DEFINITIONS

            000000              R0=%0
            000001              R1=%1
            000002              R2=%2
            000003              R3=%3
            000004              R4=%4
            000005              R5=%5
            000006              SP=%6
            000007              PC=%7
```

```
                                        ;LOAD TRAP CATCHER INTO LOC'S 0-1000
                 000000                         .=0
000000  000000                                  HALT
000002  000000                                  HALT
                 000024                         .=24
000024  011676                                  PWRFAL                  ;POWER FAIL HANDLER
000026  000340                                  340
                 000060                         .=60
000060  010414                                  XTTYIN                  ;TELEPRINTER KEYBOARD ROUTINE
000062  000340                                  340
                 000030                         .=30
000030  011776                                  EMTSRV                  ;EMT TRAP, EMT DISPATCH SERVICE
000032  000340                                  340
000034  013304                                  LOGERR                  ;TRAP TRAP, LOGIC ERROR TRAP
000036  000340                                  340
                 000046                         .=46
000046  001740                                  LOGICAL
                 000052                         .=52
000052  000000                                  0
                 000170                         .=170
000170  000000                          SOFTSW: 0                       ;SOFTWARE SWITCH VALUE
000172  000000                          SOFTDI: 0                       ;SOFTWARE DISPLAY VALUE
000174  000137  001426                          JMP     MONITR          ;PROGRAM 'RESTART' ADDRESS
000200  000137  001060                          JMP     INIT            ;INITIALIZATION ADDRESS
000204  000137  001764                          JMP     ADTEST          ;MANUAL START OF A TO D LOGIC
000210  000137  004050                          JMP     DMATST          ;MANUAL START OF DMA LOGIC
000214  000137  007504                          JMP     DSHTST          ;MANUAL START OF DUAL SAMPLE
000220  000137  006004                          JMP     MANCAL          ;MANUAL START OF THE A TO D CALIBRATION

                                        ;TRAP EQUIVALENCE TABLE:

                 104400                 ERROR=TRAP                      ;LOGIC TEST ERROR ROUTINE
                 104000                 PRINT=EMT                       ;MESSAGE PRINTER ROUTINE
                 104001                 DECOCT=EMT+1                    ;OCTAL CONVERSIN ROUTINE
                 104002                 SCOPE=EMT+2                     ;LOGIC TEST SCOPE SUBROUTINE (4000)
                 104003                 SCOPE1=EMT+3                    ;LOGIC TEST SCOPE SUBROUTINE (10)
                 104004                 CMPUTE=EMT+4                    ;A/D AVERAGING ROUTINE
                 104005                 CATORIZ=EMT+5                   ;ROUTINE TO CALCULATE THE COUNT SPREAD
                 104006                 BINDEC=EMT+6                    ;BINARY TO DECIMAL CONVERSION ROUTINE
                 104007                 SPACE=EMT+7                     ;TYPE 'N' SPACES
                 104010                 PRTOCT=EMT+10                   ;OCTAL PRINT ROUTINE
                 104011                 TTYIN=EMT+11                    ;TELETYPE INPUT ROUTINE
                 104012                 PRTAVG=EMT+12                   ;GAIN AVERAGE PRINT ROUTINE
                 104013                 TSTTKS=EMT+13                   ;SUBROUTINE TO TEST FOR KEYBOARD FLAG
                 104014                 SCOPE0=EMT+14                   ;SCOPE SUBROUTINE (1)

                 001000                         .=1000
001000  170400                          LPSADD: 170400                  ;LPS STARTING DEVICE ADDRESS
001002  000340                          LPSVCT: 340                     ;LPS STARTING DEVICE VECTOR
001004  000300                          ADBRL:  300                     ;LPS A TO D BR LEVEL
001006  000001                          PDPDLY: 1                       ;CHANGED BY THE PROGRAM
001010  000037                          AMASK:  37                      ;+ OR - 37 COUNTS FOR DUAL SAMPLE LOGIC TEST
001012  000002                          FILLS:  2                       ;NUMBER OF FILLER CHARS AFTER LF
001014  000000                          FILCHR: 0                       ;FILLER CHARACTER
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```
                                PSW:    177776
                                TKS:    177560
                                TKB:    177562
                                TPS:    177564
                                TPB:    177566
                                SWR:    177570          ;OR 170 IF NO SWR CPU TYPE
                                DISPLA: 177570          ;OR 172 IF NO SWR CPU TYPE
                                PASSCT: 0
                                ICOUNT: 4000

                                ADCS:   170400                  ;A TO D STATUS/CONTROL REGISTER
                                ADCS1:  170401                  ;A TO D STATUS REGISTER <HIGH BYTE>
                                ADDBR:  170402                  ;A TO D CONVERTED VALUE <READ>
                                                                ;A TO D LED DISPLAY LIGHTS <WRITE>
                                CSR:    170404                  ;CLOCK STATUS REGISTER
                                CSB:    170406                  ;CLOCK PRESET BUFFER

                                ADMR:   170436                  ;A TO D DIRECT MEMORY ACCESS ADDRESS

                                ADINT:  340                     ;A TO D INTERRUPT VECTOR
                                ADINT1: 342                     ;

                                ;THIS ROUTINE IS EXECUTED ON LOADING THE PROGRAM
                                ; OR RESTARTING AT LOCATION 174

001060  013706  015444  INIT:   MOV     STACK,SP        ;INIT STACK POINTER=1000
001064  012777  000340  177724  MOV     #340,@PSW
001072  000005                  RESET                   ;CLEAR THE WORLD
001074  013737  001000  001040  MOV     LPSADD,ADCS     ;HOUSEKEEP THE ADDRESS AND VECTOR
001102  013737  001000  001042  MOV     LPSADD,ADCS1
001110  013737  001000  001044  MOV     LPSADD,ADDBR
001116  013737  001000  001046  MOV     LPSADD,CSR
001124  013737  001000  001050  MOV     LPSADD,CSB
001132  013737  001000  001052  MOV     LPSADD,ADMR
001140  005237  001042          INC     ADCS1
001144  062737  000002  001044  ADD     #2,ADDBR
001152  062737  000004  001046  ADD     #4,CSR
001160  062737  000006  001050  ADD     #6,CSB
001166  062737  000036  001052  ADD     #36,ADMR
001174  013737  001002  001054  MOV     LPSVCT,ADINT
001202  013737  001002  001056  MOV     LPSVCT,ADINT1
001210  062737  000002  001056  ADD     #2,ADINT1

                                ;NOW TEST IF A SWITCH REGISTE EXISTS

001216  012737  001232  000004          MOV     #1$,@#4         ;LOAD BUS TRAP
001224  005777  177600                  TST     @SWR            ;TEST IF REAL SWITCH REGISTER
001230  000407                          BR      CPUTYP          ;BR IF NO TRAP
001232  022626                  1$:     CMP     (SP)+,(SP)+     ;POP STACK
001234  012737  000170  001030          MOV     #170,SWR        ;CHANGE POINTER TO LOC. 170
001242  012737  000172  001032          MOV     #172,DISPLA     ;       AND 172
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```
                                        ;DETERMINE CPU TYPE
                                        ;       R0=3 IF 11/45
                                        ;       R0=2 IF 11/40
                                        ;       R0=1 IF 11/20
                                        ;       R0=0 IF 11/05
                 177772                 PIRQ=177772
                 177776                 PS=177776
001250  012737  000002  000006  CPUTYP: MOV     #RTI,@#6
001256  012737  000006  000004          MOV     #6,@#4
001264  012700  000003                  MOV     #3,R0           ;LOAD R0
001270  000261                          SEC                     ;SET C BIT
001272  005737  177772                  TST     @#PIRQ          ;TEST PIRQ
001276  005600                          SBC     R0
001300  000261                          SEC
001302  105737  177777                  TSTB    @#PS+1
001306  005600                          SBC     R0
001310  005037  177700                  CLR     @#177700
001314  005037  000006                  CLR     @#6
001320  006300                          ASL     R0
001322  016037  012070  012100          MOV     CPDLAY(R0),CPTIME       ;GET TIME DELAY
001330  010037  001006                  MOV     R0,PDPDLY       ;LOAD CPU DELAY
001334  001002                          BNE     1$
001336  005237  001006                  INC     PDPDLY          ;UPDATE IT
                                        ;TRAP CATCHER
001342  012702  000242          1$:     MOV     #242,R2                 ;LOAD R2
001346  012701  000240                  MOV     #240,R1                 ;LOAD R1
001352  010221                  5$:     MOV     R2,(R1)+                ;LOAD .+2
001354  005021                          CLR     (R1)+                   ;LOAD HALT
001356  010102                          MOV     R1,R2                   ;LOAD R2
001360  005722                          TST     (R2)+                   ;BUMP R2
001362  020227  001002                  CMP     R2,#1002                ;TEST FOR LAST
001366  001371                          BNE     5$                      ;BR UNTIL DONE
001370  005737  000042                  TST     @#42
001374  001402                          BEQ     .+6
001376  000137  001454                  JMP     INIT2
001402  012777  000100  177410          MOV     #100,@TKS       ;ENABLE TTY INTERUPTS
001410  005037  015442                  CLR     PRINT1
001414  104000                          PRINT                   ;CALL MESSAGE PRINTER VIA 'EMT'
001416  014012                          TITLE                   ;TYPE PROGRAM HEADER.
001420  104000                  INITA:  PRINT
001422  014133                          MES4                    ;PRINT THE TEST CALL LETTERS.
001424  000413                          BR      INIT2           ;GO AND AWAIT COMMAND.
                                        ;MONITOR SUBROUTINE. ENTER VIA 'C' OR A RESTART AT LOCATION '200'.
001426  000005                  MONITR: RESET                   ;INITIALIZE ON ENTRY
001430  013706  015444                  MOV     STACK,SP        ;RESET STACK POINTER
001434  012777  000340  177354          MOV     #340,@PSW
001442  012777  000100  177350          MOV     #100,@TKS       ;ENABLE TTY INTERRUPTS
001450  104000                          PRINT                   ;CALL MESSAGE PRINTER
001452  014432                          CNTRLC                  ;TYPE '^C'
001454  012737  011676  000024  INIT2:  MOV     #PWRFAL,@#24    ;SET UP POWER FAIL
001462  012737  000006  000004          MOV     #6,@#4          ;SET UP BUSS ERROR
001470  005037  000006                  CLR     @#6
001474  013777  001056  177352          MOV     ADINT1,@ADINT
001502  005077  177350                  CLR     @ADINT1
001506  012737  001420  015446          MOV     #INITA,AVECTR   ;SET UP '^A' VECTOR ADDRESS.
001514  004537  013664                  JSR     R5,LEDS
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                                                6
001520  000006                                  TST     @#42
001522  005737  000042                          BEQ     .+6
001526  001402                                  JMP     WHAT
001530  000137  001674                          MOV     #100,@TKS       ;ENABLE KEYBOARD INTERRUPT
001534  012777  000100  177256                  PRINT
001542  104000                                  DOT                     ;PRINT '.' TO INDICATE MONITOR READY
001544  014472                                  TTYIN                   ;WAIT FOR TTY ENTRY
001546  104011                                  BIC     #BIT5,INBUF     ;CLEAR LOWER CASE BIT
001550  042737  000040  011032                  CMPB    #'A,INBUF       ;TEST FOR 'A'
001556  122737  000101  011032                  BNE     .+6             ;NOT 'A
001564  001002                                  JMP     ADTEST          ;YES, RUN 'A TO D LOGIC' TEST
001566  000137  001764                          CMPB    #'B,INBUF       ;TEST FOR 'B'
001572  122737  000102  011032                  BNE     .+6             ;NOT 'B'
001600  001002                                  JMP     DMATST          ;YES, RUN 'A TO D DMA LOGIC TEST'
001602  000137  004050                          CMPB    #'C,INBUF       ;TEST FOR 'C'
001606  122737  000103  011032                  BNE     .+6             ;NOT 'C'
001614  001002                                  JMP     CALBRT          ;YES, RUN 'A TO D CALIBRATION' TEST
001616  000137  005742                          CMPB    #'D,INBUF       ;TEST FOR 'D'
001622  122737  000104  011032                  BNE     .+6             ;NOT 'D'
001630  001002                                  JMP     REPTST          ;YES, RUN 'A TO D REPEATABILITY' TEST
001632  000137  006252                          CMPB    #'E,INBUF       ;TEST FOR 'E'
001636  122737  000105  011032                  BNE     .+6             ;NOT 'E'
001644  001002                                  JMP     RECVRY          ;YES RUN 'A TO D RECOVERY TEST
001646  000137  007070                          CMPB    #'F,INBUF       ;TEST FOR 'F'
001652  122737  000106  011032                  BNE     .+6             ;NOT 'F'
001660  001002                                  JMP     DSHTST          ;YES, RUN 'DUAL MODE' TEST
001662  000137  007504                  INIT3:  PRINT                   ;ILLEGAL ENTRY
001666  104000                                  QMARK                   ;TYPE '?'
001670  014475                                  BR      INIT2           ;WAIT AGAIN
001672  000670                          WHAT:   CLR     NODMA           ;CLEAR DMA POINTER
001674  005037  001762                          MOV     #WHAT1,@#4
001700  012737  001754  000004                  CLR     @ADMR           ;TEST DMA OPTION
001706  005077  177140                          JMP     ADTST1          ;RUN A TO D TEST
001712  000137  001770                  WHATA:  TST     NODMA           ;TEST FOR DMA OPTION
001716  005737  001762                          BNE     .+6
001722  001002                                  JMP     DMA01
001724  000137  004054                  WHATB:  RESET
001730  000005                                  RESET
001732  000005                                  MOV     @#42,R0
001734  013700  000042                  LOGICAL:        JSR     PC,(0)
001740  004710                                  NOP
001742  000240                                  NOP
001744  000240                                  NOP
001746  000240                                  JMP     WHAT
001750  000137  001674                  WHAT1:  COM     NODMA
001754  005137  001762                          RTI
001760  000002                          NODMA:  0
001762  000000
```

```
                                ;*****************************************************************
                                ;       A TO D LOGIC TEST
                                ;*****************************************************************

001764  104000                  ADTEST: PRINT
001766  014500                          MESS
001770  000005                  ADTST1: RESET
001772  005037  001034                  CLR     PASSCT
001776  012737  002042  013600  ADTST0: MOV     #ADT1+2,RETURN
002004  013777  001034  177020          MOV     PASSCT,@DISPLA
002012  013706  015444                  MOV     STACK,SP
002016  005077  176774                  CLR     @PSW
002022  052777  000100  176770          BIS     #BIT6,@TKS

                                ;TEST FOR NO BUSS ERRORS

002030  005077  177004                  CLR     @ADCS
002034  005077  177004                  CLR     @ADDBR

                                ;DOES (BIT 1) SET AND CLEAR

002040  104003                  ADT1:   SCOPE1
002042  012777  000002  176770          MOV     #BIT1,@ADCS             ;SET BIT 1
002050  022777  000002  176762          CMP     #BIT1,@ADCS
002056  001401                          BEQ     .+4
002060  104400                          ERROR                           ;ERROR, ADCS NOT = 2
002062  005077  176752                  CLR     @ADCS
002066  005777  176746                  TST     @ADCS
002072  001401                          BEQ     .+4
002074  104400                          ERROR                           ;ERROR, ADCS NOT = 0

                                ;DOES (BIT 2) SET AND CLEAR

002076  104002                  ADT2:   SCOPE
002100  012777  000004  176732          MOV     #BIT2,@ADCS             ;SET BIT 2
002106  022777  000004  176724          CMP     #BIT2,@ADCS
002114  001401                          BEQ     .+4
002116  104400                          ERROR                           ;ERROR, ADCS NOT = 4
002120  005077  176714                  CLR     @ADCS
002124  005777  176710                  TST     @ADCS
002130  001401                          BEQ     .+4
002132  104400                          ERROR                           ;ERROR, ADCS NOT = 0

                                ;DOES BURST (BIT 3) SET AND CLEAR

002134  104002                  ADT3:   SCOPE
002136  012777  000010  176674          MOV     #BIT3,@ADCS             ;SET BIT 3
002144  022777  000010  176666          CMP     #BIT3,@ADCS
002152  001401                          BEQ     .+4
002154  104400                          ERROR                           ;ERROR, ADCS NOT = 10
002156  005077  176656                  CLR     @ADCS
002162  005777  176652                  TST     @ADCS
002166  001401                          BEQ     .+4
002170  104400                          ERROR                           ;ERROR, ADCS NOT = 0
```

```
                                        ;DOES SCHMITT TRIGGER (BIT 4) SET AND CLEAR

002172  104003                  ADT4:   SCOPE1
002174  012777  000020  176636          MOV     #BIT4,@ADCS                     ;SET BIT 4
002202  022777  000020  176630          CMP     #BIT4,@ADCS
002210  001401                          BEQ     .+4
002212  104400                          ERROR                           ;ERROR ADCS NOT = 20
002214  005077  176620                  CLR     @ADCS                   ;CLEAR ADCS
002220  005777  176614                  TST     @ADCS
002224  001401                          BEQ     .+4
002226  104400                          ERROR                           ;ERROR ADCS NOT = 0

                                        ;DOES CLOCK OVERFLOW (BIT 5) SET AND CLEAR

002230  104002                  ADT5:   SCOPE
002232  012777  000040  176600          MOV     #BIT5,@ADCS             ;SET BIT 5
002240  022777  000040  176572          CMP     #BIT5,@ADCS
002246  001401                          BEQ     .+4
002250  104400                          ERROR                           ;ERROR ADCS NOT = 40
002252  005077  176562                  CLR     @ADCS
002256  005777  176556                  TST     @ADCS
002262  001401                          BEQ     .+4
002264  104400                          ERROR                           ;ERROR ADCS NOT = 0

                                        ;DOES INTERRUPT ENABLE (BIT 6) SET AND CLEAR

002266  104002                  ADT6:   SCOPE
002270  012777  000100  176542          MOV     #BIT6,@ADCS             ;SET BIT 6
002276  022777  000100  176534          CMP     #BIT6,@ADCS
002304  001401                          BEQ     .+4
002306  104400                          ERROR                           ;ERROR ADCS NOT = 100
002310  005077  176524                  CLR     @ADCS
002314  005777  176520                  TST     @ADCS
002320  001401                          BEQ     .+4
002322  104400                          ERROR                           ;ERROR ADCS NOT = 100

                                        ;DOES MUX CHANNEL (BIT 8) SET AND CLEAR

002324  104002                  ADT7:   SCOPE
002326  012777  000400  176504          MOV     #BIT8,@ADCS             ;SET BIT 8
002334  022777  000400  176476          CMP     #BIT8,@ADCS
002342  001401                          BEQ     .+4
002344  104400                          ERROR                           ;ERROR ADCS NOT = 400
002346  005077  176466                  CLR     @ADCS
002352  005777  176462                  TST     @ADCS
002356  001401                          BEQ     .+4
002360  104400                          ERROR                           ;ERROR ADCS NOT = 0
```

```
                                        ;DOES MUX CHANNEL (BIT 9) SET AND CLEAR
                                        ;
002362  104002                  ADT10:  SCOPE
002364  012777  001000  176446          MOV     #BIT9,@ADCS             ;SET BIT 9
002372  022777  001000  176440          CMP     #BIT9,@ADCS
002400  001401                         BEQ     .+4
002402  104400                         ERROR                           ;ERROR ADCS NOT = 10000
002404  005077  176430                 CLR     @ADCS
002410  005777  176424                 TST     @ADCS
002414  001401                         BEQ     .+4
002416  104400                         ERROR                           ;ERROR ADCS NOT = 0
                                        ;
                                        ;DOES MUX CHANNEL (BIT 10) SET AND CLEAR
                                        ;
002420  104002                  ADT11:  SCOPE
002422  012777  002000  176410          MOV     #BIT10,@ADCS            ;SET BIT 10
002430  022777  002000  176402          CMP     #BIT10,@ADCS
002436  001401                         BEQ     .+4
002440  104400                         ERROR                           ;ERROR ADCS NOT 2000
002442  005077  176372                 CLR     @ADCS
002446  005777  176366                 TST     @ADCS
002452  001401                         BEQ     .+4
002454  104400                         ERROR                           ;ERROR ADCS NOT = 0
                                        ;
                                        ;DOES MUX CHANNEL (BIT 11) SET AND CLEAR
                                        ;
002456  104002                  ADT12:  SCOPE
002460  012777  004000  176352          MOV     #BIT11,@ADCS            ;SET BIT 11
002466  022777  004000  176344          CMP     #BIT11,@ADCS
002474  001401                         BEQ     .+4
002476  104400                         ERROR                           ;ERROR ADCST NOT = 4000
002500  005077  176334                 CLR     @ADCS
002504  005777  176330                 TST     @ADCS
002510  001401                         BEQ     .+4
002512  104400                         ERROR                           ;ERROR ADCST NOT = 0
                                        ;
                                        ;DOES MUX CHANNEL (BIT 12) SET AND CLEAR
                                        ;
002514  104002                  ADT13:  SCOPE
002516  012777  010000  176314          MOV     #BIT12,@ADCS
002524  022777  010000  176306          CMP     #BIT12,@ADCS
002532  001401                         BEQ     .+4
002534  104400                         ERROR                           ;ERROR ADCS NOT = 10000
002536  005077  176276                 CLR     @ADCS
002542  005777  176272                 TST     @ADCS
002546  001401                         BEQ     .+4
002550  104400                         ERROR                           ;ERROR ADCS NOT = 0
```

```
                                        ;DOES MUX CHANNEL (BIT 13) SET AND CLEAR

002552  104002                  ADT14:  SCOPE
002554  012777  020000  176256          MOV     #BIT13,@ADCS            ;SET BIT 13
002562  022777  020000  176250          CMP     #BIT13,@ADCS
002570  001401                        BEQ     .+4
002572  104400                        ERROR                           ;ERROR ADCS NOT = 20000
002574  005077  176240                CLR     @ADCS
002600  005777  176234                TST     @ADCS
002604  001401                        BEQ     .+4
002606  104400                        ERROR                           ;ERROR ADCS NOT = 0

                                        ;DOES DUAL MODE (BIT14) SET AND CLEAR

002610  104002                  ADT15:  SCOPE
002612  012777  040000  176220          MOV     #BIT14,@ADCS            ;SET BIT 14
002620  022777  040000  176212          CMP     #BIT14,@ADCS
002626  001401                        BEQ     .+4
002630  104400                        ERROR                           ;ERROR, ADCS NOT 40000
002632  005077  176202                CLR     @ADCS                   ;CLEAR BIT 14
002636  005777  176176                TST     @ADCS
002642  001401                        BEQ     .+4
002644  104400                        ERROR                           ;ERROR, ADCS NOT = 0

                                        ;DOES ERROR (BIT 15) SET AND CLEAR

002646  104002                  ADT16:  SCOPE
002650  012777  100000  176162          MOV     #BIT15,@ADCS
002656  022777  100000  176154          CMP     #BIT15,@ADCS
002664  001401                        BEQ     .+4
002666  104400                        ERROR                   ;ERROR , ERROR BIT FAILED TO SET
002670  005077  176144                CLR     @ADCS
002674  005777  176140                TST     @ADCS
002700  001401                        BEQ     .+4
002702  104400                        ERROR                   ;ERROR, ERROR BIT FAILED TO CLEAR

                                        ;DOES DONE (BIT 7) SET AND CLEAR

002704  104003                  ADT20:  SCOPE1
002706  017700  176132                MOV     @ADDBR,R0
002712  005037  015464                CLR     KSTOR4
002716  012777  000001  176114        MOV     #BIT0,@ADCS
002724  105777  176110          ADT20A: TSTB    @ADCS
002730  100404                        BMI     ADT20B
002732  005237  015464                INC     KSTOR4
002736  001372                        BNE     ADT20A
002740  104400                        ERROR                           ;ERROR, ADCS NOT = 200
002742  017700  176076          ADT20B: MOV     @ADDBR,R0
002746  105777  176066                TSTB    @ADCS
002752  100001                        BPL     .+4
002754  104400                        ERROR                           ;ERROR, DONE FAILED TO CLEAR
002756  032777  000001  176054        BIT     #BIT0,@ADCS
002764  001401                        BEQ     .+4
002766  104400                        ERROR                           ;ERROR, AD TO FAILED TO CLEAR
```

```
                                        ;DOES ERROR (BIT 15) SET
                                        ;
002770  104003                  ADT21:  SCOPE1
002772  017700  176046                  MOV     @ADDBR,R0
002776  012777  000001  176034          MOV     #BIT0,@ADCS
003004  105777  176030          1$:     TSTB    @ADCS           ;WAIT FOR FLAG
003010  100375                          BPL     1$
003012  013737  012100  015502          MOV     CPTIME,DELAY1
003020  006237  015502                  ASR     DELAY1
003024  006237  015502                  ASR     DELAY1
003030  006237  015502                  ASR     DELAY1
003034  012777  000001  175776          MOV     #BIT0,@ADCS
003042  005337  015502          2$:     DEC     DELAY1
003046  100375                          BPL     2$
003050  005777  175764                  TST     @ADCS
003054  100401                          BMI     .+4
003056  104400                          ERROR                   ;ERROR ADCS NOT = 100000
003060  005077  175754                  CLR     @ADCS
003064  013737  012100  015502          MOV     CPTIME,DELAY1
003072  005337  015502          3$:     DEC     DELAY1
003076  100375                          BPL     3$
003100  000240                          NOP
003102  000240                          NOP
003104  000240                          NOP
003106  005777  175726                  TST     @ADCS
003112  100001                          BPL     .+4
003114  104400                          ERROR                   ;ERROR ADCS NOT = 0
                                        ;
                                        ;TEST THAT NO EXTERNAL CONVERSIONS INPUT
                                        ;
003116  104003                  ADT22:  SCOPE1
003120  005077  175714                  CLR     @ADCS
003124  017700  175714                  MOV     @ADDBR,R0
003130  052777  000020  175702          BIS     #BIT4,@ADCS
003136  005000                          CLR     R0
003140  005200                          INC     R0
003142  001376                          BNE     .-2
003144  105777  175670                  TSTB    @ADCS
003150  100001                          BPL     .+4
003152  104400                          ERROR                   ;ERROR EXTERNAL CONVERSION
                                        ;
                                        ;TEST THAT NO CLOCK OVERFLOWS START CONVERSIONS
                                        ;
003154  104003                  ADT23:  SCOPE1
003156  005077  175656                  CLR     @ADCS
003162  017700  175656                  MOV     @ADDBR,R0
003166  052777  000040  175644          BIS     #BIT5,@ADCS
003174  005037  015464                  CLR     KSTOR4
003200  005237  015464          1$:     INC     KSTOR4
003204  001375                          BNE     1$
003206  105777  175626                  TSTB    @ADCS
003212  100001                          BPL     .+4
003214  104400                          ERROR                   ;ERROR OVERFLOW STARTED A CONVERSION
```

```
1010                                        ;PRE INTERRUPT SETUP
1011
1012  003216  042737  177437  001004        BIC     #177437,ADBRL   ;MASK TO BITS
1013  003224  001001                        BNE     .+4
1014  003226  000000                        HALT                    ;BR LEVEL INDICATED IS 0
1015  003230  022737  000340  001004        CMP     #340,ADBRL      ;IS IT BR LEVEL 7
1016  003236  001001                        BNE     .+4
1017  003240  000000                        HALT                    ;BR LEVEL INDICATED IS 7
1018
1019  003242  013737  001004  015524        MOV     ADBRL,BRLEV1
1020  003250  162737  000040  015524        SUB     #40,BRLEV1
1021  003256  013737  001004  015526        MOV     ADBRL,BRLEV2
1022  003264  013737  001004  015530        MOV     ADBRL,BRLEV3
1023  003272  062737  000040  015530        ADD     #40,BRLEV3
1024
1025                                        ;TEST THAT A TO D INTERRUPT AT LEVEL INDICATED -1
1026
1027  003300  104003                ADT24:  SCOPE1
1028  003302  012777  000340  175506        MOV     #340,@PSW
1029  003310  005077  175524                CLR     @ADCS           ;CLEAR A TO D STATUS
1030  003314  017700  175524                MOV     @ADDBR,R0       ;READ ADBUFF
1031  003320  012777  003360  175526        MOV     #ADT24A,@ADINT  ;LOAD RETURN ADDRESS
1032  003326  013777  015524  175462        MOV     BRLEV1,@PSW     ;BR LEVEL -1
1033  003334  052777  000101  175476        BIS     #BIT6!BIT0,@ADCS        ;SET THE AD GO AND INTERRUPT ENABLE BIT
1034  003342  012737  010000  015464        MOV     #10000,KSTOR4
1035  003350  005337  015464        1$:     DEC     KSTOR4          ;DELAY
1036  003354  001375                        BNE     1$
1037  003356  104400                        ERROR                   ;ERROR, A TO D FAILED TO INTERRUPT
1038
1039  003360  005077  175454        ADT24A: CLR     @ADCS           ;CLEAR ERROR BIT
1040
1041                                        ;TEST THAT THE A TO D DOES NOT INTERRUPT AT LEVEL INDICATED
1042
1043  003364  104003                ADT25:  SCOPE1
1044  003366  005077  175446                CLR     @ADCS           ;CLEAR A TO D STATUS
1045  003372  017700  175446                MOV     @ADDBR,R0       ;READ ADBUFF
1046  003376  013777  015526  175412        MOV     BRLEV2,@PSW     ;BR LEVEL
1047  003404  012777  003436  175442        MOV     #ADT25A,@ADINT  ;LOAD RETURN ADDRESS
1048  003412  052777  000101  175420        BIS     #BIT6!BIT0,@ADCS        ;SET AD GO AND INTERRUPT ENABLE BIT
1049  003420  012737  010000  015464        MOV     #10000,KSTOR4
1050  003426  005337  015464        1$:     DEC     KSTOR4          ;DELAY
1051  003432  001375                        BNE     1$
1052  003434  000403                        BR      ADT26
1053  003436  104400                ADT25A: ERROR                   ;ERROR, A TO D INTERRUPTED IN ERROR
1054  003440  005077  175374                CLR     @ADCS           ;CLEAR ERROR FLAG
1055
```

```
                                        ;TEST THAT THE A TO D DOES NOT INTERRUPT AT LEVEL INDICATED +1
                                        ;
003444  104003                  ADT26:  SCOPE1
003446  005077  175366                  CLR     @ADCS           ;CLEAR A TO D STATUS
003452  017700  175366                  MOV     @ADDBR,R0
003456  012777  003516  175370          MOV     #ADT26A,@ADINT
003464  013777  015530  175324          MOV     BRLEV3,@PSW     ;BR LEVEL +1
003472  052777  000101  175340          BIS     #BIT6!BIT0,@ADCS        ;SET THE AD GO AND INTERRUPT ENABLE BIT
003500  012737  001000  015464          MOV     #1000,KSTOR4
003506  005337  015464          1$:     DEC     KSTOR4          ;DELAY
003512  001375                          BNE     1$
003514  000401                          BR      ADT26B          ;NO INTERRUPT
003516  104400                  ADT26A: ERROR                   ;ERROR, A TO D INTERRUPTED IN ERROR
003520  013777  001056  175326  ADT26B: MOV     ADINT1,@ADINT
003526  005077  175324                  CLR     @ADINT1
                                        ;
                                        ;TEST THAT RESET CLEARS MUX BITS
                                        ;
003532  104003                  ADT27:  SCOPE1
003534  012777  037400  175276          MOV     #BIT13!BIT12!BIT11!BIT10!BIT9!BIT8,@ADCS
003542  000005                          RESET
003544  005777  175270                  TST     @ADCS
003550  001401                          BEQ     .+4
003552  104400                          ERROR                   ;ERROR, RESET FAILED TO CLEAR MUX BITS
                                        ;
                                        ;TEST THAT RESET CLEARS ST, CLOCK OVERFLOW AND INTERRUPT ENABLE BITS
                                        ;
003554  104003                  ADT30:  SCOPE1
003556  012777  000160  175254          MOV     #BIT6!BIT5!BIT4,@ADCS
003564  000005                          RESET
003566  005777  175246                  TST     @ADCS
003572  001401                          BEQ     .+4
003574  104400                          ERROR                   ;ERROR, RESET FAILED TO CLEAR ENABLES
                                        ;
                                        ;TEST THAT RESET CLEARS DONE AND ERROR BITS
                                        ;
003576  104003                  ADT31:  SCOPE1
003600  012777  000001  175232          MOV     #BIT0,@ADCS
003606  105777  175226                  TSTB    @ADCS
003612  100375                          BPL     .-4
003614  012777  100000  175216          MOV     #BIT15,@ADCS    ;SET ERROR BIT
003622  000005                          RESET
003624  005777  175210                  TST     @ADCS
003630  001401                          BEQ     .+4
003632  104400                          ERROR                   ;ERROR, RESET FAILED TO CLEAR ERROR OR DONE FLAG
```

```
1101
1102                                    ;TEST THAT RESET CLEARS BURST AND MODE BITS
1103
1104  003634  104003                    ADT32:  SCOPE1
1105  003636  012777  000016  175174            MOV     #BIT3!BIT2!BIT1,@ADCS   ;SET BITS 1-3
1106  003644  000005                            RESET
1107  003646  005777  175166                    TST     @ADCS
1108  003652  001401                            BEQ     .+4
1109  003654  104400                            ERROR                           ;ERROR, ADCS NOT = 0
1110
1111
1112                                    ;LED TEST
1113
1114  003656  104003                    TEST15: SCOPE1
1115  003660  005737  000042                    TST     @#42
1116  003664  001054                            BNE     TEST16
1117  003666  005737  001034                    TST     PASSCT          ;TEST IF FIRST PASS
1118  003672  001451                            BEQ     TEST16          ;BR IF YES
1119  003674  005077  175116                    CLR     @PSW
1120  003700  052777  000100  175112            BIS     #BIT6,@TKS
1121  003706  005037  015516                    CLR     TEMP1
1122  003712  013737  015516  015520  TST15A:  MOV     TEMP1,TEMP2
1123  003720  012737  000006  015522            MOV     #6,TEMP3
1124  003726  013777  015520  175110  TST15B:  MOV     TEMP2,@ADDBR
1125  003734  013737  001006  015462            MOV     PDPDLY,KSTOR3
1126  003742  012700  000000                    MOV     #0,R0
1127  003746  032777  004000  175054            BIT     #BIT11,@SWR     ;TEST IF NO INTERATIONS
1128  003754  001020                            BNE     TEST16          ;BR IF NO INTERATIONS
1129  003756  005300                    TST15C: DEC     R0
1130  003760  001376                            BNE     TST15C
1131  003762  005337  015462                    DEC     KSTOR3
1132  003766  001373                            BNE     TST15C
1133  003770  105237  015521                    INCB    TEMP2+1
1134  003774  005337  015522                    DEC     TEMP3
1135  004000  001352                            BNE     TST15B
1136  004002  005237  015516                    INC     TEMP1
1137  004006  022737  000040  015516            CMP     #40,TEMP1
1138  004014  001336                            BNE     TST15A
1139
1140  004016  104014                    TEST16: SCOPE0                          ;LOGICAL END OF A TO D LOGIC TEST
1141  004020  000005                            RESET
1142  004022  005737  000042                    TST     @#42
1143  004026  001402                            BEQ     .+6
1144  004030  000137  001716                    JMP     WHATA
1145  004034  004737  013656                    JSR     PC,BELL         ;REPORT END OF PASS
1146  004040  005237  001034                    INC     PASSCT
1147  004044  000137  001776                    JMP     ADTST0
```

```
1148
1149                                    ;*************************************************************
1150                                    ;       DMA LOGIC TEST
1151                                    ;*************************************************************
1152  004050  104000                    DMATST: PRINT
1153  004052  014653                            MES11
1154  004054  000005                    DMA01:  RESET
1155  004056  005037  001034                    CLR     PASSCT
1156
1157  004062  013706  015444            DMA00:  MOV     STACK,SP
1158  004066  052777  000100  174724            BIS     #BIT6,@TKS
1159  004074  005077  174716                    CLR     @PSW
1160  004100  013777  001034  174724            MOV     PASSCT,@DISPLA
1161  004106  012737  004122  013600            MOV     #DMAT0+2,RETURN
1162
1163                                    ;TEST FOR NO BUSS ERRORS
1164
1165  004114  005077  174732                    CLR     @ADMR
1166
1167                                    ;TEST THAT CURRENT ADDRESS REGISTER (BITS 1-15) SET AND CLEAR
1168
1169  004120  104002                    DMAT0:  SCOPE
1170  004122  005077  174712                    CLR     @ADCS           ;CLEAR AD STATUS
1171  004126  012777  000006  174704            MOV     #6,@ADCS        ;SET UP CA POINTER
1172  004134  012777  000000  174710            MOV     #0,@ADMR        ;LOAD CURRENT ADDRESS
1173  004142  022777  000000  174702            CMP     #0,@ADMR        ;
1174  004150  001401                            BEQ     .+4
1175  004152  104400                            ERROR                   ;ERROR, CURRENT ADDRESS NOT = 0
1176
1177                                    ;TEST THAT CURRENT ADDRESS REGISTER (BITS 1-15) SET AND CLEAR
1178
1179  004154  104002                    DMAT1:  SCOPE
1180  004156  005077  174656                    CLR     @ADCS           ;CLEAR AD STATUS
1181  004162  012777  000006  174650            MOV     #6,@ADCS        ;SET UP CA POINTER
1182  004170  012777  177776  174654            MOV     #177776,@ADMR   ;LOAD CURRENT ADDRESS
1183  004176  022777  177776  174646            CMP     #177776,@ADMR   ;
1184  004204  001401                            BEQ     .+4
1185  004206  104400                            ERROR                   ;ERROR, CURRENT ADDRESS NOT = 177776
1186
1187                                    ;TEST THAT CURRENT ADDRESS REGISTER (BITS 1-15) SET AND CLEAR
1188
1189  004210  104002                    DMAT2:  SCOPE
1190  004212  005077  174622                    CLR     @ADCS           ;CLEAR AD STATUS
1191  004216  012777  000006  174614            MOV     #6,@ADCS        ;SET UP CA POINTER
1192  004224  012777  125252  174620            MOV     #125252,@ADMR   ;LOAD CURRENT ADDRESS
1193  004232  022777  125252  174612            CMP     #125252,@ADMR   ;
1194  004240  001401                            BEQ     .+4
1195  004242  104400                            ERROR                   ;ERROR, CURRENT ADDRESS NOT = 125252
1196
```

```
1197
1198                                    ;TEST THAT CURRENT ADDRESS REGISTER (BITS 1-15) SET AND CLEAR
1199
1200  004244  104002                    DMAT3:  SCOPE
1201  004246  005077  174566                    CLR     @ADCS           ;CLEAR AD STATUS
1202  004252  012777  000006  174560            MOV     #6,@ADCS        ;SET UP CA POINTER
1203  004260  012777  052524  174564            MOV     #52524,@ADMR    ;LOAD CURRENT ADDRESS
1204  004266  022777  052524  174556            CMP     #52524,@ADMR    ;
1205  004274  001401                            BEQ     .+4
1206  004276  104400                            ERROR                   ;ERROR, CURRENT ADDRESS NOT = 52525
1207
1208                                    ;TEST THAT WORD COUNT REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1209
1210  004300  104002                    DMAT4:  SCOPE
1211  004302  005077  174532                    CLR     @ADCS           ;CLEAR AD STATUS
1212  004306  012777  000004  174524            MOV     #4,@ADCS        ;LOAD WC POINTER
1213  004314  012777  000000  174530            MOV     #0,@ADMR        ;LOAD WORD COUNT REGISTER
1214  004322  022777  000000  174522            CMP     #0,@ADMR        ;
1215  004330  001401                            BEQ     .+4
1216  004332  104400                            ERROR                   ;ERROR, WORD COUNT NOT = 0
1217
1218                                    ;TEST THAT WORD COUNT REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1219
1220  004334  104002                    DMAT5:  SCOPE
1221  004336  005077  174476                    CLR     @ADCS           ;CLEAR AD STATUS
1222  004342  012777  000004  174470            MOV     #4,@ADCS        ;LOAD WC POINTER
1223  004350  012777  177777  174474            MOV     #-1,@ADMR       ;LOAD WORD COUNT REGISTER
1224  004356  022777  007777  174466            CMP     #7777,@ADMR     ;
1225  004364  001401                            BEQ     .+4
1226  004366  104400                            ERROR                   ;ERROR, WORD COUNT NOT = 7777
1227
1228                                    ;TEST THAT WORD COUNT REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1229
1230  004370  104002                    DMAT6:  SCOPE
1231  004372  005077  174442                    CLR     @ADCS           ;CLEAR AD STATUS
1232  004376  012777  000004  174434            MOV     #4,@ADCS        ;LOAD WC POINTER
1233  004404  012777  125252  174440            MOV     #125252,@ADMR   ;LOAD WORD COUNT REGISTER -
1234  004412  022777  005252  174432            CMP     #5252,@ADMR     ;
1235  004420  001401                            BEQ     .+4
1236  004422  104400                            ERROR                   ;ERROR, WORD COUNT NOT = 5252
1237
1238                                    ;TEST THAT WORD COUNT REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1239
1240  004424  104002                    DMAT7:  SCOPE
1241  004426  005077  174406                    CLR     @ADCS           ;CLEAR AD STATUS
1242  004432  012777  000004  174400            MOV     #4,@ADCS        ;LOAD WC POINTER
1243  004440  012777  052525  174404            MOV     #52525,@ADMR    ;LOAD WORD COUNT REGISTER
1244  004446  022777  002525  174376            CMP     #2525,@ADMR     ;
1245  004454  001401                            BEQ     .+4
1246  004456  104400                            ERROR                   ;ERROR, WORD COUNT NOT = 2525
1247
1248
```

```
                                        ;TEST THAT DMA STATUS (BIT 0) CAN BE SET AND CLEARED
                                        
004460  104002                  DMAT10: SCOPE
004462  005077  174352                  CLR     @ADCS                   ;CLEAR AD STATUS
004466  012777  000002  174344          MOV     #2,@ADCS                ;POINTER TO DMA MODE STATUS
004474  012777  010000  174350          MOV     #BIT12,@ADMR            ;LOAD ENABLE
004502  022777  010000  174342          CMP     #BIT12,@ADMR            ;
004510  001401                          BEQ     .+4
004512  104400                          ERROR                           ;ERROR, DMA STATUS NOT = 10000
                                        
                                        ;TEST THAT DMA STATUS (BIT 1) CAN BE SET AND CLEARED
                                        
004514  104002                  DMAT11: SCOPE
004516  005077  174316                  CLR     @ADCS
004522  012777  000002  174310          MOV     #2,@ADCS
004530  012777  020000  174314          MOV     #BIT13,@ADMR            ;LOAD EXT 1
004536  022777  020000  174306          CMP     #BIT13,@ADMR
004544  001401                          BEQ     .+4
004546  104400                          ERROR                           ;ERROR, DMA STATUS NOT = 20000
                                        
                                        ;TEST THAT DMA STATUS (BIT 2) CAN SET AND CLEAR
                                        
004550  104002                  DMAT12: SCOPE
004552  005077  174262                  CLR     @ADCS
004556  012777  000002  174254          MOV     #2,@ADCS
004564  012777  040000  174260          MOV     #BIT14,@ADMR            ;LOAD EXT 2
004572  022777  040000  174252          CMP     #BIT14,@ADMR
004600  001401                          BEQ     .+4
004602  104400                          ERROR                           ;ERROR, DMA STATUS NOT = 40000
                                        
                                        ;TEST THAT RESET CLEARS CURRENT ADDRESS REGISTER
                                        
004604  104002                  DMAT13: SCOPE
004606  005077  174226                  CLR     @ADCS
004612  012777  000006  174220          MOV     #6,@ADCS
004620  012777  177777  174224          MOV     #-1,@ADMR               ;SET CA = -1
004626  000005                          RESET
004630  012777  000006  174202          MOV     #6,@ADCS
004636  005777  174210                  TST     @ADMR
004642  001401                          BEQ     .+4
004644  104400                          ERROR                           ;ERROR, RESET FAILED TO CLEAR CURRENT ADDRESS
                                        
                                        ;TEST THAT RESET CLEARS WORD COUNT REGISTER
                                        
004646  104003                  DMAT14: SCOPE1
004650  005077  174164                  CLR     @ADCS
004654  012777  000004  174156          MOV     #4,@ADCS
004662  012777  177777  174162          MOV     #-1,@ADMR               ;SET WC = -1
004670  000005                          RESET
004672  012777  000004  174140          MOV     #4,@ADCS
004700  005777  174146                  TST     @ADMR
004704  001401                          BEQ     .+4
004706  104400                          ERROR                           ;ERROR, RESET FAILED TO CLEAR WORD COUNT REGISTER
```

```
1303
1304                                    ;TEST THAT RESET CLEARS DMA STATUS REGISTER
1305
1306  004710  104003                    DMAT15: SCOPE1
1307  004712  005077  174122                    CLR     @ADCS
1308  004716  012777  000002  174114          MOV     #2,@ADCS
1309  004724  012777  177777  174120          MOV     #-1,@ADMR
1310  004732  000005                          RESET
1311  004734  012777  000002  174076          MOV     #2,@ADCS
1312  004742  005777  174104                  TST     @ADMR
1313  004746  001401                          BEQ     .+4
1314  004750  104400                          ERROR                   ;ERROR, RESET FAILED TO CLEAR DMA STATUS
1315
1316                                    ;TEST THAT THE DMA ENABLE CLEARS INTERRUPT ENABLE
1317
1318  004752  104003                    DMAT16: SCOPE1
1319  004754  005077  174060                  CLR     @ADCS           ;CLEAR
1320  004760  012777  000100  174052          MOV     #BIT6,@ADCS     ;ENABLE INTERRUPT
1321  004766  032777  000100  174044          BIT     #BIT6,@ADCS
1322  004774  001001                          BNE     .+4
1323  004776  104400                          ERROR                   ;ERROR, BIT 6 FAILED TO SET
1324
1325  005000  052777  000002  174032          BIS     #BIT1,@ADCS     ;SET DMA POINTER
1326  005006  012777  010000  174036          MOV     #BIT12,@ADMR    ;SET DMA ENABLE
1327  005014  032777  000100  174016          BIT     #BIT6,@ADCS     ;TEST BIT 6
1328  005022  001401                          BEQ     .+4
1329  005024  104400                          ERROR                   ;ERROR, SETTING DMA ENABLE FAILED
1330                                                                  ; TO CLEAR INTERRUPT ENABLE
1331  005026  005077  174020                  CLR     @ADMR
```

```
                                        ;TEST THAT THE DMA ACCESS A CORRECT MEMORY LOCATION
                                        ; AND CAN INTERRUPT
                                        
005032  104003                  DMAT17: SCOPE1
005034  012777  000340  173754          MOV     #340,@PSW
005042  012777  000100  173750          MOV     #BIT6,@TKS
005050  012777  005264  173776          MOV     #DMT17A,@ADINT
005056  005077  173734                  CLR     @PSW
005062  012737  177777  005734          MOV     #-1,DMKO
005070  005077  173744                  CLR     @ADCS           ;CLEAR AD STATUS
005074  012777  000006  173736          MOV     #6,@ADCS        ;LOAD CA POINTER
005102  012777  015654  173742          MOV     #ADBUFF,@ADMR   ;LOAD CURRENT ADDRESS
005110  012777  000004  173722          MOV     #4,@ADCS        ;LOAD WC POINTER
005116  012777  177777  173726          MOV     #-1,@ADMR
005124  012777  000002  173706          MOV     #2,@ADCS        ;LOAD DMA STATUS POINTER
005132  012777  010000  173712          MOV     #BIT12,@ADMR    ;LOAD DMA ENABLE
005140  012777  000001  173672          MOV     #1,@ADCS        ;START A TO D CONVERSION
005146  012737  002000  015464          MOV     #2000,KSTOR4    ;SET UP A DELAY
005154  012777  000000  173634          MOV     #0,@PSW
005162  005337  015464          1$:     DEC     KSTOR4
005166  001375                          BNE     1$              ;DELAY
005170  012777  000006  173642          MOV     #6,@ADCS        ;LOAD CA POINTER
005176  012737  015656  015514          MOV     #ADBUFF+2,TEMP  ;SET UP COMPARE
005204  023777  015514  173640          CMP     TEMP,@ADMR      ;
005212  001401                          BEQ     .+4
005214  104400                          ERROR                   ;ERROR, CURRENT ADDRESS FAILED TO INCREMENT
                                                                ; BY 2
005216  012777  000004  173614          MOV     #4,@ADCS        ;LOAD WC POINTER
005224  005777  173622                  TST     @ADMR           ;TEST WORD COUNT
005230  001401                          BEQ     .+4
005232  104400                          ERROR                   ;ERROR, WORD COUNT FAILED TO INCREMENT BY 1
                                        
005234  012777  000002  173576          MOV     #2,@ADCS        ;LOAD DMA STATUS POINTER
005242  005777  173604                  TST     @ADMR           ;TEST DMA STATUS
005246  001401                          BEQ     .+4
005250  104400                          ERROR                   ;ERROR, DMA STATUS FAILED TO CLEAR
                                        
005252  005737  005734                  TST     DMKO
005256  001401                          BEQ     .+4
005260  104400                          ERROR                   ;ERROR, DMA FAILED TO INTERRUPT
005262  000403                          BR      DMAT20
                                        
005264  005037  005734          DMT17A: CLR     DMKO
005270  000002                          RTI                     ;EXIT
```

```
1377
1378                                        ;TEST THAT THE DMA CAN INCREMENT THRU MEMORY
1379
1380  005272  104003                DMAT20: SCOPE1
1381  005274  012777  000340  173514        MOV     #340,@PSW
1382  005302  013706  015444              MOV     STACK,SP
1383  005306  013777  001056  173540        MOV     ADINTI,@ADINT
1384  005314  005077  173536              CLR     @ADINTI
1385  005320  012737  000777  005734        MOV     #777,DMK0       ;SET UP COUNTER
1386  005326  012737  007001  005736        MOV     #7001,DMK1
1387  005334  012737  015656  005740        MOV     #ADBUFF+2,DMK2  ;SET UP POINTER
1388  005342  005077  173472              CLR     @ADCS           ;CLEAR STATUS
1389  005346  012777  000006  173464        MOV     #6,@ADCS        ;SET UP CA POINTER
1390  005354  012777  015654  173470        MOV     #ADBUFF,@ADMR   ;LOAD CURRENT ADDRESS BUFFER
1391  005362  012777  000004  173450        MOV     #4,@ADCS        ;LOAD WC POINTER
1392  005370  012777  177000  173454        MOV     #-1000,@ADMR    ;LOAD WORD COUNT REGISTER
1393  005376  012777  000002  173434        MOV     #2,@ADCS        ;LOAD STATUS POINTER
1394  005404  012777  010000  173440        MOV     #BIT12,@ADMR    ;LOAD DMA ENABLE
1395  005412  012777  000001  173420  DMT20A: MOV     #1,@ADCS        ;LOAD A TO D GO
1396  005420  012737  000400  015464        MOV     #400,KSTOR4
1397  005426  005337  015464        1$:     DEC     KSTOR4          ;DELAY
1398  005432  001375                       BNE     1$
1399  005434  012777  000006  173376        MOV     #6,@ADCS        ;LOAD CA POINTER
1400  005442  013737  005740  015514        MOV     DMK2,TEMP       ;SET UP COMPARE
1401  005450  023777  015514  173374        CMP     TEMP,@ADMR      ;TEST
1402  005456  001401                       BEQ     .+4
1403  005460  104400                       ERROR                   ;ERROR, CURRENT ADDRESS FAILED TO INCREMENT
1404                                                                ; BY 2 PROPERLY
1405  005462  013737  005736  015514        MOV     DMK1,TEMP       ;SET UP COMPARE
1406  005470  012777  000004  173342        MOV     #4,@ADCS        ;LOAD WC POINTER
1407  005476  023777  015514  173346        CMP     TEMP,@ADMR      ;TEST
1408  005504  001402                       BEQ     .+6
1409  005506  104400                       ERROR                   ;ERROR, WORD COUNT FAILED TO INCREMENT
1410  005510  000410                       BR      DMAT21          ; BY 1 PROPERLY
1411  005512  062737  000002  005740        ADD     #2,DMK2         ;UPDATE CA
1412  005520  005237  005736              INC     DMK1
1413  005524  005337  005734              DEC     DMK0
1414  005530  001330                       BNE     DMT20A          ;MORE TEST
1415
```

```
1416
1417                                        ;TEST THAT THE DMA ERROR BIT (BIT 15) CAN BE SET
1418
1419  005532  104003                DMAT21: SCOPE1
1420  005534  012777  000340  173254        MOV     #340,@PSW
1421  005542  012777  000100  173250        MOV     #BIT6,@TKS
1422  005550  012737  177777  005734        MOV     #-1,DMK0
1423  005556  005077  173256              CLR     @ADCS           ;CLEAR AD STATUS
1424  005562  012777  000006  173250        MOV     #6,@ADCS        ;LOAD CA POINTER
1425  005570  012777  160000  173254        MOV     #160000,@ADMR   ;LOAD NON-EXISTENT MEMORY LOCATION
1426  005576  012777  000004  173234        MOV     #4,@ADCS        ;LOAD WC POINTER
1427  005604  012777  177777  173240        MOV     #-1,@ADMR       ;LOAD 1 WRD
1428  005612  012777  000002  173220        MOV     #2,@ADCS        ;LOAD DMA STATUS POINTER
1429  005620  012777  070000  173224        MOV     #70000,@ADMR    ;LOAD DMA ENABLE
1430  005626  012777  000001  173204        MOV     #1,@ADCS        ;START CONVERSION
1431  005634  012737  002000  015464        MOV     #2000,KSTOR4
1432  005642  005337  015464        1$:    DEC     KSTOR4
1433  005646  001375                       BNE     1$
1434  005650  012777  000002  173162        MOV     #2,@ADCS        ;LOAD DMA STATUS POINTER
1435  005656  005777  173170              TST     @ADMR           ;TEST BIT 15
1436  005662  100401                       BMI     .+4             ;BRANCH IF SET
1437  005664  104400                       ERROR                   ;ERROR, DMA ERROR BIT FAILED TO SET
1438
1439  005666  005077  173160              CLR     @ADMR           ;CLEAR DMA STATUS
1440  005672  005777  173154              TST     @ADMR           ;TEST IT
1441  005676  001401                       BEQ     .+4             ;
1442  005700  104400                       ERROR                   ;ERROR, DMA STATUS FAILED TO CLEAR
1443
1444  005702  104003                       SCOPE1                  ;LOGICAL END OF DMA LOGIC TEST
1445  005704  000005                       RESET
1446  005706  005737  000042              TST     @#42
1447  005712  001402                       BEQ     .+6
1448  005714  000137  001730              JMP     WHATB
1449  005720  004737  013656              JSR     PC,BELL         ;REPORT END OF PASS
1450  005724  005237  001034              INC     PASSCT
1451  005730  000137  004062              JMP     DMA00
1452
1453
1454  005734  000000              DMK0:   0
1455  005736  000000              DMK1:   0
1456  005740  000000              DMK2:   0
```

```
1457                                    ;*****************************************************************************
1458                                    ;CALIBRATION ROUTINE
1459                                    ;*****************************************************************************
1460
1461                                    ;ROUTINE REQUESTS THE TYPE OF 'SYNC' TO BE USED ('I' INTERNAL OR 'E' EXTERNAL).
1462                                    ;OR 'C' LPS CLOCK)
1463                                    ;THE PROGRAM THEN TAKES CONTINUOUS CONVERSIONS USING DATA SW'S 5-0
1464                                    ;TO SELECT THE CH.,
1465                                    ;OR SW '10' TO PRINT THE CONVERSION VALUE.
1466
1467  005742  012737  005754  015446  CALBRT: MOV     #CALBT1,AVECTR  ;SET UP 'tA' RESTART ADDRESS
1468  005750  104000                          PRINT
1469  005752  014527                          MES7                    ;TYPE TEST HEADER
1470  005754  104000                  CALBT1: PRINT
1471  005756  014606                          MES10                   ;TEXT 'SYNC I OR E OR C'
1472  005760  104011                  CALB1A: TTYIN                   ;WAIT FOR INPUT.
1473  005762  042737  000040  011032          BIC     #BIT5,INBUF
1474  005770  013737  011032  015450          MOV     INBUF,PROC      ;SAVE IT IN TEMP STORAGE
1475  005776  104000                          PRINT
1476  006000  014470                          CRLF
1477  006002  000402                          BR      .+6
1478  006004  005037  015450          MANCAL: CLR     PROC
1479  006010  005037  015506                  CLR     USEDMA          ;CLEAR DMA FLAG
1480  006014  005037  015510                  CLR     USECLK          ;CLEAR CLOCK FLAG
1481  006020  005037  015504                  CLR     USEDSH          ;CLEAR DUAL MODE
1482  006024  012737  000001  015454          MOV     #1,COUNT        ;SET UP FOR 'I' CONVERSION
1483  006032  117737  172772  015441  CALBT2: MOVB    @SWR,ADWRD2+1   ;GET CH. FROM THE SW REG.
1484  006040  042737  140377  015440          BIC     #140377,ADWRD2  ;CLR UNWANTED BITS, A/D WORD COMPLETE
1485  006046  017737  172756  015460          MOV     @SWR,KSTOR2     ;SAVE ORIGINAL SWITCH SETTING.
1486  006054  022737  000105  015450          CMP     #105,PROC       ;TEST SYNC SELECT
1487  006062  001004                          BNE     CALB2           ;BRANCH IF NOT 'E'
1488  006064  052737  000020  015440          BIS     #20,ADWRD2      ;OTHERWISE ADD 'EXT' SYNC BIT TO A/D.
1489  006072  000416                          BR      CALB2A
1490  006074  122737  000103  015450  CALB2:  CMPB    #103,PROC
1491  006102  001007                          BNE     CALB2C          ;BRANCH IF NOT 'C'
1492  006104  052737  000040  015440          BIS     #40,ADWRD2      ;OTHERWISE ADD 'CLOCK' SYNC TO A/D
1493  006112  012737  177777  015510          MOV     #-1,USECLK
1494  006120  000403                          BR      CALB2A
1495  006122  052737  000001  015440  CALB2C: BIS     #1,ADWRD2
1496  006130  005737  015510          CALB2A: TST     USECLK          ;CHECK CLOCK FLAG
1497  006134  001410                          BEQ     CALB2D          ;NOT LPS CLOCK
1498  006136  005077  172704                  CLR     @CSR            ;USE CLOCK, CLEAR CLOCK STATUS
1499  006142  012777  176000  172700          MOV     #-2000,@CSB             ;SET UP PRESET BUFFER
1500  006150  012777  000403  172670          MOV     #403,@CSR       ;SET UP RATE, START CLOCK
1501  006156  013706  015444          CALB2D: MOV     STACK,SP
1502  006162  004737  011212                  JSR     PC,ADCNVT       ;TAKE AND STORE THE CONVERSIONS
1503  006166  012737  000001  015522          MOV     #1,TEMP3        ;SETUP TO PRINT '1' VALUE
1504  006174  004537  013664                  JSR     R5,LEDS
1505  006200  015654                          ADBUFF
1506  006202  032777  002000  172620          BIT     #SW10,@SWR
1507  006210  001404                          BEQ     CALB2B
1508  006212  104012                          PRTAVG                  ;PRINT IT
1509  006214  104000                          PRINT
1510  006216  014470                          CRLF
1511  006220  000406                          BR      CALBT4          ;TEST FOR LOOP
1512  006222  013700  015654          CALB2B: MOV     ADBUFF,R0       ;SET UP A/D BUFFER.
```

```
1513  006226  010077  172600                  MOV     R0,@DISPLA      ;LOAD DISPLAY REG. (11/45)
1514  006232  104013                          TSTTKS                  ;TEST FOR TTY FLAG
1515  006234  000240                  ARESET: NOP
1516  006236  104013                  CALBT4: TSTTKS                  ;TEST FOR KEYBOARD INTERRUPT
1517  006240  023777  015460  172562          CMP     KSTOR2,@SWR     ;TEST IF SWITCH REGISTER HAS CHANGED
1518  006246  001730                          BEQ     CALB2A          ;BRANCH AND TAKE NEXT CONVERSION
1519  006250  000670                          BR      CALBT2          ;YES, COMPUTE NEW INPUT
1520                          ;*****************************************************************************
1521                          ;REPEATABILITY TEST
1522                          ;*****************************************************************************
1523
1524                          ;THIS ROUTINE TO DESIGNED TO SHOW REPEATIBILITY BY TAKING A SERIES OF
1525                          ;'512' CONVERSIONS,  AVERAGING THEM AND THEN CATORIZING
1526                          ;THEM IN BINS FROM THE AVERAGE PLUS & MINUS 6 COUNTS.  THE ROUTINE
1527                          ;REQUESTS FOR A CHANNEL OR CHANNELS, A COUNT SPREAD AND A A/D MODE TO BE TYPED
1528                          ;IN VIA THE OPERATOR.  A CONTINUOUS SERIES OF CONVERSIONS ARE THEN TAKEN
1529                          ;AND COMPARED AGAINST THE INPUT COUNT SPREAD.  IF ALL '512' CONVERSIONS
1530                          ;ARE FOUND TO BE WITHIN THE SPREAD THE NEXT CH. IS EXERCISED OTHERWISE
1531                          ;THE COUNTS ARE TYPED OUT.  SETTING SWITCH '10' TO A '1' WILL FORCE A PRINTOUT
1532                          ;OF THE CH (S).
1533
1534  006252  012737  006264  015446  REPTST: MOV     #REPT1,AVECTR   ;SET UP CNTR 'A' VECTOR ADDRESS
1535  006260  104000                          PRINT
1536  006262  014726                          MES13                   ;TEXT 'REPEATIBILITY TEST'
1537  006264  005037  015532          REPT1:  CLR     MESPRT
1538  006270  005037  015506                  CLR     USEDMA
1539  006274  005037  015504                  CLR     USEDSH
1540  006300  005037  015512                  CLR     OPS1
1541  006304  104000                          PRINT
1542  006306  014756                          MES14                   ;REQUEST CHANNEL (S)
1543  006310  104011                          TTYIN                   ;WAIT FOR INPUT
1544  006312  104001                          DECOCT                  ;CONVERT TO OCTAL
1545  006314  013737  011202  015456          MOV     BCDTAB,KSTOR1   ;SAVE AS INTIAL CH.
1546  006322  013737  015456  015460          MOV     KSTOR1,KSTOR2   ;ALSO SAVE AS 2ND CH. ENTRY
1547  006330  005737  011204                  TST     BCDTAB+2        ;TEST FOR SECOND ENTRY
1548  006334  001407                          BEQ     REPT2           ;BRANCH IF NO SECOND ENTRY
1549  006336  023737  011204  015456          CMP     BCDTAB+2,KSTOR1 ;COMPARE ENTRY 1 TO ENTRY 2
1550  006344  100747                          BMI     REPT1           ;BRANCH AND RESTART IF ILLEGAL
1551  006346  013737  011204  015460          MOV     BCDTAB+2,KSTOR2 ;OTHERWISE SAVE AS SECOND CH.
1552  006354  104000                  REPT2:  PRINT
1553  006356  015016                          MES16                   ;TEXT 'COUNT SPREAD ?'
1554  006360  104011                          TTYIN                   ;WAIT FOR ENTRY
1555  006362  104001                          DECOCT                  ;DECODE TO OCTAL
1556  006364  013737  011202  015462          MOV     BCDTAB,KSTOR3   ;SAVE IT
1557  006372  104000                          PRINT
1558  006374  015035                          MES18
1559  006376  104011                          TTYIN                   ;REQUEST MODE
1560  006400  122737  000102  011032          CMPB    #'B,INBUF       ;TEST FOR B
1561  006406  001003                          BNE     REPT2B          ;NOT
1562  006410  005137  015506                  COM     USEDMA
1563  006414  000411                          BR      REPT2A
1564  006416  122737  000104  011032  REPT2B: CMPB    #'D,INBUF       ;TEST FOR DUAL MODE
1565  006424  001005                          BNE     REPT2A          ;BRANCH IF NOT
1566  006426  005137  015504                  COM     USEDSH          ;SET DUAL MODE
1567  006432  052737  000100  015456          BIS     #BIT6,KSTOR1    ; BIT
1568  006440  013706  015444          REPT2A: MOV     STACK,SP
```

```
1569  006444  013737  015456  015464          MOV     KSTOR1,KSTOR4   ;SAVE STARTING CH.
1570  006452  104013          REPT3:  TSTTKS          ;TEST FOR KEYBOARD FLAG
1571  006454  012737  001000  015454          MOV     #1000,COUNT     ;SET FOR '512' CONVERSIONS
1572  006462  113737  015464  015441          MOVB    KSTOR4,ADWRD2+1 ;MOV SELECTED CH. TO HIGH BYTE OF ADWORD
1573  006470  042737  100377  015440          BIC     #100377,ADWRD2  ;MASK
1574  006476  052737  000001  015440          BIS     #1,ADWRD2
1575  006504  004737  011212                  JSR     PC,ADCNVT       ;TAKE THE CONVERSIONS
1576  006510  104004                          CMPUTE                  ;AVERAGE & COMPUTE DISTRIBUTION
1577  006512  104005                          CATORIZ
1578  006514  013777  015554  172310          MOV     AVRAGE,@DISPLA  ;LOAD DISPLAY REG. (11/45)
1579  006522  032777  002000  172300          BIT     #SW10,@SWR      ;TEST DATA SW10
1580  006530  001047                          BNE     REPT4           ;IF SET, FORCE TYPE OUT
1581  006532  032777  020000  172270  TSTCT4: BIT     #SW13,@SWR      ;TEST FOR INHIBIT TYPEOUT
1582  006540  001135                          BNE     REPT7           ;BRANCH IF SW SET
1583  006542  022737  000004  015462          CMP     #4,KSTOR3       ;WAS 4 TYPED
1584  006550  001005                          BNE     TSTCT3          ;NO, TEST FOR '3'
1585  006552  022737  001000  015630          CMP     #1000,XSPRD4    ;TOTAL COUNTS WITHIN 4 COUNTS
1586  006560  001033                          BNE     REPT4           ;BRANCH IF NO.
1587  006562  000524                          BR      REPT7           ;YES, TEST NEXT CH.
1588  006564  022737  000003  015462  TSTCT3: CMP     #3,KSTOR3       ;COUNT = TO 3
1589  006572  001005                          BNE     TSTCT2          ;NO TEST COUNT 2
1590  006574  022737  001000  015626          CMP     #1000,XSPRD3
1591  006602  001022                          BNE     REPT4           ;BRANCH IF COUNT NOT WITHIN 3
1592  006604  000513                          BR      REPT7           ;YES, TEST NEXT CH.
1593
1594  006606  022737  000002  015462  TSTCT2: CMP     #2,KSTOR3       ;COUNT =TO 2
1595  006614  001005                          BNE     TSTCT1          ;NO, TEST COUNT 1
1596  006616  022737  001000  015624          CMP     #1000,XSPRD2
1597  006624  001011                          BNE     REPT4           ;BRANCH IF NOT WITHIN 2
1598  006626  000502                          BR      REPT7           ;YES, TEST NEXT CH.
1599  006630  022737  000001  015462  TSTCT1: CMP     #1,KSTOR3       ;COUNT = TO 1
1600  006636  001004                          BNE     REPT4           ;NO, REPORT EVEN IF NOT '0'
1601  006640  022737  001000  015622          CMP     #1000,XSPRD1
1602  006646  001472                          BEQ     REPT7           ;BRANCH IF TOTAL WITHIN 1 COUNT
1603  006650  104000          REPT4:  PRINT
1604  006652  014470                  CRLF
1605  006654  005737  015532                  TST     MESPRT          ;TEST IF HEADER HAS BEEN TYPED
1606  006660  001002                          BNE     REPT5           ;BRANCH IF YES
1607  006662  104000                          PRINT
1608  006664  015114                          MES19                   ;TEXT 'CH. HIGH AVG. LOW'
1609  006666  104013          REPT5:  TSTTKS          ;TEST FOR KEYBOARD INTERRUPT
1610  006670  104000                  PRINT
1611  006672  014470                  CRLF            ;CARRIAGE RETURN, LINE FEED
1612  006674  013737  015464  007066          MOV     KSTOR4,REPT8A   ;MOV. CH.
1613  006702  042737  177700  007066          BIC     #177700,REPT8A
1614  006710  005737  015504                  TST     USEDSH          ;TEST FOR DUAL MODE
1615  006714  001403                          BEQ     REPT8           ;BRANCH IF NOT
1616  006716  062737  000010  007066          ADD     #10,REPT8A
1617  006724  104010          REPT8:  PRTOCT
1618  006726  007066                  REPT8A
1619  006730  104007                  SPACE
1620  006732  104010                  PRTOCT                  ;PRINT LOW VALUE
1621  006734  015540                  LOW
1622  006736  104007                  SPACE
1623  006740  104010                  PRTOCT                  ;PRINT AVERAGE VALUE
1624  006742  015554                  AVRAGE
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1625  006744  104007                          SPACE
1626  006746  104010                          PRTOCT                  ;PRINT HIGH VALUE
1627  006750  015536                          HIGH
1628  006752  005737  015532                  TST     MESPRT
1629  006756  001002                          BNE     REPT6
1630  006760  104000                          PRINT
1631  006762  015147                          MES20                   ;PRINT 'COUNT SPREAD' HEADER
1632  006764  052737  000007  015532  REPT6:  BIS     #7,MESPRT       ;INHIBIT OTHER HEADERS
1633  006772  022737  001000  015604          CMP     #1000,AVGCNT    ;TEST IF ALL COUNTS WERE AT AVG.
1634  007000  000240                          NOP                     ;<BEQ REPT7> BRANCH TO NEXT CH. IF YES.
1635  007002  104000                          PRINT
1636  007004  014470                          CRLF
1637  007006  012704  015570                  MOV     #ORLOW,R4
1638  007012  012402                  REPT6A: MOV     (R4)+,R2
1639  007014  104006                          BINDEC                  ;TYPE OUT COUNT SPREAD
1640  007016  022704  015622                  CMP     #XSPRD1,R4      ;TEST FOR DONE
1641  007022  001373                          BNE     REPT6A          ;BRANCH IF NO AND TYPE NEXT COUNT
1642  007024  005777  172000                  TST     @SWR
1643  007030  100001                          BPL     REPT7
1644  007032  000000                          HALT                    ;REPEATIBILITY ERROR
1645  007034  013704  015464          REPT7:  MOV     KSTOR4,R4
1646  007040  042704  177700                  BIC     #177700,R4
1647  007044  023704  015460                  CMP     KSTOR2,R4       ;TESTED ALL CH.(S)?
1648  007050  001404                          BEQ     REPT7A
1649  007052  005237  015464                  INC     KSTOR4          ;TEST NEXT CHANNEL
1650  007056  000137  006452                  JMP     REPT3           ;
1651  007062  000137  006440          REPT7A: JMP     REPT2A
1652
1653  007066  000000                  REPT8A: 0
```

```
                                        ;*****************************************************************************
                                        ;RECOVERY TEST
                                        ;*****************************************************************************
                                        ;THIS TEST IS DESIGNED TO TEST RECOVERY OF THE A/D CONVERTER VIA ACCEPT-
                                        ;ING TWO (2) CHANNEL FROM THE TELETYPE AND THEN TAKE A
                                        ;SERIES OF EIGHT CONVERSIONS ON EACH CHANNEL AND TYPING OUT THE CON-
                                        ;VERSION VALUES OF THE 2ND CHANNEL IN THE ORDER THEY WERE TAKEN.
007070  012737  007112  015446  RECVRY: MOV     #RECVY1,AVECTR  ;SET UP THE '↑A' RETURN ADDRESS
007076  005037  015506                  CLR     USEDMA
007102  005037  015504                  CLR     USEDSH
007106  104000                          PRINT
007110  014556                          MES8                    ;TEXT 'RECOVERY TEST'
007112  104000                  RECVY1: PRINT                   ;REQUEST CHANNELS
007114  014756                          MES14
007116  104011                          TTYIN                   ;WAIT FOR INPUT
007120  104001                          DECOCT                  ;CONVERT TO OCTAL
007122  013737  011202  015456          MOV     BCDTAB,KSTOR1   ;SAVE 1ST CH.
007130  013737  011204  015460          MOV     BCDTAB+2,KSTOR2 ;SAVE 2ND CH.
007136  013706  015444          RECVY2: MOV     STACK,SP
007142  104013                          TSTTKS                  ;CHECK FOR KEYBOARD FLAG
007144  012737  000020  007456          MOV     #16.,10$        ;LOAD COUNT
007152  005037  007460                  CLR     11$             ;CLEAR POINTER
007156  012737  000010  015522          MOV     #10,TEMP3       ;SET UP TO PRINT 10
007164  012737  000010  015454          MOV     #10,COUNT       ;SETUP TO TAKE '8' CONVERSIONS ON 1ST CH.
007172  113737  015456  015441  1$:     MOVB    KSTOR1,ADWRD2+1 ;LOAD 1ST CH.
007200  042737  140377  015440          BIC     #140377,ADWRD2
007206  052737  000001  015440          BIS     #1,ADWRD2
007214  005237  015500                  INC     DELAY           ;SET FLAG
007220  004737  011212                  JSR     PC,ADCNVT       ;TAKE THE CONVERSIONS
007224  113737  015460  015441          MOVB    KSTOR2,ADWRD2+1 ;SET UP 2ND CH.
007232  042737  140377  015440          BIC     #140377,ADWRD2
007240  052737  000001  015440          BIS     #1,ADWRD2
007246  005237  015500                  INC     DELAY           ;SET FLAG
007252  004737  011212                  JSR     PC,ADCNVT       ;TAKE 2ND SERIES OF CONVERSIONS
```

```
1688  007256  013701  007460                  MOV     11$,R1          ;LOAD A POINTER
1689  007262  012700  015654                  MOV     #ADBUFF,R0      ;LOAD POINTER
1690  007266  012061  015716                  MOV     (R0)+,ADTB0(R1)
1691  007272  012061  015760                  MOV     (R0)+,ADTB1(R1)
1692  007276  012061  016022                  MOV     (R0)+,ADTB2(R1)
1693  007302  012061  016064                  MOV     (R0)+,ADTB3(R1)
1694  007306  012061  016126                  MOV     (R0)+,ADTB4(R1)
1695  007312  012061  016170                  MOV     (R0)+,ADTB5(R1)
1696  007316  012061  016232                  MOV     (R0)+,ADTB6(R1)
1697  007322  012061  016274                  MOV     (R0)+,ADTB7(R1)
1698  007326  062737  000002  007460          ADD     #2,11$          ;UPDATE POINTER
1699  007334  005337  007456                  DEC     10$
1700  007340  001314                          BNE     1$
1701
1702  007342  012700  000010                  MOV     #8.,R0          ;LOAD COUNT
1703  007346  012702  015654                  MOV     #ADBUFF,R2      ;LOAD POINTER
1704  007352  012701  000000                  MOV     #0,R1
1705  007356  012737  000017  015516  2$:     MOV     #15.,TEMP1      ;LOAD TEMP
1706  007364  012737  000004  012612          MOV     #4,CMPCNT       ;LOAD AVRG. COUNT
1707  007372  016104  007464                  MOV     LADTB(R1),R4    ;GET POINTER
1708  007376  012746  000340                  MOV     #340,-(SP)      ;PUSH
1709  007402  004737  012446                  JSR     PC,CMPTEA       ;CONVERT AND AVERAGE
1710  007406  013722  015554                  MOV     AVRAGE,(R2)+    ;SAVE AVERAGE
1711  007412  005721                          TST     (R1)+           ;UPDATE POINTER
1712  007414  005300                          DEC     R0
1713  007416  001357                          BNE     2$              ;BR IF NOT DONE
1714
1715  007420  032777  002000  171402          BIT     #SW10,@SWR      ;TEST BIT 10
1716  007426  001243                          BNE     RECVY2
1717  007430  104000                          PRINT
1718  007432  014601                          MES9                    ;TEXT 'CH.'
1719  007434  104013                          TSTTKS                  ;CHECK AGAIN FOR KEYBOARD FLAG
1720  007436  013737  015460  007066          MOV     KSTOR2,REPT8A
1721  007444  104010                          PRTOCT
1722  007446  007066                          REPT8A
1723  007450  104007                          SPACE
1724  007452  104012                          PRTAVG                  ;PRINT VALUES OF 2ND CH.
1725  007454  000630                          BR RECVY2               ;DO IT AGAIN
1726  007456  000000                  10$:    0
1727  007460  000000                  11$:    0
1728  007462  000000                  12$:    0
1729
1730  007464  015716                  LADTB:  ADTB0
1731  007466  015760                          ADTB1
1732  007470  016022                          ADTB2
1733  007472  016064                          ADTB3
1734  007474  016126                          ADTB4
1735  007476  016170                          ADTB5
1736  007500  016232                          ADTB6
1737  007502  016274                          ADTB7
```

```
                                        ;*****************************************************************
                                        ;       DUAL SAMPLE AND HOLD TEST       <CH 0-3> AND <CH 10-13> ONLY
                                        ;*****************************************************************

007504  012737  007512  015446  DSHTST: MOV     #DSHT0,AVECTR   ;SET UP '↑A' RETURN
007512  104000                  DSHT0:  PRINT                   ;TYPE HEADER
007514  014771                          MES15
007516  005037  001034          DSHT1:  CLR     PASSCT          ;CLEAR PASS COUNT
007522  005037  015474          DSHT2:  CLR     STCHAN          ;CLEAR STARTING CHANNEL
007526  004537  013664          DSHT3:  JSR     R5,LEDS
007532  015474                          STCHAN
007534  000240                          NOP                     ;RESET'''
007536  052777  000100  171254          BIS     #BIT6,@TKS      ;ENABLE INTERRUPT
007544  013706  015444                  MOV     STACK,SP        ;LOAD THE STACK POINTER
007550  013777  001034  171254          MOV     PASSCT,@DISPLA  ;LOAD PASS COUNT
007556  113777  015474  171256          MOVB    STCHAN,@ADCS1   ;LOAD CHANNEL <0-3>
007564  005277  171250                  INC     @ADCS           ;START CONVERSION
007570  105777  171244                  TSTB    @ADCS           ;WAIT FOR DONE
007574  100375                          BPL     .-4
007576  017737  171242  015544          MOV     @ADDBR,AVERM4   ;SAVE THE CONVERTED VALUE
007604  152777  000010  171230          BISB    #10,@ADCS1      ;UPDATE THE CHANNEL
007612  005277  171222                  INC     @ADCS           ;START CONVERSION
007616  105777  171216                  TSTB    @ADCS           ;WAIT FOR DONE
007622  100375                          BPL     .-4
007624  017737  171214  015546          MOV     @ADDBR,AVERM3   ;SAVE THE CONVERTED VALUE

007632  004537  010120                  JSR     R5,COMPR        ;COMPARE TWO NUMBERS
007636  015544                          AVERM4
007640  015546                          AVERM3
007642  001014                          BNE     DSHT6           ;BRANCH IF NOT EQUAL <DIFFERENT INPUT>
007644  032777  020000  171156          BIT     #BIT13,@SWR
007652  001004                          BNE     DSHT4
007654  104000                          PRINT
007656  014470                          CRLF
007660  104000                          PRINT
007662  015255                          MES22                   ;PRINT MESSAGE
007664  005777  171140          DSHT4:  TST     @SWR
007670  100001                          BPL     DSHT6
007672  000000                          HALT                    ;ERROR, CHANNEL PAIRS HAVE SAME INPUT VOLTAGE
                                                                ;THE FIRST CHANNEL NUMBER OF THE PAIR IS IN THE LEDS
```

```
                                        ;NOW TEST THAT DUAL SAMPLE REALLY WORKS
                                        ;SET DUAL MODE AND CONVERT A CHANNEL THE FIRST CONVERSION
                                        ;SHOULD NOT EQUAL THE SECOND CONVERSION
                                        ;IF IT DOES THE DUAL SAMPLE AND HOLD IS NOT WORKING CORRECTLY

007674  113777  015474  171140  DSHT6:  MOVB    STCHAN,@ADCS1   ;LOAD 1ST MUX CHANNEL
007702  052777  040000  171130          BIS     #BIT14,@ADCS    ;SET 'DUAL MODE'
007710  005277  171124                  INC     @ADCS           ;START CONVERSION
007714  105777  171120                  TSTB    @ADCS           ;WAIT FOR DONE
007720  100375                          BPL     .-4
007722  005277  171112                  INC     @ADCS           ;START SECOND CONVERSION
007726  017737  171112  015550          MOV     @ADDBR,AVERM2   ;SAVE 1ST CHANNEL CONVERSION
007734  105777  171100                  TSTB    @ADCS           ;WAIT FOR DONE
007740  100375                          BPL     .-4
007742  017737  171076  015552          MOV     @ADDBR,AVERM1   ;SAVE 2ND CHANNEL CONVERSION

007750  004537  010120                  JSR     R5,COMPR
007754  015550                          AVERM2
007756  015552                          AVERM1
007760  001015                          BNE     DSHT7           ;BRANCH IF NOT EQUAL
007762  032777  020000  171040          BIT     #BIT13,@SWR
007770  001004                          BNE     DSHT6A
007772  104000                          PRINT
007774  014470                          CRLF
007776  104000                          PRINT
010000  015333                          MES23                   ;PRINT ERROR
010002  005777  171022  DSHT6A: TST     @SWR
010006  100014                  BPL     DSHT7A
010010  000000                  HALT                            ;ERROR, FIRST CONVERSION ON CHANNEL X (STCHAN) WAS EQUAL
010012  000412                  BR      DSHT7A                  ;TO THE SECOND CONVERSION IN DUAL MODE
```

```
1812
1813  010014  004537  010120          DSHT7:  JSR     R5,COMPR
1814  010020  015544                          AVERM4                  ;COMPARE TWO NUMBERS
1815  010022  015550                          AVERM2                  ;TEST IF NOT EQUAL
1816  010024  001017                          BNE     DSHT8
1817  010026  004537  010120                  JSR     R5,COMPR        ;COMPARE TWO SAMPLES
1818  010032  015546                          AVERM3
1819  010034  015552                          AVERM1
1820  010036  001012                          BNE     DSHT8           ;BRANCH IF NOT EQUAL
1821  010040  005237  015474          DSHT7A: INC     STCHAN          ;UPDATE CHANNEL
1822  010044  022737  000004  015474        CMP     #4,STCHAN       ;FINISHED ?
1823  010052  001225                          BNE     DSHT3           ;NO
1824  010054  005037  015474                  CLR     STCHAN          ;CLEAR CHANNEL
1825  010060  104013                          TSTTKS                  ;TEST KEYBOARD
1826  010062  000414                          BR      DSHT8B
1827
1828  010064  032777  020000  170736  DSHT8:  BIT     #BIT13,@SWR
1829  010072  001004                          BNE     DSHT8A
1830  010074  104000                          PRINT
1831  010076  014470                          CRLF
1832  010100  104000                          PRINT
1833  010102  015412                          MES24
1834  010104  005777  170720          DSHT8A: TST     @SWR
1835  010110  100001                          BPL     DSHT8B
1836  010112  000000                          HALT                    ;ERROR, PREVIOUS CONVERSTION ON CHANNEL NOT EQUAL
1837  010114  000137  010040          DSHT8B: JMP     DSHT7A          ; CURRENT CONVERSION
1838
1839  010120  013537  010210          COMPR:  MOV     @(R5)+,CMPRA    ;SAVE 1ST NUMBER
1840  010124  013537  010212                  MOV     @(R5)+,CMPRB    ;SAVE 2ND NUMBER
1841  010130  013737  010212  010214          MOV     CMPRB,CMPRC     ;SAVE 2ND AGAIN
1842  010136  163737  010210  010214          SUB     CMPRA,CMPRC     ;SUBTRACT 2ND FROM 1ST
1843  010144  001413                          BEQ     CMPR2           ;BRANCH IF EQUAL
1844  010146  100005                          BPL     CMPR1           ;BRANCH IF + <A-B=+>
1845  010150  063737  001010  010214          ADD     AMASK,CMPRC     ;ADD SPREAD
1846  010156  100006                          BPL     CMPR2           ;BRANCH IF <A=B+MASK>
1847  010160  000410                          BR      CMPR3           ;BRANCH IF
1848  010162  163737  001010  010214  CMPR1:  SUB     AMASK,CMPRC     ;SUBTRACT AMASK
1849  010170  003401                          BLE     CMPR2           ;BRANCH IF EQUAL *
1850  010172  000403                          BR      CMPR3           ;BRANCH IF NOT-EQUAL *
1851
1852  010174  005037  010214          CMPR2:  CLR     CMPRC           ;A AND B ARE WITHIN AMASK
1853  010200  000205                          RTS     R5
1854
1855  010202  005137  010214          CMPR3:  COM     CMPRC           ;A AND B ARE NOT WITHIN AMASK
1856  010206  000205                          RTS     R5
1857
1858  010210  000000          CMPRA:  0
1859  010212  000000          CMPRB:  0
1860  010214  000000          CMPRC:  0
```

```
                                        ;ROUTINE TO LOOP THUR A SINGLE LOGIC SUBTEST.  ENTERED FROM THE 'MONITOR'
                                        ;VIA TYPING 'TNN' WHERE 'NN' IS EQUATED TO THE 'PC' OF A SUBTEST.
                                        ;NOTE THAT 'SW11' MUST BE '0' (DOWN) TO RUN THIS TEST.

010216  012701  011032          TESTX:  MOV     #INBUF,R1
010222  005037  015456                  CLR     KSTOR1
010226  042711  177770          TSTA:   BIC     #177770,(R1)    ;MASK TO OCTAL
010232  062137  015456                  ADD     (R1)+,KSTOR1    ;ADD TO LAST RESULT
010236  005337  015452                  DEC     CHRCNT
010242  001407                          BEQ     TSTXB
010244  006337  015456                  ASL     KSTOR1
010250  006337  015456                  ASL     KSTOR1
010254  006337  015456                  ASL     KSTOR1
010260  000762                          BR      TSTA

010262  022737  005742  015456  TSTXB:  CMP     #CALBRT,KSTOR1  ;IS NO. WITHIN LIMITS OF THE LOGIC TEST
010270  100002                          BPL     .+6             ;CONTINUE IF YES
010272  000137  001666                  JMP     INIT3           ;OTHERWISE RETURN TO MONITOR
010276  062737  000002  015456          ADD     #2,KSTOR1       ;ADD '2' TO POINT TO INSTRUCTION AFTER SCOPE
010304  005037  013576          XLOOP:  CLR     SCOPEF          ;KEEP COUNT AT ZERO
010310  012737  010304  013600          MOV     #XLOOP,RETURN   ;LOAD SCOPE LOOP RETURN POINTER
010316  000177  005134                  JMP     @KSTOR1         ;JUMP TO TEST

                                        ;SUBROUTINE TO ISSUE N SPACES
                                        ;N IS ONE PLUS VALUE CONTAINED IN SPACEX
                                        ;SPACEX IS CLEARED WITHIN THE SUBROUTINE, SO THAT A CALL ON
                                        ;SPACE WITHOUT LOADING SPACEX ISSUES ONLY ONE SPACE

010322  105777  170476          XSPACE: TSTB    @TPS            ;WAIT FOR TTY READY
010326  100375                          BPL     .-4
010330  012777  000240  170470          MOV     #240,@TPB       ;OUTPUT A SPACE
010336  005337  010352                  DEC     SPACEX          ;DECREMENT COUNT
010342  003367                          BGT     XSPACE          ;LOOP IF NOT DONE
010344  005037  010352                  CLR     SPACEX          ;RESET COUNT TO ZERO
010350  000002                          RTI                     ;RETURN
010352  000000          SPACEX: 0

                                        ;SUBROUTINE TO TYPE OUT AVERAGES FOR THE RECOVERY TEST

010354  012737  015654  010364  XPRTAV: MOV     #ADBUFF,AVGTAB
010362  104010          XPTA1:  PRTOCT
010364  015654          AVGTAB: ADBUFF
010366  062737  000002  010364          ADD     #2,AVGTAB
010374  012737  000002  010352          MOV     #2,SPACEX
010402  104007                          SPACE
010404  005337  015522                  DEC     TEMP3
010410  001364                          BNE     XPTA1
010412  000002                          RTI
```

```
1909                                    ;KEYBOARD SERVICE ROUTINE
1910
1911  010414  010046                    XTTYIN: MOV     R0,-(SP)
1912  010416  010146                            MOV     R1,-(SP)
1913  010420  010246                            MOV     R2,-(SP)
1914  010422  010346                            MOV     R3,-(SP)
1915  010424  010446                            MOV     R4,-(SP)
1916  010426  010546                            MOV     R5,-(SP)
1917  010430  012704  011032           NEWIN:   MOV     #INBUF,R4          ;SETUP CHARACTER BUFFER
1918  010434  042777  000100  170356            BIC     #BIT6,@TKS
1919  010442  005037  015452                    CLR     CHRCNT             ;CLEAR CHARACTER COUNTER
1920  010446  005037  011032                    CLR     INBUF
1921  010452  005037  011034                    CLR     INBUF+2
1922  010456  005037  011036                    CLR     INBUF+4
1923  010462  005037  011040                    CLR     INBUF+6
1924  010466  005037  011042                    CLR     INBUF+10
1925  010472  005037  011044                    CLR     INBUF+12
1926  010476  005037  011046                    CLR     INBUF+14
1927  010502  105777  170312           INPUTA:  TSTB    @TKS               ;CHARACTER READY?
1928  010506  100375                            BPL     INPUTA             ;NO, WAIT IT OUT
1929  010510  017701  170306                    MOV     @TKB,R1            ;SAVE CHARACTER
1930  010514  042701  177600                    BIC     #177600,R1         ;STRIP PARITY BIT
1931  010520  120127  000060                    CMPB    R1,#60             ;IS IT A SPECIAL CHARACTER
1932  010524  100420                            BMI     SPCHR              ;YES, TEST IT
1933  010526  122701  000173                    CMPB    #173,R1
1934  010532  100415                            BMI     SPCHR
1935  010534  010124                  INPUTB:   MOV     R1,(R4)+           ;SAVE CHARACTER
1936  010536  005237  015452                    INC     CHRCNT             ;INCREMENT THE CHARACTER COUNT.
1937  010542  022737  000006  015452            CMP     #6,CHRCNT
1938  010550  100524                            BMI     SPCHR5
1939  010552  105777  170246           OUTPTA:  TSTB    @TPS               ;ECHO CHARACTER
1940  010556  100375                            BPL     OUTPTA
1941  010560  110177  170242                    MOVB    R1,@TPB
1942  010564  000746                            BR      INPUTA             ;WAIT FOR NEXT CHARACTER
1943
1944                                    ;SUBROUTINE TO TEST FOR SPECIAL CHARACTERS :'↑A','↑C','↑G','CR','.' OR 'RUBOUT'
1945
1946  010566  122701  000001           SPCHR:   CMPB    #1,R1              ;CHAR.='↑A'
1947  010572  001016                            BNE     SPCHR1             ;NO, NOT '↑A'
1948  010574  104000                            PRINT                      ;ECHO '↑A'
1949  010576  014436                            CNTRLA                     ;RESTORE 'SP'
1950  010600  012605                            MOV     (SP)+,R5
1951  010602  012604                            MOV     (SP)+,R4
1952  010604  012603                            MOV     (SP)+,R3
1953  010606  012602                            MOV     (SP)+,R2
1954  010610  012601                            MOV     (SP)+,R1
1955  010612  012600                            MOV     (SP)+,R0
1956  010614  022626                            CMP     (SP)+,(SP)+
1957  010616  052777  000100  170174            BIS     #BIT6,@TKS         ;ENABLE KEYBOARD INTR.
1958  010624  000177  004616                    JMP     @AVECTR            ;YES, EXIT VIA '↑A' VECTOR ADDRESS.
1959  010630  122701  000003           SPCHR1:  CMPB    #3,R1              ;CHAR.='↑C'
1960  010634  001002                            BNE     1$                 ;NO,NOT '↑C'
1961  010636  000137  001426                    JMP     MONITR             ;YES, EXIT TO MONITOR
1962  010642  122701  000177           1$:      CMPB    #177,R1            ;CHAR. = 'RUBOUT'
1963  010646  001011                            BNE     SPCHR3             ;NO TRY ANOTHER CHAR
1964  010650  005737  015452                    TST     CHRCNT             ;IS RUBOUT LEGAL?
```

```
 1965  010654  001712                          BEQ     INPUTA          ;NO, IGNORE IT
 1966  010656  005337  015452                  DEC     CHRCNT
 1967  010662  012701  000134                  MOV     #134,R1         ;TYPE '\' TO INDICATE RUBOUUT
 1968  010666  005744                          TST     -(R4)           ;POP OFF LAST CHARACTER
 1969  010670  000730                          BR      OUTPTA          ;WAIT FOR NEXT CHARACTER
 1970  010672  122701  000054          SPCHR3: CMPB    #54,R1          ;TEST FOR ','
 1971  010676  001716                          BEQ     INPUTB          ;LEGAL CHAR., SAVE IT
 1972  010700  122701  000015          SPCHR4: CMPB    #15,R1          ;=TO 'CARRIAGE RETURN' TO TERMINATE?
 1973  010704  001014                          BNE     1$              ;NO, CONTINUE
 1974  010706  104000                          PRINT                   ;YES, TYPE 'CR-LF'
 1975  010710  014470                          CRLF
 1976  010712  012605                  4$:     MOV     (SP)+,R5
 1977  010714  012604                          MOV     (SP)+,R4
 1978  010716  012603                          MOV     (SP)+,R3
 1979  010720  012602                          MOV     (SP)+,R2
 1980  010722  012601                          MOV     (SP)+,R1
 1981  010724  012600                          MOV     (SP)+,R0
 1982  010726  052777  000100  170064          BIS     #BIT6,@TKS      ;ENABLE KEYBOARD INTR.
 1983  010734  000002                          RTI                     ;EXIT
 1984  010736  122701  000007          1$:     CMPB    #7,R1           ;TEST IF CTRL G
 1985  010742  001027                          BNE     SPCHR5          ;BR IF NOT
 1986  010744  104000                          PRINT
 1987  010746  014441                          CNTRLG
 1988  010750  104010                          PRTOCT                  ;PRINT OLD VALUE
 1989  010752  000170                          SOFTSW
 1990  010754  104000                          PRINT
 1991  010756  014457                          NEWSWR                  ;ASK FOR NEW VALUE
 1992  010760  104011                          TTYIN
 1993  010762  005001                          CLR     R1
 1994  010764  012700  011032                  MOV     #INBUF,R0
 1995  010770  005710                  2$:     TST     (R0)            ;TEST FOR TERM
 1996  010772  001410                          BEQ     3$              ;BR IF TERM
 1997  010774  012002                          MOV     (R0)+,R2        ;GET CHAR
 1998  010776  042702  177770                  BIC     #177770,R2      ;MASK OUT
 1999  011002  006301                          ASL     R1
 2000  011004  006301                          ASL     R1
 2001  011006  006301                          ASL     R1
 2002  011010  060201                          ADD     R2,R1
 2003  011012  000766                          BR      2$
 2004  011014  010137  000170          3$:     MOV     R1,SOFTSW       ;SAVE NEW SWITCH VALUE
 2005  011020  000734                          BR      4$
```

```
2006  011022  104000                SPCHR5: PRINT                   ;OTHERWISE TYPE '?'
2007  011024  014475                        QMARK
2008  011026  000137  010414                JMP     XTTYIN          ; WAIT FOR NEW ENTRY
2009  011032  000000                INBUF:  0                       ;CHARACTER STORAGE BUFFER
2010
2011
2012          011050                        .=.+14
2013                                ;SUBROUTINE WILL CONVERT 'N' WORDS (SEPARATED VIA COMMA'S)
2014                                ;WHICH WERE STORED IN A TABLE VIA 'TTYIN' TO OCTAL AND STORE THEM.
2015
2016  011050  012704  011032        BCDBIN: MOV     #INBUF,R4       ;SETUP ASCII STORAGE TABLE
2017  011054  012703  011202                MOV     #BCDTAB,R3      ;TABLE FOR STORAGE OF CONVERTED WORDS
2018  011060  005037  011204                CLR     BCDTAB+2
2019  011064  005001                BCDBN1: CLR     R1              ;REG. TO STORE RUNNING TOTAL
2020  011066  005002                        CLR     R2              ;TEMP. STORAGE FOR 'R1'
2021  011070  005737  015452        BCDBN2: TST     CHRCNT          ;END OF DATA?
2022  011074  003424                        BLE     BCDEND          ;YES, EXIT
2023  011076  005337  015452                DEC     CHRCNT          ;DECREMENT CHARACTER COUNTER
2024  011102  122714  000054                CMPB    #54,(R4)        ;IS CHARACTER = TO ' ,'?
2025  011106  001417                        BEQ     BCDEND          ;YES, DECODE NEW WORD
2026  011110  121427  000060                CMPB    (R4),#60
2027  011114  002425                        BLT     BCDERR          ;TEST FOR LEGAL NO.
2028  011116  021427  000067                CMP     (R4),#67
2029  011122  003022                        BGT     BCDERR
2030  011124  042714  177770                BIC     #177770,(R4)    ;STRIP NO.
2031  011130  012400                        MOV     (R4)+,R0        ;SAVE NO. IN R0.
2032  011132  010102                        MOV     R1,R2           ;SAVE CURRENT TOTAL
2033  011134  006301                        ASL     R1              ;NX2
2034  011136  006301                        ASL     R1              ;NX4
2035  011140  006301                        ASL     R1              ;NX8
2036  011142  060001                        ADD     R0,R1           ;N+NEW NO.
2037  011144  000751                        BR      BCDBN2
2038  011146  020127  000077        BCDEND: CMP     R1,#77
2039  011152  003006                        BGT     BCDERR
2040  011154  005724                        TST     (R4)+           ;UPDATE BUFFER
2041  011156  010123                        MOV     R1,(R3)+        ;SAVE CONVERTED VALUE & SETUP TO SAVE NEXT
2042  011160  005737  015452                TST     CHRCNT          ;FINISHED?
2043  011164  001337                        BNE     BCDBN1          ;NO, CONVERT NEXT WORD
2044  011166  000002                        RTI                     ;YES, EXIT
2045  011170  104000                BCDERR: PRINT
2046  011172  014475                        QMARK                   ;TYPE '?',
2047  011174  104011                        TTYIN                   ;TO BE TYPED ON QUESTIONABLE ENTRIES.
2048  011176  000137  011050                JMP     BCDBIN
2049  011202  000000                BCDTAB: 0                       ;OCTAL STORAGE TABLE
2050  011204  000000                        0
2051  011206  000000                        0
2052  011210  000000                        0
```

```
                                        ;SUBROUTINE TO TAKE 'N' CONVERSIONS AND STORE THEM IN AN A/D BUFFER. ROUTINE
                                        ;IS ENTERED WITH 'N' IN COUNT AND THE CH TO BE CONVERTED IN 'ADWORD'.

011212  005077  167600          ADCNVT: CLR     @PSW
011216  013737  015454  015516          MOV     COUNT,TEMP1     ;SET UP # OF CONVERSIONS TO BE TAKEN
011224  012704  015654                  MOV     #ADBUFF,R4      ;LOAD BUFFER ADDRESS
011230  005037  015476                  CLR     FIRST           ;CLEAR TEMP
011234  005737  015500                  TST     DELAY           ;TEST DELAY
011240  001031                          BNE     6$              ;IF SET, SKIP
011242  117737  167574  005740          MOVB    @ADCS1,DMK2     ;READ MUX CHANNELS
011250  123737  015441  005740          CMPB    ADWRD2+1,DMK2   ;TEST
011256  001411                          BEQ     1$              ;BR IF SAME
011260  113777  015441  167554          MOVB    ADWRD2+1,@ADCS1 ;LOAD MUX CHANNELS
011266  013737  012100  015502          MOV     CPTIME,DELAY1
011274  005337  015502          2$:     DEC     DELAY1
011300  001375                          BNE     2$              ;DELAY
011302  005037  015500          1$:     CLR     DELAY
011306  005737  015506                  TST     USEDMA          ;TEST DMA FLAG
011312  001051                          BNE     DMACVT          ;USE DMA
011314  113777  015440  167516  4$:     MOVB    ADWRD2,@ADCS    ;LOAD CONTROL BYTE
011322  000403                          BR      5$
011324  013777  015440  167506  6$:     MOV     ADWRD2,@ADCS    ;LOAD CONTROL WORD
                                                                ;LOAD CH. & START CONVERT IF NOT 'EXT'
011332  105777  167502          5$:     TSTB    @ADCS           ;TEST A/D DONE
011336  100375                          BPL     5$              ;WAIT FOR DONE
011340  005777  167474                  TST     @ADCS           ;TEST ERROR BIT
011344  100014                          BPL     11$             ;BRANCH IT NOT SET
011346  005077  167466                  CLR     @ADCS
011352  037727  167452  020000          BIT     @SWR,#BIT13
011360  001002                          BNE     10$
011362  104000                          PRINT
011364  014706                          MES12
011366  005777  167436          10$:    TST     @SWR
011372  100001                          BPL     11$
011374  000000                          HALT                    ;ERROR BIT SET

011376  005737  015504          11$:    TST     USEDSH
011402  001407                          BEQ     12$             ;BRANCH IF NOT DUAL MODE
011404  005137  015476                  COM     FIRST
011410  001404                          BEQ     12$
011412  017737  167426  015524          MOV     @ADDBR,BRLEV1   ;EJECT THIS VALUE
011420  000735                          BR      4$
011422  017724  167416          12$:    MOV     @ADDBR,(R4)+    ;SAVE DATA
011426  005337  015516                  DEC     TEMP1           ;DECREMENT COUNTER
011432  003330                          BGT     4$              ;IF NOT '0' TAKE NEXT CONVERSION
011434  000207                          RTS     PC
```

```
2100
2101  011436  012777  011606  167410  DMACVT: MOV     #DACUTC,@ADINT  ;SET UP RETURN ADDRESS
2102  011444  012704  030000                  MOV     #30000,R4
2103  011450  105077  167364                  CLRB    @ADCS
2104  011454  112777  000006  167356          MOVB    #6,@ADCS        ;LOAD CA POINTER
2105  011462  012777  015654  167362          MOV     #ADBUFF,@ADMR   ;LOAD CURRENT ADDRESS
2106  011470  112777  000004  167342          MOVB    #4,@ADCS        ;LOAD WO POINTER
2107  011476  012777  177000  167346          MOV     #-1000,@ADMR    ;LOAD WORD COUNT
2108  011504  112777  000002  167326          MOVB    #2,@ADCS        ;LOAD DMA STATUS POINTER
2109  011512  012777  010000  167332          MOV     #BIT12,@ADMR    ;LOAD DMA ENABLE
2110  011520  052737  000010  015440          BIS     #BIT3,ADWRD2
2111  011526  113777  015440  167304          MOVB    ADWRD2,@ADCS
2112  011534  005304                  DACUTA: DEC     R4
2113  011536  001376                          BNE     DACUTA
2114  011540  005777  167274                  TST     @ADCS
2115  011544  100404                          BMI     DACUTB
2116  011546  005077  167266                  CLR     @ADCS
2117  011552  104400                          ERROR
2118  011554  000000                          HALT                    ;A TO D FAILED TO INTERRUPT IN BURST MODE
2119  011556  005077  167256          DACUTB: CLR     @ADCS
2120  011562  037727  167242  002000          BIT     @SWR,#2000
2121  011570  001002                          BNE     DACUTD
2122  011572  104000                          PRINT
2123  011574  014706                          MES12                   ;PRINT 'ERROR BIT SET'
2124  011576  005777  167226          DACUTD: TST     @SWR
2125  011602  100001                          BPL     DACUTC
2126  011604  000000                          HALT                    ;ERROR BIT SET IN BURST MODE
2127
2128  011606  005077  167226          DACUTC: CLR     @ADCS
2129  011612  012777  000006  167220          MOV     #6,@ADCS
2130  011620  022777  017654  167224          CMP     #ADBUFF+2000,@ADMR
2131  011626  001401                          BEQ     .+4
2132  011630  104400                          ERROR                   ;ERROR, DMA CURRENT ADDRESS IN ERROR
2133
2134  011632  012777  000004  167200          MOV     #4,@ADCS
2135  011640  005777  167206                  TST     @ADMR
2136  011644  001401                          BEQ     .+4
2137  011646  104400                          ERROR                   ;ERROR, DMA WORD COUNT IN ERROR
2138
2139  011650  012777  000002  167162          MOV     #2,@ADCS
2140  011656  005777  167170                  TST     @ADMR
2141  011662  001401                          BEQ     .+4
2142  011664  104400                          ERROR                   ;ERROR, DMA STATUS IN ERROR
2143
2144  011666  005237  015512                  INC     OPS1
2145  011672  022626                          CMP     (SP)+,(SP)+
2146  011674  000207                          RTS     PC
```

```
2147
2148                                    ;POWER FAIL HANDLER
2149
2150  011676  010046                    PWRFAL: MOV     R0,-(SP)
2151  011700  010146                            MOV     R1,-(SP)
2152  011702  010246                            MOV     R2,-(SP)
2153  011704  010346                            MOV     R3,-(SP)
2154  011706  010446                            MOV     R4,-(SP)
2155  011710  010546                            MOV     R5,-(SP)
2156  011712  013746  000024                    MOV     24,-(SP)
2157  011716  010637  015450                    MOV     SP,PROC
2158  011722  012737  011732  000024            MOV     #PWRUP,24
2159  011730  000000                            HALT
2160
2161                                    ;POWER UP HANDLER
2162
2163  011732  012777  000340  167056  PWRUP:   MOV     #340,@PSW
2164  011740  013706  015450                    MOV     PROC,SP
2165  011744  012637  000024                    MOV     (SP)+,24
2166  011750  012605                            MOV     (SP)+,R5
2167  011752  012604                            MOV     (SP)+,R4
2168  011754  012603                            MOV     (SP)+,R3
2169  011756  012602                            MOV     (SP)+,R2
2170  011760  012601                            MOV     (SP)+,R1
2171  011762  012600                            MOV     (SP)+,R0
2172  011764  000005                            RESET
2173  011766  104000                            PRINT
2174  011770  015235                            MES21
2175  011772  000137  001426                    JMP     MONITR
```

```
                                        ;EMT DISPATCH SERVICE ROUTINE
                                        ;ARGUMENT OF EMT IS EXTRACTED AND USED AS OFFSET TO OBTAIN POINTER
                                        ;TO THE SELECTED SUBROUTINE.

011776  011646                  EMTSRV: MOV     (SP),-(SP)      ;GET PC FOR TO RETURN
012000  162716  000002                  SUB     #2,(SP)         ;PC OF EMT
012004  017616  000000                  MOV     @(SP),(SP)      ;GET EMT
012010  005716                          TST     (SP)            ;IS EMT VALID?
012012  001001                          BNE     EMTOK
012014  000000                          HALT                    ;INVALID EMT
012016  006316                  EMTOK:  ASL     (SP)            ;MULTIPLY EMT ARG BY '2'
012020  042716  177001                  BIC     #177001,(SP)    ;CLEAR UNWANTED BITS
012024  062716  012036                  ADD     #EMTTAB,(SP)    ;POINTER TO SUBROUTINE ADDRESS
012030  017616  000000                  MOV     @(SP),(SP)      ;SUBROUTINE ADDRESS
012034  000136                          JMP     @(SP)+          ;GO TO SUBROUTINE

                                        ;EMT DISPATCH TABLE

012036  012102                  EMTTAB: TYPMES                  ;MESSAGE PRINT ROUTINE
012040  011050                          BCDBIN                  ;BINARY CONVERSION ROUTINE
012042  013506                          SCOPEC                  ;LOGIC TEST SCOPE ROUTINE
012044  013602                          SCOPEH                  ;LOGIC TEST SCOPE LOOP (ID)
012046  012426                          CMPTE                   ;SUBROUTINE TO COMPUTE THE AVG
012050  012614                          CATORZ                  ;SUBROUTINE TO COMPUTE 'COUNT SPREAD'
012052  012230                          DECPRT                  ;SUBROUTINE TO CONVERT OCT TO DEC + PRINT
012054  010322                          XSPACE                  ;SUBROUTINE TO TYPE SPACES
012056  013154                          OCTPRT                  ;OCTAL PRINT ROUTINE
012060  010414                          XTTYIN                  ;TELEPRINTER SERVICE ROUTINE
012062  010354                          XPRTAV                  ;SUBROUTINE TO PRINT OUT THE GAIN AVERAGES
012064  013272                          TKSFLG                  ;SUBROUTINE TO TEST FOR KEYBOARD FLAG
012066  013642                          SCOPEI                  ;SCOPE ROUTINE

012070  002000                  CPDLAY: 2000                    ;PDP-11/05
012072  002400                          2400                    ;PDP-11/20
012074  003500                          3500                    ;PDP-11/40
012076  006000                          6000                    ;PDP-11/45

012100  002000                  CPTIME: 2000
```

```
2216                                    ;MESSAGE PRINT ROUTINE, ENTERED VIA EMT DISPATCH HANDLER.
2217                                    ;ROUTINE PICKS UP CONTENTS OF THE 'PC' AND USES THIS AS
2218                                    ;THE ADDRESS OF MESSAGE TO BE TYPED.
2219
2220  012102  005077  166710           TYPMES: CLR     @PSW            ;ENABLE KEYBOARD INTR.
2221  012106  017605  000000                   MOV     @(SP),R5        ;GET THE MESSAGE ADDRESS FROM START
2222  012112  062716  000002                   ADD     #2,(SP)         ;SET UP STACK TO EXIT
2223  012116  105777  166702           TYPERA: TSTB    @TPS
2224  012122  100375                           BPL     TYPERA          ;WAIT FOR TTY DONE
2225  012124  122715  000100                   CMPB    #100,(R5)       ;TEST FOR '@'
2226  012130  001001                           BNE     TYPER1          ;BRANCH IF NO EQUAL
2227  012132  000002                           RTI                     ;OTHERWISE EXIT
2228  012134  122715  000045           TYPER1: CMPB    #45,(R5)        ;TEST FOR '%'
2229  012140  001403                           BEQ     TYPECL          ;IF = TYPE 'CR-LF'
2230  012142  112577  166660           TYPER2: MOVB    (R5)+,@TPB      ;OUTPUT CHAR.
2231  012146  000763                           BR      TYPERA
2232  012150  012777  000015  166650   TYPECL: MOV     #15,@TPB        ;TYPE 'CR'
2233  012156  105777  166642                   TSTB    @TPS
2234  012162  100375                           BPL     .-4
2235  012164  012777  000012  166634           MOV     #12,@TPB
2236  012172  013737  001012  012226           MOV     FILLS,2$        ;LOAD FILL COUNT
2237  012200  105777  166620           1$:     TSTB    @TPS
2238  012204  100375                           BPL     1$
2239  012206  113777  001014  166612           MOVB    FILCHR,@TPB     ;FILL CHAR
2240  012214  005337  012226                   DEC     2$
2241  012220  100367                           BPL     1$
2242  012222  105725                           TSTB    (R5)+           ;INCREMENT BUFFER
2243  012224  000734                           BR      TYPERA
2244  012226  000002           2$:     2
2245
2246                                    ;PRINT DECIMAL VALUE IN R2
2247
2248  012230  005077  166562           DECPRT: CLR     @PSW
2249  012234  012737  177774  012410           MOV     #-4,DIGCNT
2250  012242  012737  012416  012414           MOV     #DECPNT+2,DECPNT
2251  012250  012737  000240  012412           MOV     #240,ZERO
2252  012256  012737  177777  012406   TYPT1:  MOV     #-1,DIGIT
2253  012264  005237  012406           TYPT2:  INC     DIGIT
2254  012270  167702  000120                   SUB     @DECPNT,%2
2255  012274  100373                           BPL     TYPT2
2256  012276  067702  000112                   ADD     @DECPNT,%2
2257  012302  004737  012326                   JSR     PC,DECOUT
2258  012306  005237  012410                   INC     DIGCNT
2259  012312  001001                           BNE     TYPT3
2260  012314  000002                           RTI
2261  012316  062737  000002  012414   TYPT3:  ADD     #2,DECPNT
2262  012324  000754                           BR      TYPT1
2263  012326  005737  012406           DECOUT: TST     DIGIT
2264  012332  001010                           BNE     DEC1
2265  012334  022737  177777  012410           CMP     #-1,DIGCNT
2266  012342  001404                           BEQ     DEC1
2267  012344  013737  012412  012406           MOV     ZERO,DIGIT
2268  012352  000406                           BR      DEC2
2269  012354  012737  000260  012412   DEC1:   MOV     #260,ZERO
2270  012362  052737  000260  012406           BIS     #260,DIGIT
2271  012370  105777  166430           DEC2:   TSTB    @TPS
```

```
2272  012374  100375                        BPL     .-4
2273  012376  013777  012406  166422        MOV     DIGIT,@TPB
2274  012404  000207                        RTS     7
2275
2276  012406  000000              DIGIT:    0
2277  012410  000000              DIGCNT:   0
2278  012412  000240              ZERO:     240
2279  012414  012416              DECPNT:   .+2
2280  012416  001750                        1000.
2281  012420  000144                        100.
2282  012422  000012                        10.
2283  012424  000001                        1.
2284
2285                              ;COMPUTE THE RESULTS OF 512 CONVERSIONS AS HIGH, LOW AND AVERAGE
2286
2287  012426  012737  000777  015516  CMPTE:  MOV     #777,TEMP1      ;SET UP TO COMPARE '511' NUMBERS
2288  012434  012704  015654                  MOV     #ADBUFF,R4      ;SET UP DATA BUFFER ADDRESS
2289  012440  012737  000011  012612          MOV     #11,CMPCNT      ;LOAD AVRG. COUNT
2290  012446  005037  015534          CMPTEA: CLR     HIORDV
2291  012452  012437  015554                  MOV     (R4)+,AVRAGE    ;STORE 1ST VALUE AS AVERAGE
2292  012456  013737  015554  015536          MOV     AVRAGE,HIGH     ;HIGH
2293  012464  013737  015554  015540          MOV     AVRAGE,LOW      ;& LOW
2294  012472  012437  015520          GETDAT: MOV     (R4)+,TEMP2
2295  012476  023737  015520  015536          CMP     TEMP2,HIGH      ;IS NEW NO. GREATER THAN OLD NO.
2296  012504  003403                          BLE     TSLO            ;BRANCH IF NOT GREATER
2297  012506  013737  015520  015536          MOV     TEMP2,HIGH      ;OTHERWISE SAVE AS NEW HIGH
2298  012514  023737  015520  015540  TSLO:   CMP     TEMP2,LOW
2299  012522  003003                          BGT     TAGA
2300  012524  013737  015520  015540          MOV     TEMP2,LOW       ;OTHERWISE SAVE AS NEW LOW
2301  012532  063737  015520  015554  TAGA:   ADD     TEMP2,AVRAGE    ;ADD LOW ORDER
2302  012540  005537  015534                  ADC     HIORDV          ;ADD CARRY TO HI ORDER
2303  012544  005337  015516                  DEC     TEMP1
2304  012550  001350                          BNE     GETDAT          ;512 OR 16 ADDITIONS?
2305  012552  013737  012612  015516          MOV     CMPCNT,TEMP1    ;YES, DIVIDE/512 OR 16
2306  012560  006237  015534          AVGDAT: ASR     HIORDV
2307  012564  006037  015554                  ROR     AVRAGE          ;SHIFT CARRY BIT INTO LO ORDER
2308  012570  005337  015516                  DEC     TEMP1
2309  012574  001371                          BNE     AVGDAT          ;DONE?
2310  012576  005537  015554                  ADC     AVRAGE          ;YES, ADD REMAINDER TO LO ORDER
2311  012602  004537  013664                  JSR     5,LEDS
2312  012606  015554                          AVRAGE
2313  012610  000002                          RTI
2314
2315  012612  000011              CMPCNT:   11                      ;11 OR 4
```

```
2316                                    ;SUBROUTINE TO CALCULATE THE PLUS & MINUS 5 COUNT LIMITS FROM AN AVERAGE
2317
2318  012614  012737  000005  015516  CATORZ: MOV     #5,TEMP1
2319  012622  013737  015554  015520          MOV     AVRAGE,TEMP2    ;MOV AVER. TO WORK AREA
2320  012630  012703  015556                  MOV     #AVERP1,R3      ;SETUP DISTRIBUTION TABLE (POS.)
2321  012634  005237  015520          FILE1:  INC     TEMP2           ;A=A+1
2322  012640  013723  015520                  MOV     TEMP2,(R3)+     ;SAVE A+1
2323  012644  005337  015516                  DEC     TEMP1           ;SAVED '5' COUNTS?
2324  012650  001371                          BNE     FILE1           ;BRANCH IF NO
2325                                  ;SET UP TABLE OF AVG. -1 TO -5
2326  012652  012737  000005  015516          MOV     #5,TEMP1
2327  012660  013737  015554  015520          MOV     AVRAGE,TEMP2    ;MOV AVG. TO WORK AREA.
2328  012666  012703  015554                  MOV     #AVRAGE,R3      ;SET UP DISTRIBUTION TABLE NEG.
2329  012672  005337  015520          FILE2:  DEC     TEMP2           ;A=1-1
2330  012676  013743  015520                  MOV     TEMP2,-(R3)     ;SAVE 'A-1'
2331  012702  005337  015516                  DEC     TEMP1           ;SAVED '5' COUNTS?
2332  012706  001371                          BNE     FILE2           ;BRANCH IF NO
2333
2334                                  ;CATEGORIZE THE COUNT SPREAD AS '+6 & -6' COUNTS FROM THE AVERAGE
2335
2336  012710  012703  015570                  MOV     #ORLOW,R3       ;CLEAR COUNTS
2337  012714  005023                  CATR1:  CLR     (R3)+
2338  012716  022703  015622                  CMP     #ORHIGH+2,R3    ;FINISHED?
2339  012722  001374                          BNE     CATR1           ;NO, CLEAR NEXT COUNTER
2340  012724  012737  001001  015516          MOV     #1001,TEMP1     ;COMPARE '512' COUNTS
2341  012732  012700  015654                  MOV     #ADBUFF,R0      ;SET UP A/D BUFFER
2342  012736  005337  015516          CATR2:  DEC     TEMP1
2343  012742  001437                          BEQ     CATR5           ;EXIT IF '0'
2344  012744  012037  015520                  MOV     (R0)+,TEMP2
2345  012750  023737  015566  015520          CMP     AVERP5,TEMP2
2346  012756  100423                          BMI     OVRHI
2347  012760  023737  015520  015542          CMP     TEMP2,AVERM5
2348  012766  100422                          BMI     OVRLO
2349  012770  005001                          CLR     R1
2350  012772  012702  015542                  MOV     #AVERM5,R2
2351  012776  022237  015520          CATR3:  CMP     (R2)+,TEMP2
2352  013002  001405                          BEQ     CATR4
2353  013004  005201                          INC     R1
2354  013006  022701  000013                  CMP     #13,R1
2355  013012  001371                          BNE     CATR3
2356  013014  000000                          HALT                    ;FATAL ERROR
2357  013016  006301                  CATR4:  ASL     R1              ;MULTIPLY 'OFFSET' X2
2358  013020  005261  015572                  INC     MINUS5(R1)
2359  013024  000744                          BR      CATR2
2360  013026  005237  015620          OVRHI:  INC     ORHIGH
2361  013032  000741                          BR      CATR2
2362  013034  005237  015570          OVRLO:  INC     ORLOW
2363  013040  000736                          BR      CATR2
```

```
2364
2365                                    ;ADD THE COUNTS AND SAVE TOTAL IN SPREADS OF '1-4'
2366
2367  013042  013737  015604  015622  CATR5:  MOV     AVGCNT,XSPRD1
2368  013050  063737  015606  015622          ADD     PLUS1,XSPRD1
2369  013056  063737  015602  015622          ADD     MINUS1,XSPRD1   ;=TO NO. COUNTS AT SPREAD OF '1'
2370  013064  013737  015622  015624          MOV     XSPRD1,XSPRD2
2371  013072  063737  015610  015624          ADD     PLUS2,XSPRD2
2372  013100  063737  015600  015624          ADD     MINUS2,XSPRD2   ;=TO NO. COUNTS AT SPREAD OF '2'
2373  013106  013737  015624  015626          MOV     XSPRD2,XSPRD3
2374  013114  063737  015612  015626          ADD     PLUS3,XSPRD3
2375  013122  063737  015576  015626          ADD     MINUS3,XSPRD3   ;=TO NO. COUNTS AT SPREAD OF '3'
2376  013130  013737  015626  015630          MOV     XSPRD3,XSPRD4
2377  013136  063737  015614  015630          ADD     PLUS4,XSPRD4
2378  013144  063737  015574  015630          ADD     MINUS4,XSPRD4   ;=TO NO. COUNTS AT SPREAD OF '4'
2379  013152  000002                          RTI                     ;EXIT
2380
2381                                    ;SUBROUTINE TO TYPEOUT A '6' DIGIT OCTAL NO. THE 'PC' CONTAINS
2382                                    ;THE ADDRESS OF 'WORD' TO BE TYPED
2383
2384  013154  017605  000000          OCTPRT: MOV     @(SP),R5        ;THE ADDRESS OF WORD TO BE TYPED
2385  013160  062716  000002                  ADD     #2,(SP)         ;SET UP STACK TO EXIT
2386  013164  012737  000006  013264          MOV     #6,10$          ;LOAD COUNTER
2387  013172  012737  000376  013270          MOV     #376,MASK       ;MASK FOR FIRST BIT
2388  013200  000401                          BR      .+4
2389  013202  006115                  1$:     ROL     (R5)
2390  013204  006115                          ROL     (R5)
2391  013206  006115                          ROL     (R5)
2392  013210  111537  013266                  MOVB    (R5),11$
2393  013214  143737  013270  013266          BICB    MASK,11$
2394  013222  052737  000260  013266          BIS     #260,11$
2395  013230  132777  000200  165566          BITB    #200,@TPS
2396  013236  100374                          BPL     .-6             ;WAIT FOR PRINTER READY
2397  013240  113777  013266  165560          MOVB    11$,@TPB        ;PRINT CHAR.
2398  013246  012737  000370  013270          MOV     #370,MASK       ;MASK FOR NEXT '5' DIGITS
2399  013254  005337  013264                  DEC     10$
2400  013260  001350                          BNE     1$
2401  013262  000002                          RTI
2402  013264  000000                  10$:    0
2403  013266  000000                  11$:    0
2404  013270  000376                  MASK:   376
2405
2406                                    ;SUBROUTINE TO TEST FOR THE KEYBOARD FLAG BEING SET
2407
2408  013272  105777  165522          TKSFLG: TSTB    @TKS            ;FLAG SET?
2409  013276  100001                          BPL     .+4             ;NO, EXIT
2410  013300  104011                          TTYIN                   ;YES,INQUIRE
2411
2412
2413  013302  000002                          RTI
2414                                    ;ENTERED WITH SYSTEM TRAP CALL (ERROR)
2415  013304  104013                  LOGERR: TSTTKS                  ;TEST FOR KEYBOARD INTERRUPT
2416  013306  037727  165516  020000          BIT     @SWR,#20000     ;TEST FOR INHIBIT PRINT OUT
2417  013314  001067                          BNE     CK              ;INHIBIT,CHECK FOR HALT
2418  013316  012737  000002  000006          MOV     #RTI,@#6        ;SET UP FOR BUSS ERROR
2419  013324  011637  015462                  MOV     (SP),KSTOR3     ;PC OF FAILING ROUTINE
```

```
2420  013330  162737  000002  015462          SUB     #2,KSTOR3
2421  013336  004537  013664                  JSR     5,LEDS
2422  013342  015462                          KSTOR3
2423  013344  017737  165470  015464          MOV     @ADCS,KSTOR4    ;SAVE A/D STATUS TO BE TYPED
2424  013352  017737  165466  015466          MOV     @ADDBR,KSTOR5   ;SAVE A/D CONVERTED VALUE
2425  013360  017705  165466                  MOV     @ADMR,R5        ;SAVE DMA REG.
2426  013364  010537  015472                  MOV     R5,KSTR12       ;SAVE R5 IN KSTR12
2427  013370  013737  015514  015470          MOV     TEMP,KSTR11     ;SAVE TEMP
2428  013376  012737  000000  000006          MOV     #0,@#6          ;RESET BUSS ERROR
2429  013404  005737  015442                  TST     PRINT1
2430  013410  001006                          BNE     LGERR1
2431  013412  104000                          PRINT
2432  013414  014470                          CRLF
2433  013416  104000                          PRINT
2434  013420  014071                          MES1
2435  013422  005237  015442                  INC     PRINT1
2436  013426  104000          LGERR1: PRINT                   ;OUTPUT CARRIAGE RETURN AND LINE FEED
2437  013430  014470                  CRLF
2438  013432  104010                  PRTOCT                  ;PRINT FAILING PC+2
2439  013434  015462                  KSTOR3
2440  013436  104007                  SPACE                   ;OUTPUT A SPACE
2441  013440  104010                  PRTOCT                  ;PRINT
2442  013442  015464                  KSTOR4                  ;CONTENTS OF A/D STATUS REG.
2443  013444  104007                  SPACE
2444  013446  104010                  PRTOCT
2445  013450  015466                  KSTOR5
2446  013452  104007                  SPACE
2447  013454  104010                  PRTOCT
2448  013456  015472                  KSTR12
2449  013460  104007                  SPACE
2450  013462  104010                  PRTOCT
2451  013464  015470                  KSTR11
2452  013466  105777  165332          TSTB    @TPS
2453  013472  100375                  BPL     .-4
2454  013474  005777  165330  CK:     TST     @SWR            ;CHECK SR FOR HALT SWITCH
2455  013500  100001                  BPL     .+4             ;BRANCH IF NOT SET
2456  013502  000000                  HALT                    ;HALT ON ERROR UP
2457  013504  000002                  RTI                     ;RETURN TO MAIN LINE
```

```
2458
2459                                    ;SCOPE AND/OR ITERATION LOOP FOR SOME TEST 4000 TIMES
2460
2461  013506  104013                    SCOPEC: TSTTKS                          ;TEST FOR KEYBOARD INIT
2462  013510  032777  040000  165312            BIT     #40000,@SWR             ;TEST SR FOR SCOPE
2463  013516  001015                            BNE     SCOPEB                  ;YES, SCOPE
2464  013520  032777  004000  165302            BIT     #4000,@SWR              ;NO-TEST FOR ITERATION
2465  013526  001016                            BNE     SCOPEG                  ;INHIBIT ITERATION
2466  013530  005737  001034                    TST     PASSCT                  ;TEST IF FIRST PASS
2467  013534  001413                            BEQ     SCOPEG                  ;BR IF FIRST PASS -- QUCIK PASS
2468  013536  023737  013576  001036            CMP     SCOPEF,ICOUNT           ;COMPARE CURRENT COUNT TO MAX NUMBER
2469  013544  001407            SCOPEJ: BEQ     SCOPEG                  ;EXIT-DONE
2470  013546  005237  013576            INC     SCOPEF                  ;INCREMENT COUNT
2471  013552  022606            SCOPEB: CMP     (6)+,SP                 ;REPOSITION STACK
2472  013554  012677  165236            MOV     (6)+,@PSW               ;RESTORE PREVIOUS PROCESSOR STATUS
2473  013560  000177  000014            JMP     @RETURN                 ;REPEAT TEST
2474  013564  005037  013576    SCOPEG: CLR     SCOPEF                  ;CLEAR COUNT
2475  013570  011637  013600            MOV     @SP,RETURN              ;SAVE SCOPE RETURN POINTER
2476  013574  000002                    RTI                             ;RETURN INLINE-NEXT TEST
2477  013576  000000            SCOPEF: 0                               ;COUNT LOCATION FOR ITERATION LOOP
2478  013600  002042            RETURN: ADT1+2                          ;ADDRESS OF LAST TEST
2479
2480                                    ;SCOPE AND/OR INTERATION LOOP FOR SOME TESTS 10 TIMES
2481
2482  013602  104013            SCOPEH: TSTTKS
2483  013604  032777  040000  165216            BIT     #40000,@SWR
2484  013612  001357                            BNE     SCOPEB
2485  013614  032777  004000  165206            BIT     #4000,@SWR
2486  013622  001360                            BNE     SCOPEG
2487  013624  005737  001034                    TST     PASSCT                  ;TEST IF FIRST PASS
2488  013630  001755                            BEQ     SCOPEG                  ;BR IF YES
2489  013632  023727  013576  000010            CMP     SCOPEF,#10
2490  013640  000741                            BR      SCOPEJ
2491
2492                                    ;SCOPE LOOP FOR SOME TEST 1 TIME
2493
2494  013642  104013            SCOPEI: TSTTKS                                  ;TEST KEYBOARD
2495  013644  032777  040000  165156            BIT     #40000,@SWR
2496  013652  001337                            BNE     SCOPEB
2497  013654  000743                            BR      SCOPEG
```

```
2498
2499  013656  104000                    BELL:   PRINT
2500  013660  013772                            ENDPAS
2501  013662  000207                            RTS     PC              ;EXIT
2502
2503                                    ;LOAD THE LPS DISPLAY LIGHTS
2504
2505  013664  012737  000006  013762    LEDS:   MOV     #6,CNTLED
2506  013672  005037  013770                    CLR     LEDSV3
2507  013676  013537  013764                    MOV     @(5)+,LEDSV1
2508  013702  013737  013764  013766    LEDSA:  MOV     LEDSV1,LEDSV2
2509  013710  042737  177770  013766            BIC     #177770,LEDSV2
2510  013716  113737  013770  013767            MOVB    LEDSV3,LEDSV2+1
2511  013724  013777  013766  165112            MOV     LEDSV2,@ADDBR
2512  013732  006237  013764                    ASR     LEDSV1
2513  013736  006237  013764                    ASR     LEDSV1
2514  013742  006237  013764                    ASR     LEDSV1
2515  013746  005237  013770                    INC     LEDSV3
2516  013752  005337  013762                    DEC     CNTLED
2517  013756  001351                            BNE     LEDSA
2518  013760  000205                            RTS     5
2519
2520  013762  000006                    CNTLED: 6
2521  013764  000000                    LEDSV1: 0
2522  013766  000000                    LEDSV2: 0
2523  013770  000000                    LEDSV3: 0
2524
2525  013772      007       007         ENDPAS: .BYTE   7,7
2526  013774  042445  042116  050040            .ASCII  '%END PASS   @'
2527  014002  051501  020123  020040
2528  014010      100
```

```
                                        ;MESSAGES
014011    000                                   .BYTE
014012  022445  046045  051520  TITLE:  .ASCII  '%%%LPS DIAGNOSTIC TEST I, (MAINDEC-11-DZLPC-C)@'
014020  042040  040511  047107
014026  051517  044524  020103
014034  042524  052123  044440
014042  020054  046450  044501
014050  042116  041505  030455
014056  026461  055104  050114
014064  026503  024503     100
014071     040  050040  020103  MES1:   .ASCII  "  PC   "
014076  020040
014100  042101  052123  052101          .ASCII  "ADSTAT "
014106     040
014107     101  041104  043125          .ASCII  "ADBUFF "
014114  020106
014116  040440  042104  040515          .ASCII  " ADDMA "
014124     040
014125     040  042524  050115          .ASCII  " TEMP@"
014132     100
014133     045  054524  042520  MES4:   .ASCII  "%TYPE LETTER ' ' TO RUN DESIRED TEST:%"
014140  046040  052105  042524
014146  020122  020047  020047
014154  047524  051040  047125
014162  042040  051505  051111
014170  042105  052040  051505
014176  035124     045
014201     047  023501  040475          .ASCII  "'A'=A TO D LOGIC TEST%"
014206  052040  020117  020104
014214  047514  044507  020103
014222  042524  052123     045
014227     047  023502  040475          .ASCII  "'B'=A TO D DMA LOGIC TEST%"
014234  052040  020117  020104
014242  046504  020101  047514
014250  044507  020103  042524
014256  052123     045
014261     047  023503  040475          .ASCII  "'C'=A TO D CALIBRATION%"
014266  052040  020117  020104
014274  040503  044514  051102
014302  052101  047511  022516
014310  042047  036447  020101          .ASCII  "'D'=A TO D REPEATABILITY%"
014316  047524  042040  051040
014324  050105  040505  040524
014332  044502  044514  054524
014340     045
014341     047  023505  040475          .ASCII  "'E'=A TO D RECOVERY%"
014346  052040  020117  020104
014354  042522  047503  042526
014362  054522     045
014365     047  023506  040475          .ASCII  "'F'=A TO D DUAL MODE DYNAMIC LOGIC %@"
014372  052040  020117  020104
014400  052504  046101  046440
```

```
2585  014406  042117  020105  054504
2586  014414  040516  044515  020103
2587  014422  047514  044507  020103
2588  014430  040045
2589
2590  014432  041536  040045          CNTRLC: .ASCII  '↑C%@'
2591
2592  014436  040536     100          CNTRLA: .ASCII  '↑A@'
2593  014441     136  022507  046117  CNTRLG: .ASCII  '↑G%OLD SWR = @'
2594  014446  020104  053523  020122
2595  014454  020075     100
2596  014457     040  047040  053505  NEWSWR: .ASCII  '  NEW = @'
2597  014464  036440  040040
2598
2599  014470  040045                  CRLF:   .ASCII  '%@'
2600
2601  014472  027045     100          DOT:    .ASCII  '%.@'
2602
2603  014475     077  040040          QMARK:  .ASCII  '? @'
2604
2605  014500  021045  020101  047524  MES5:   .ASCII  '%"A TO D LOGIC TEST"% @'
2606  014506  042040  046040  043517
2607  014514  041511  052040  051505
2608  014522  021124  020045     100
2609
2610  014527     045  040442  052040  MES7:   .ASCII  '%"A TO D CALIBRATION"%@'
2611  014534  020117  020104  040503
2612  014542  044514  051102  052101
2613  014550  047511  021116  040045
2614  014556  021045  020101  047524  MES8:   .ASCII  '%"A TO D RECOVERY"@'
2615  014564  042040  051040  041505
2616  014572  053117  051105  021131
2617  014600     100
2618
2619  014601     045  044103  040040  MES9:   .ASCII  '%CH @'
2620
2621  014606  023445  023505  052130  MES10:  .ASCII  "%'E'XT. OR 'I'NT. OR 'C'LOCK. SYNC? @"
2622  014614  020056  051117  023440
2623  014622  023511  052116  020056
2624  014630  051117  023440  023503
2625  014636  047514  045503  020056
2626  014644  054523  041516  020077
2627  014652     100
2628
2629
2630  014653     045  040442  052040  MES11:  .ASCII  '%"A TO D DMA LOGIC TEST"% @'
2631  014660  020117  020104  046504
2632  014666  020101  047514  044507
2633  014674  020103  042524  052123
2634  014702  022442  040040
2635  014706  051105  047522  020122  MES12:  .ASCII  'ERROR BIT SET!%@'
2636  014714  044502  020124  042523
2637  014722  020524  040045
2638
2639  014726  021045  020101  047524  MES13:  .ASCII  '%"A TO D REPEATIBILITY"@'
2640  014734  042040  051040  050105
```

```
2641  014742  040505  044524  044502
2642  014750  044514  054524  040042
2643
2644  014756  022445  044103  024056  MES14:  .ASCII  '%%CH.(S)? @'
2645  014764  024523  020077     100
2646  014771     045  040442  052040  MES15:  .ASCII  '%"A TO D DUAL MODE"%@'
2647  014776  020117  020104  052504
2648  015004  046101  046440  042117
2649  015012  021105  040045
2650
2651  015016  047503  047125  020124  MES16:  .ASCII  'COUNT SPREAD? @'
2652  015024  050123  042522  042101
2653  015032  020077     100
2654  015035     045  044447  047047  MES18:  .ASCII  "%'I'NTERNAL OR 'B'URST OR 'D'UAL SAMPLE MODE? @"
2655  015042  042524  047122  046101
2656  015050  047440  020122  041047
2657  015056  052447  051522  020124
2658  015064  051117  023440  023504
2659  015072  040525  020114  040523
2660  015100  050115  042514  046440
2661  015106  042117  037505  040040
2662  015114  020045  041440  027110  MES19:  .ASCII  '%  CH.    LO     AV     HI@'
2663  015122  020040  020040  047514
2664  015130  020040  020040  040440
2665  015136  020126  020040  020040
2666  015144  044510     100
2667
2668  015147     045  020040  047514  MES20:  .ASCII  '%  LO  -5  -4  -3  -2  -1  AV  +1  +2  +3  +4  +5  HI@'
2669  015154  020040  032455  020040
2670  015162  032055  020040  031455
2671  015170  020040  031055  020040
2672  015176  030455  020040  053101
2673  015204  020040  030453  020040
2674  015212  031053  020040  031453
2675  015220  020040  032053  020040
2676  015226  032453  020040  044510
2677  015234     100
2678
2679  015235     045  047520  042527  MES21:  .ASCII  '%POWER FAILURE @'
2680  015242  020122  040506  046111
2681  015250  051125  020105     100
2682  015255     111  050116  052125  MES22:  .ASCII  'INPUT CHANNEL PAIR HAVE THE SAME INPUT VALUE%@'
2683  015262  041440  040510  047116
2684  015270  046105  050040  044501
2685  015276  020122  040510  042526
2686  015304  052040  042510  051440
2687  015312  046501  020105  047111
2688  015320  052520  020124  040526
2689  015326  052514  022505     100
2690  015333     105  051122  051117  MES23:  .ASCIZ  'ERROR - FIRST CONVERSION EQUAL TO THE SECOND%@'
2691  015340  026440  043040  051111
2692  015346  052123  041440  047117
2693  015354  042526  051522  047511
2694  015362  020116  050505  040525
2695  015370  020114  047524  052040
2696  015376  042510  051440  041505
```

```
 2697  015404  047117  022504  000100
 2698  015412  051461  020124  047503  MES24:  .ASCIZ  '1ST CONV. NOT = 2ND%@'
 2699  015420  053116  020056  047516
 2700  015426  020124  020075  047062
 2701  015434  022504  000100
 2702                                  .EVEN
 2703                                 ;ADDRESS AND CONSTANTS TABLE
 2704  015440  000000                 ADWRD2: 0                       ;LOW BYTE OF 'ADWORD'
 2705  015442  000000                 PRINT1: 0
 2706  015444  001000                 STACK:  1000                    ;INITIAL SP. ADDRESS
 2707  015446  001420                 AVECTR: INITA                   ;'↑A' VECTOR ADDRESS
 2708  015450  000000                 PROC:   0                       ;TEMP STORAGE FOR 'PSW'
 2709  015452  000000                 CHRCNT: 0                       ;TEMP STORAGE
 2710  015454  000000                 COUNT:  0                       ;TEMP STORAGE
 2711  015456  000000                 KSTOR1: 0                       ;PERMANENT STORAGE
 2712  015460  000000                 KSTOR2: 0                       ;PERMANENT STORAGE
 2713  015462  000000                 KSTOR3: 0                       ;PERMANENT STORAGE
 2714  015464  000000                 KSTOR4: 0                       ;PERMANENT STORAGE
 2715  015466  000000                 KSTOR5: 0
 2716  015470  000000                 KSTR11: 0
 2717  015472  000000                 KSTR12: 0
 2718  015474  000000                 STCHAN: 0
 2719  015476  000000                 FIRST:  0
 2720  015500  000000                 DELAY:  0
 2721  015502  000000                 DELAY1: 0
 2722  015504  000000                 USEDSH: 0
 2723  015506  000000                 USEDMA: 0
 2724  015510  000000                 USECLK: 0
 2725  015512  000000                 OPS1:   0
 2726  015514  000000                 TEMP:   0
 2727  015516  000000                 TEMP1:  0                       ;TEMPORARY STORAGE
 2728  015520  000000                 TEMP2:  0                       ;TEMPORARY STORAGE
 2729  015522  000000                 TEMP3:  0                       ;TEMPORARY STORAGE
 2730  015524  000000                 BRLEV1: 0
 2731  015526  000000                 BRLEV2: 0
 2732  015530  000000                 BRLEV3: 0
 2733  015532  000000                 MESPRT: 0
 2734  015534  000000                 HIORDV: 0
 2735  015536  000000                 HIGH:   0
 2736  015540  000000                 LOW:    0
 2737  015542  000000                 AVERM5: 0
 2738  015544  000000                 AVERM4: 0
 2739  015546  000000                 AVERM3: 0
 2740  015550  000000                 AVERM2: 0
 2741  015552  000000                 AVERM1: 0
 2742  015554  000000                 AVRAGE: 0
 2743  015556  000000                 AVERP1: 0
 2744  015560  000000                 AVERP2: 0
 2745  015562  000000                 AVERP3: 0
 2746  015564  000000                 AVERP4: 0
 2747  015566  000000                 AVERP5: 0
 2748  015570  000000                 ORLOW:  0
 2749  015572  000000                 MINUS5: 0
 2750  015574  000000                 MINUS4: 0
 2751  015576  000000                 MINUS3: 0
 2752  015600  000000                 MINUS2: 0
```

```
2753  015602  000000                  MINUS1: 0
2754  015604  000000                  AVGCNT: 0
2755  015606  000000                  PLUS1:  0
2756  015610  000000                  PLUS2:  0
2757  015612  000000                  PLUS3:  0
2758  015614  000000                  PLUS4:  0
2759  015616  000000                  PLUS5:  0
2760  015620  000000                  ORHIGH: 0
2761  015622  000000                  XSPRD1: 0
2762  015624  000000                  XSPRD2: 0
2763  015626  000000                  XSPRD3: 0
2764  015630  000000                  XSPRD4: 0
2765  015632  000000                  DIAA:   0
2766  015634  000000                  DIAB:   0
2767  015636  000000                  DIAC:   0
2768  015640  015642                  DIAD:   .+2
2769  015642  023420                          10000.
2770  015644  001750                          1000.
2771  015646  000144                          100.
2772  015650  000012                          10.
2773  015652  000001                          1.
2774
2775  015654  000000                  ;HERE STARTS THE '512' WORD A/D DATA BUFFER.
2776                                  ADBUFF: 0
2777          015716                          .=.+40
2778  015716  000000                  ADTB0:  0
2779          015760                          .=.+40
2780  015760  000000                  ADTB1:  0
2781          016022                          .=.+40
2782  016022  000000                  ADTB2:  0
2783          016064                          .=.+40
2784  016064  000000                  ADTB3:  0
2785          016126                          .=.+40
2786  016126  000000                  ADTB4:  0
2787          016170                          .=.+40
2788  016170  000000                  ADTB5:  0
2789          016232                          .=.+40
2790  016232  000000                  ADTB6:  0
2791          016274                          .=.+40
2792  016274  000000                  ADTB7:  0
2793          016336                          .=.+40
2794          001060                          .END    INIT
```

```
ADT25   003364          1043#
ADT25A  003436          1047    1053#
ADT26   003444          1052    1058#
ADT26A  003516          1061    1068#
ADT26B  003520          1067    1069#
ADT27   003532          1074#
ADT3    002134           795#
ADT30   003554          1083#
ADT31   003576          1092#
ADT32   003634          1104#
ADT4    002172           808#
ADT5    002230           820#
ADT6    002266           832#
ADT7    002324           844#
ADWRD2  015440          1483*   1484*   1488*   1492*   1495*   1572*   1573*   1574*   1678*   1679*   1680*   1683*   1684*
                        1685*   2063    2065    2072    2074    2110*   2111    2704#
AMASK   001010           591#   1845    1848
ARESET  006234          1515#
AVECTR  015446           700*   1467*   1534*   1661*   1743*   1958    2707#
AVERM1  015552          1795*   1799    1819    2741#
AVERM2  015550          1792*   1798    1815    2740#
AVERM3  015546          1763*   1767    1818    2739#
AVERM4  015544          1758*   1766    1814    2738#
AVERM5  015542          2347    2350    2737#
AVERP1  015556          2320    2743#
AVERP2  015560          2744#
AVERP3  015562          2745#
AVERP4  015564          2746#
AVERP5  015566          2345    2747#
AVGCNT  015604          1633    2367    2754#
AVGDAT  012560          2306#   2309
AVGTAB  010364          1900*   1902#   1903*
AVRAGE  015554          1578    1624    1710    2291*   2292    2293    2301*   2307*   2310*   2312    2319    2327    2328
                        2742#
BCDBIN  011050          2016#   2048    2197
BCDBN1  011064          2019#   2043
BCDBN2  011070          2021#   2037
BCDEND  011146          2022    2025    2038#
BCDERR  011170          2027    2029    2039    2045#
BCDTAB  011202          1545    1547    1549    1551    1556    1670    1671    2017    2018*   2049#
BELL    013656          1145    1449    2499#
BINDEC= 104006           578#   1639
BIT0  = 000001           508#    943     953     961     968    1033    1048    1063    1093
BIT1  = 000002           507#    772     773    1105    1325
BIT10 = 002000           498#    869     870    1075
BIT11 = 004000           497#    881     882    1075    1127
BIT12 = 010000           496#    893     894    1075    1254    1255    1326    1348    1394    2109
BIT13 = 020000           495#    905     906    1075    1264    1265    1769    1801    1828    2081
BIT14 = 040000           494#    917     918    1274    1275    1787
BIT15 = 100000           493#    929     930    1096
BIT2  = 000004           506#    784     785    1105
BIT3  = 000010           505#    796     797    1105    2110
BIT4  = 000020           504#    809     810     990    1084
BIT5  = 000040           503#    710     821     822    1003    1084    1473
BIT6  = 000100           502#    762     833     834    1033    1048    1063    1084    1120    1158    1320    1321    1327
                        1338    1421    1567    1751    1918    1957    1982
```

```
BIT7   = 000200   501#
BIT8   = 000400   500#   845    846    1075
BIT9   = 001000   499#   857    858    1075
BRLEV1   015524  1019*  1020*  1032   2093*  2730#
BRLEV2   015526  1021*  1046   2731#
BRLEV3   015530  1022*  1023*  1062   2732#
CALBRT   005742   719   1467#  1876
CALBT1   005754  1467   1470#
CALBT2   006032  1483#  1519
CALBT4   006236  1511   1516#
CALB1A   005760  1472#
CALB2    006074  1487   1490#
CALB2A   006130  1489   1494   1496#  1518
CALB2B   006222  1507   1512#
CALB2C   006122  1491   1495#
CALB2D   006156  1497   1501#
CATORI=  104005   577#  1577
CATORZ   012614  2201   2318#
CATR1    012714  2337#  2339
CATR2    012736  2342#  2359   2361   2363
CATR3    012776  2351#  2355
CATR4    013016  2352   2357#
CATR5    013042  2343   2367#
CHRCNT   015452  1869*  1919*  1936*  1937   1964   1966*  2021   2023*  2042   2709#
CK       013474  2417   2454#
CMPCNT   012612  1706*  2289*  2305   2315#
CMPRA    010210  1839*  1842   1858#
CMPRB    010212  1840*  1841   1859#
CMPRC    010214  1841*  1842*  1845*  1848*  1852*  1855*  1860#
CMPR1    010162  1844   1848#
CMPR2    010174  1843   1846   1849   1852#
CMPR3    010202  1847   1850   1855#
CMPTE    012426  2200   2287#
CMPTEA   012446  1709   2290#
CMPUTE=  104004   576#  1576
CNTLED   013762  2505*  2516*  2520#
CNTRLA   014436  1949   2592#
CNTRLC   014432   694   2590#
CNTRLG   014441  1987   2593#
COMPR    010120  1765   1797   1813   1817   1839#
COUNT    015454  1482*  1571*  1677*  2057   2710#
CPDLAY   012070   665   2210#
CPTIME   012100   665*   964    975    2066   2215#
CPUTYP   001250   642    653#
CRLF     014470  1476   1510   1604   1611   1636   1772   1804   1831   1975   2432   2437   2599#
CSB      001050   610#   627*   632*   1499*
CSR      001046   609#   626*   631*   1498*  1500*
DACUTA   011534  2112#  2113
DACUTB   011556  2115   2119#
DACUTC   011606  2101   2125   2128#
DACUTD   011576  2121   2124#
DECOCT=  104001   573#  1544   1555   1669
DECOUT   012326  2257   2263#
DECPNT   012414  2250*  2254   2256   2261*  2279#
DECPRT   012230  2202   2248#
DEC1     012354  2264   2266   2269#
```

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DEC2    012370          2268    2271#
DELAY   015500          1681*   1686*   2060    2069*   2720#
DELAY1  015502           964*    965*    966*    967*    969*    975*    976*   2066*   2067*   2721#
DIAA    015632          2765#
DIAB    015634          2766#
DIAC    015636          2767#
DIAD    015640          2768#
DIGCNT  012410          2249*   2258*   2265    2277#
DIGIT   012406          2252*   2253*   2263    2267*   2270*   2273    2276#
DISPLA  001032           601#    645*    759*   1160*   1513*   1578*   1753*
DMACVT  011436          2071    2101#
DMATST  004050           565     716    1152#
DMAT0   004120          1161    1169#
DMAT1   004154          1179#
DMAT10  004460          1251#
DMAT11  004514          1261#
DMAT12  004550          1271#
DMAT13  004604          1281#
DMAT14  004646          1293#
DMAT15  004710          1306#
DMAT16  004752          1318#
DMAT17  005032          1336#
DMAT2   004210          1189#
DMAT20  005272          1373    1380#
DMAT21  005532          1410    1419#
DMAT3   004244          1200#
DMAT4   004300          1210#
DMAT5   004334          1220#
DMAT6   004370          1230#
DMAT7   004424          1240#
DMA00   004062          1157#   1451
DMA01   004054           738    1154#
DMK0    005734          1341*   1370    1375*   1385*   1413*   1422*   1454#
DMK1    005736          1386*   1405    1412*   1455#
DMK2    005740          1387*   1400    1411*   1456#   2062*   2063
DMT17A  005264          1339    1375#
DMT20A  005412          1395#   1414
DOT     014472           708    2601#
DSHTST  007504           566     728    1743#
DSHT0   007512          1743    1744#
DSHT1   007516          1746#
DSHT2   007522          1747#
DSHT3   007526          1748#   1823
DSHT4   007664          1770    1775#
DSHT6   007674          1768    1776    1786#
DSHT6A  010002          1802    1807#
DSHT7   010014          1800    1813#
DSHT7A  010040          1808    1810    1821#   1837
DSHT8   010064          1816    1820    1828#
DSHT8A  010104          1829    1834#
DSHT8B  010114          1826    1835    1837#
EMTOK   012016          2186    2188#
EMTSRV  011776           551    2182#
EMTTAB  012036          2190    2196#
ENDPAS  013772          2500    2525#
ERROR = 104400           571#    775     779     787     791     799     803     812     816     824     828     936     840
```

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                        848     852     860     864     872     876     884     888     896     900     908     912     920
                        924     932     936     948     952     955     973     983     996    1009    1037    1053    1068
                       1079    1088    1100    1109    1175    1185    1195    1206    1216    1226    1236    1246    1257
                       1267    1277    1289    1301    1314    1323    1329    1358    1363    1368    1372    1403    1409
                       1437    1442    2117    2132    2137    2142
FILCHR  001014          593#   2239
FILE1   012634         2321#   2324
FILE2   012672         2329#   2332
FILLS   001012          592#   2236
FIRST   015476         2059*   2091*   2719#
GETDAT  012472         2294#   2304
HIGH    015536         1627    2292*   2295    2297*   2735#
HIORDV  015534         2290*   2302*   2306*   2734#
ICOUNT  001036          603#   2468
INBUF   011032          710*    711     714     717     720     723     726    1473*   1474    1560    1564    1865    1917
                       1920*   1921*   1922*   1923*   1924*   1925*   1926*   1994    2009#   2016
INIT    001060          563     620#   2794
INITA   001420          685#    700    2707
INIT2   001454          680     687     695#    731
INIT3   001666          729#   1878
INPUTA  010502         1927#   1928    1942    1965
INPUTB  010534         1935#   1971
KSTOR1  015456         1545*   1546    1549    1567*   1569    1670*   1678    1866*   1868*   1871*   1872*   1873*   1876
                       1879*   1882    2711#
KSTOR2  015460         1485*   1517    1546*   1551*   1647    1671*   1683    1720    2712#
KSTOR3  015462         1125*   1131*   1556*   1583    1588    1594    1599    2419*   2420*   2422    2439    2713#
KSTOR4  015464          942*    946*   1004*   1005*   1034*   1035*   1049*   1050*   1064*   1065*   1350*   1352*   1396*
                       1397*   1431*   1432*   1569*   1572    1612    1645    1649*   2423*   2442    2714#
KSTOR5  015466         2424*   2445    2715#
KSTR11  015470         2427*   2451    2716#
KSTR12  015472         2426*   2448    2717#
LADTB   007464         1707    1730#
LEDS    013664          701    1504    1748    2311    2421    2505#
LEDSA   013702         2508#   2517
LEDSV1  013764         2507*   2508    2512*   2513*   2514*   2521#
LEDSV2  013766         2508*   2509*   2510*   2511    2522#
LEDSV3  013770         2506*   2510    2515*   2523#
LGERR1  013426         2430    2436#
LOGERR  013304          553    2415#
LOGICA  001740          556     742#
LOW     015540         1621    2293*   2298    2300*   2736#
LPSADD  001000          587#    623     624     625     626     627     628
LPSVCT  001002          588#    634     635
MANCAL  006004          567    1478#
MASK    013270         2387*   2393    2398*   2404#
MESPRT  015532         1537*   1605    1628    1632*   2733#
MES1    014071         2434    2541#
MES10   014606         1471    2621#
MES11   014653         1153    2630#
MES12   014706         2084    2123    2635#
MES13   014726         1536    2639#
MES14   014756         1542    1667    2644#
MES15   014771         1745    2646#
MES16   015016         1553    2651#
MES18   015035         1558    2654#
MES19   015114         1608    2662#
```

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MES20   015147          1631    2668#
MES21   015235          2174    2679#
MES22   015255          1774    2682#
MES23   015333          1806    2690#
MES24   015412          1833    2698#
MES4    014133           686    2553#
MES5    014500           755    2605#
MES7    014527          1469    2610#
MES8    014556          1665    2614#
MES9    014601          1718    2619#
MINUS1  015602          2369    2753#
MINUS2  015600          2372    2752#
MINUS3  015576          2375    2751#
MINUS4  015574          2378    2750#
MINUS5  015572          2358*   2749#
MONITR  001426           562     689#   1961    2175
NEWIN   010430          1917#
NEWSWR  014457          1991    2596#
NODMA   001762           732*    736     747*    749#
OCTPRT  013154          2204    2384#
OPS1    015512          1540*   2144*   2725#
ORHIGH  015620          2338    2360*   2760#
ORLOW   015570          1637    2336    2362*   2748#
OUTPTA  010552          1939#   1940    1969
OVRHI   013026          2346    2360#
OVRLO   013034          2348    2362#
PASSCT  001034           602#    757*    759    1117    1146*   1155*   1160    1450*   1746*   1753    2466    2487
PDPDLY  001006           590#    666*    668*   1125
PIRQ  = 177772           651#    657
PLUS1   015606          2368    2755#
PLUS2   015610          2371    2756#
PLUS3   015612          2374    2757#
PLUS4   015614          2377    2758#
PLUS5   015616          2759#
PRINT = 104000           572#    683     685     693     707     729     754    1152    1468    1470    1475    1509    1535
                        1541    1552    1557    1603    1607    1610    1630    1635    1664    1666    1717    1744    1771
                        1773    1803    1805    1830    1832    1948    1974    1986    1990    2006    2045    2083    2122
                        2173    2431    2433    2436    2499
PRINT1  015442           682*   2429    2435*   2705#
PROC    015450          1474*   1478*   1486    1490    2157*   2164    2708#
PRTAVG= 104012           582#   1508    1724
PRTOCT= 104010           580#   1617    1620    1623    1626    1721    1901    1988    2438    2441    2444    2447    2450
PS    = 177776           652#    660
PSW     001016           595#    621*    691*    761*   1028*   1032*   1046*   1062*   1119*   1159*   1337*   1340*   1351*
                        1381*   1420*   2056*   2163*   2220*   2248*   2472*
PWRFAL  011676           545     695    2150#
PWRUP   011732          2158    2163#
QMARK   014475           730    2007    2046    2603#
RECVRY  007070           725    1661#
RECVY1  007112          1661    1666#
RECVY2  007136          1672#   1716    1725
REPTST  006252           722    1534#
REPT1   006264          1534    1537#   1550
REPT2   006354          1548    1552#
REPT2A  006440          1563    1565    1568#   1651
REPT2B  006416          1561    1564#
```

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REPT3   006452          1570#   1650
REPT4   006650          1580    1586    1591    1597    1600    1603#
REPT5   006666          1606    1609#
REPT6   006764          1629    1632#
REPT6A  007012          1638#   1641
REPT7   007034          1582    1587    1592    1598    1602    1643    1645#
REPT7A  007062          1648    1651#
REPT8   006724          1615    1617#
REPT8A  007066          1612*   1613*   1616*   1618    1653#   1720*   1722
RETURN  013600           758*   1161*   1881*   2473    2475*   2478#
SCOPE = 104002           574#    783     795     820     832     844     856     868     880     892     904     916     928
                        1169    1179    1189    1200    1210    1220    1230    1240    1251    1261    1271    1281
SCOPEB  013552          2463    2471#   2484    2496
SCOPEC  013506          2198    2461#
SCOPEF  013576          1980*   2468    2470*   2474*   2477#   2489
SCOPEG  013564          2465    2467    2469    2474#   2486    2488    2497
SCOPEH  013602          2199    2482#
SCOPEI  013642          2208    2494#
SCOPEJ  013544          2469#   2490
SCOPED= 104014           584#   1140
SCOPE1= 104003           575#    771     808     940     959     987     1000    1027    1043    1058    1074    1083    1092
                        1104    1114    1293    1306    1318    1336    1380    1419    1444
SOFTDI  000172           561#
SOFTSW  000170           560#   1989    2004*
SPACE = 104007           579#   1619    1622    1625    1723    1905    2440    2443    2446    2449
SPACEX  010352          1892*   1894*   1896#   1904*
SPCHR   010566          1932    1934    1946#
SPCHR1  010630          1947    1959#
SPCHR3  010672          1963    1970#
SPCHR4  010700          1972#
SPCHR5  011022          1938    1985    2006#
STACK   015444           620     690     760    1157    1382    1501    1568    1672    1752    2706#
STCHAN  015474          1747*   1749    1754    1786    1821*   1822    1824*   2718#
SWR     001030           600#    641     644*   1127    1483    1485    1506    1517    1579    1581    1642    1715    1769
                        1775    1801    1807    1828    1834    2081    2085    2120    2124    2416    2454    2462    2464
                        2483    2485    2495
SW00  = 000001           527#
SW01  = 000002           526#
SW02  = 000004           525#
SW03  = 000010           524#
SW04  = 000020           523#
SW05  = 000040           522#
SW06  = 000100           521#
SW07  = 000200           520#
SW08  = 000400           519#
SW09  = 001000           518#
SW10  = 002000           517#   1506    1579    1715
SW11  = 004000           516#
SW12  = 010000           515#
SW13  = 020000           514#   1581
SW14  = 040000           513#
SW15  = 100000           512#
TAGA    012532          2299    2301#
TEMP    015514          1355*   1356    1400*   1401    1405*   1407    2427    2726#
TEMP1   015516          1121*   1122    1136*   1137    1705*   2057*   2096*   2287*   2303*   2305*   2308*   2318*   2323*
                        2326*   2331*   2340*   2342*   2727#
```

```
TEMP2   015520          1122* 1124  1133* 2294* 2295  2297  2298  2300  2301  2319* 2321* 2322  2327*
                        2329* 2330  2344* 2345  2347  2351  2728#
TEMP3   015522          1123* 1134* 1503* 1676* 1906* 2729#
TESTX   010216          1865#
TEST15  003656          1114#
TEST16  004016          1116  1118  1128  1140#
TITLE   014012           684  2532#
TKB     001022           597# 1929
TKS     001020           596#  681*  692*  706*  762* 1120* 1158* 1338* 1421* 1751* 1918* 1927  1957*
                        1982* 2408
TKSFLG  013272          2207  2408#
TPB     001026           599# 1891* 1941* 2230* 2232* 2235* 2239* 2273* 2397*
TPS     001024           598# 1889  1939  2223  2233  2237  2271  2395  2452
TSLO    012514          2296  2298#
TSTA    010226          1867# 1874
TSTCT1  006630          1595  1599#
TSTCT2  006606          1589  1594#
TSTCT3  006564          1584  1588#
TSTCT4  006532          1581#
TSTTKS= 104013           583# 1514  1516  1570  1609  1673  1719  1825  2415  2461  2482  2494
TSTXB   010262          1870  1876#
TST15A  003712          1122# 1138
TST15B  003726          1124# 1135
TST15C  003756          1129# 1130  1132
TTYIN = 104011           581#  709  1472  1543  1554  1559  1668  1992  2047  2410
TYPECL  012150          2229  2232#
TYPERA  012116          2223# 2224  2231  2243
TYPER1  012134          2226  2228#
TYPER2  012142          2230#
TYPMES  012102          2196  2220#
TYPT1   012256          2252# 2262
TYPT2   012264          2253# 2255
TYPT3   012316          2259  2261#
USECLK  015510          1480* 1493* 1496  2724#
USEDMA  015506          1479* 1538* 1562* 1662* 2070  2723#
USEDSH  015504          1481* 1539* 1566* 1614  1663* 2089  2722#
WHAT    001674           705   732#  746
WHATA   001716           736# 1144
WHATB   001730           739# 1448
WHAT1   001754           733   747#
XLOOP   010304          1880# 1881
XPRTAV  010354          1900# 2206
XPTA1   010362          1901# 1907
XSPACE  010322          1889# 1893  2203
XSPRD1  015622          1601  1640  2367* 2368* 2369* 2370  2761#
XSPRD2  015624          1596  2370* 2371* 2372* 2373  2762#
XSPRD3  015626          1590  2373* 2374* 2375* 2376  2763#
XSPRD4  015630          1585  2376* 2377* 2378* 2764#
XTTYIN  010414           548  1911# 2008  2205
ZERO    012412          2251* 2267  2269* 2278#
.     = 016336           541#  544#  547#  550#  555#  557#  559#  586#  679   704   712   715   718
                         721   724   727   737   774   778   786   790   798   802   811   815   823
                         827   835   839   847   851   859   863   871   875   883   897   895   999
                         907   911   919   923   931   935   951   954   972   982   993   995  1008
                        1013  1016  1078  1087  1095  1099  1108  1143  1174  1184  1194  1205  1215
                        1225  1235  1245  1256  1266  1276  1288  1300  1313  1322  1328  1357  1362
```

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                    1367    1371    1402    1408    1436    1441    1447    1477    1757    1762    1790    1794    1877
                    1990    2012#   2131    2136    2141    2234    2272    2279    2388    2396    2409    2453    2455
                    2768    2777#   2779#   2781#   2783#   2785#   2787#   2789#   2791#   2793#

. ABS.  016336     000


 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

 DZLPCC,DZLPCC.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DZLPCC.P11
 RUN-TIME:  10 19 2 SECONDS
 RUN-TIME RATIO: 365/33=10.9
 CORE USED:  9K  (17 PAGES)
```

E06

Spooler runtime 9 Seconds, 266 KCS, 248 disk reads, 3 disk writes, 68 pages