LPS11

TEST #2

MD-11-DZLPD-C

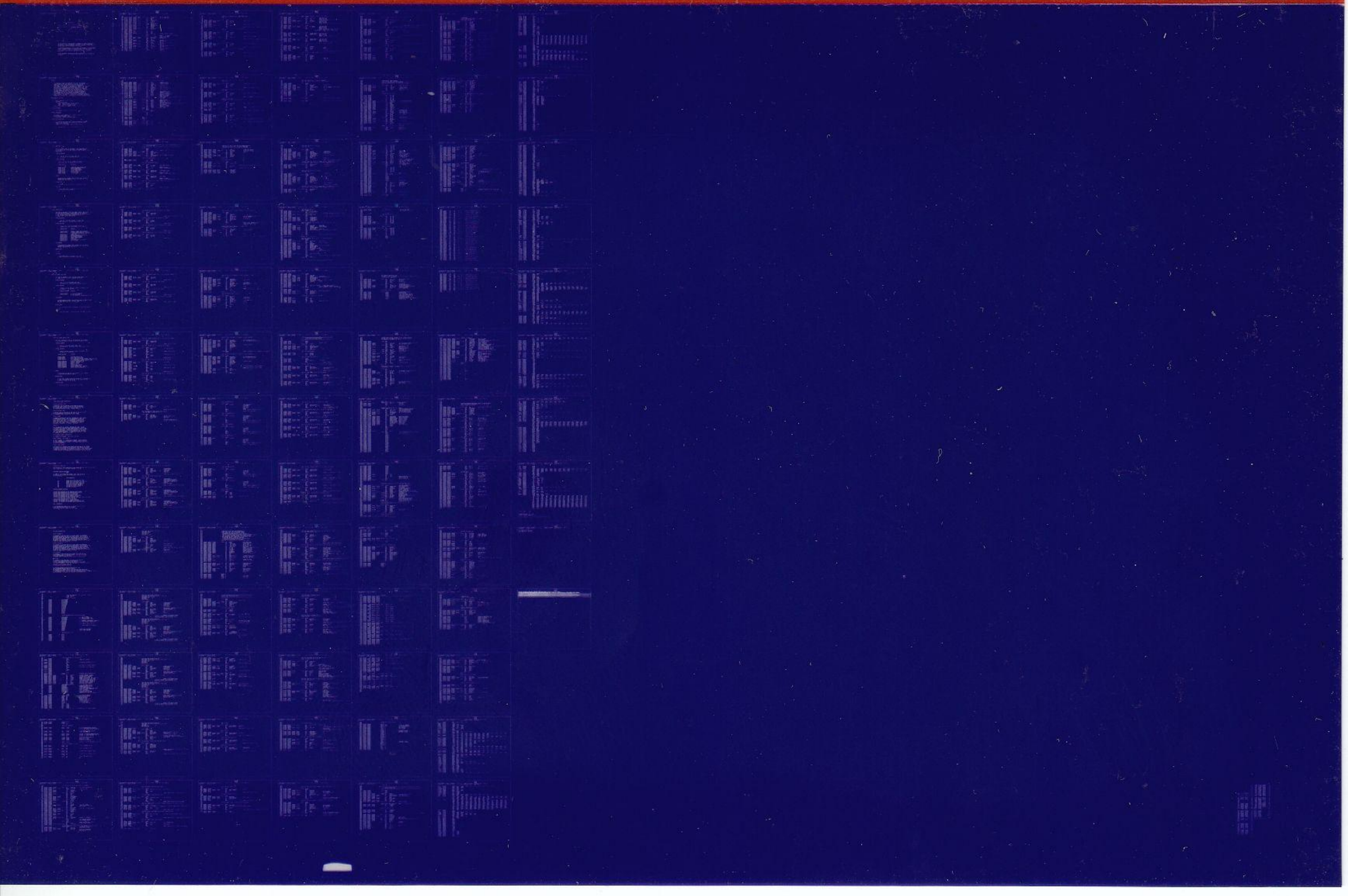
EP-DZLPD-C-DL-A

OCT 1976

FICHE 1 OF 1

digital

Made in U.S.A.



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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZLPD-C

PRODUCT NAME: LABORATORY PERIPHERAL SYSTEM
DIAGNOSTIC TEST II

DATE: MAY 21, 1976

MAINTAINER: DIAGNOSTIC GROUP

FIRST PRINTING, 1973

1. ABSTRACT

THIS DIAGNOSTIC TESTS AND EXERCISES THE "LPS". THE PROGRAM
IS SELF-STARTING AND WHEN LOADED WILL TYPE OUT THE PROGRAM TITLE.
A SENTANCE IS THEN TYPED GIVING THE LETTER DESIGNATORS
TO BE TYPED TO RUN ANY ONE OF THE SEVEN (7) 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.
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 8K OF MEMORY.
B. TELETYPE
C. LPS11 OPTION BOX WITH:
    LPSKW   REAL TIME CLOCK CONTROL AND/OR
    LPSDR   DIGITAL INPUT-OUTPUT CONTROL AND OR
    LPSVC   POINT PLOT SCOPE CONTROL
LPSDRA IS SUPPORTED BY A SEPERATE DIAGNOSTIC (MD-11-DZLPI)

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' OR
RE-INITALIZED AT ADDRESS '200'.
(FOR ADDITIONAL STARTING ADDRESSES REFER TO 11.)

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. CLOCK LOGIC TEST

A. THE "CLOCK LOGIC TEST" IS DESIGNED TO TEST INDIVIDUAL BITS IN THE CONTROL AND STATUS REGISTERS, COUNT PRESET BUFFER AND COUNTER ALONG WITH PROPER OPERATION UNDER INTERRUPT CONTROL MODE CONTROL

B. STARTING SEQUENCE

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

C. CONTROL SWITCHES

1. TYPING ^C AT ANY TIME WILL ENABLE THE PROGRAM TO EXIT 'CLOCK LOGIC' TEST AND RETURN TO THE MONITOR.

2.

CONTROL SWITCH	FUNCTIONS
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 MESSAGE
CONSOLE SW14=0	INHIBIT SCOPE MODE
CONSOLE SW14=1	RUN SCOPE MODE
CONSOLE SW15=0	CONTINUE AFTER TYPING ERROR
CONSOLE SW15=1	HALT ON ERROR

D. ERRORS

ON ENCOUNTERING AN ERROR (DATA SWITCHES DOWN) THE ERROR ADDRESS AND THE CONTENTS OF THE CLOCK STATUS AND CLOCK PRESET BUFFER ARE TYPED OUT.

E. RESTRICTIONS

NO CONNECTIONS SHOULD BE MADE TO THE SCHMITT TRIGGER.

F. TEST TIME

IT TAKES APPROXIMATELY 60 SECONDS TO RUN THE CLOCK LOGIC TEST AND RING THE TELETYPE BELL.

7. DIGITAL INPUT-OUTPUT

A. THIS TEST IS DESIGNED TO TEST THE LPSDR (DIGITAL INPUT-OUTPUT) LOGIC

FOR THIS TEST THE EXTERNAL JUMPER CABLE MUST BE INSTALLED
TO TEST THE DATA INPUT/OUTPUT REGISTERS AND THE CONTROL SIGNALS.
IF THIS EXTERNAL JUMPER CABLE IS NOT INSTALLED, ONLY
A MINUMAL LOGIC TEST CAN BE PERFORMED.

B. STARTING SEQUENCE

1. TYPE 'B' TO RUN THE 'DIGITAL I/O LOGIC' TEST.
2. THE PROGRAM WILL THEN EXECUTE THE DIGITAL I/O LOGIC TEST.

C. CONTROL SWITCHES

1. TYPING ^C WILL CAUSE THE PROGRAM TO EXIT THE
'DIGITAL I/O LOGIC' TEST AND RETURN TO THE MONITOR.

2.

CONSOLE SWITCH	FUNCTION
CONSOLE SW06=0*	EXTERNAL JUMPER CABLE CONNECTED
CONSOLE SW06=1*	EXTERNAL JUMPER CABLE NOT CONNECTED
	*= ACTIVATE SWITCH BEFORE SELECTING TEST
CONSOLE SW11=0	NORMAL RUN
CONSOLE SW11=1	SUPRESS SUBPROGRAM INTERATIONS
CONSOLE SW13=0	PRINT ERROR MESSAGES
CONSOLE SW13=1	INHIBIT ERROR MESSAGES
CONSOLE SW14=0	INHIBIT SCOPE MODE
CONSOLE SW14=1	SCOPE MODE
CONSOLE SW15=0	CONTINUE AFTER TYPING ERROR
CONSOLE SW15=1	HALT ON ERROR

D. LOGIC ERRORS

ON ENCOUNTERUNG AN ERROR (DATA SWITCHES DOWN) THE ERROR
ADDRESS AND THE CONTENTS OF THE DIGITAL I/O STATUS, OUTPUT
AND INPUT REGISTERS ARE TYPED OUT.

E. RESTRICTIONS

NONE

F. TEST TIME

IT TAKES APPROXMATELY 30 SECONDS TO RUN THE
DIGITAL I/O LOGIC TEST AND RING THE TELETYPE BELL.

8. POINT PLOT SCOPE LOGIC TEST

A. THIS TEST IS DESIGNED TO TEST THE LPSVC SCOPE CONTROL LOGIC ALL USABLE BITS OF THE STATUS REGISTER ARE TESTED.

B. STARTING SEQUENCE

1. TYPE 'C' TO RUN THE SCOPE LOGIC TEST.
2. THE PROGRAM WILL THEN EXECUTE THE SCOPE LOGIC TEST.

C. CONTROL SWITCHES

1. TYPEING ↑C AT ANY TIME WILL ENABLE THE PROGRAM TO EXIT AND RETURN TO THE MONITOR.

2.

CONSOLE SWITCHES	FUNCTION
CONSOLE SW05=0*	611/613 NOT CONNECTED
CONSOLE SW05=1*	611/613 CONNECTED

*= ACTIVATE SWITCH BEFORE SELECTING TEST

D. LOGIC ERRORS

ON ENCOUNTERING AN ERROR (DATA SWITCHWS DOWN) THE ERROR ADDRESS AND THE CONTENTS OF THE VC STATUS, X ASIX AND Y AXIS REGISTERS ARE TYPED OUT ON THE TELETYPE

E. RESTRICTIONS

IF 611/613 STORAGE SCOPE IS CONNECTED, IT MUST HAVE POWER ON.

F. TEST TIME

IT TAKES APPROXIMATELY 10 SECONDS TO RUN THE SCOPE LOGIC TEST.

9. POINT PLOT VISUAL DISPLAY TEST

A. THIS TEST IS DESIGNED TO AID IN THE ADJUSTING AND ALIGNMENT OF THE VR14/20 OR 611/613 SCOPE ON THE LPSVC DISPLAY CONTROL.

B. STARTING SEQUENCE

1. TYPE 'D' TO RUN THE VISUAL DISPLAY TEST.
2. THE PROGRAM WILL THEN EXECUTE THE VISUAL DISPLAY TEST.

C. CONTROL SWITCHES

1. TYPING ↑C AT ANY TIME WILL ENABLE THE PROGRAM TO EXIT AND RETURN TO THE MONITOR.

CONSOLE SWITCHES	FUNCTION
CONSOLE SW08=0	LOOP THRU DISPLAY TEST
CONSOLE SW08=1	SELECT TEST IN SW 00-02
CONSOLE SW04=0*	PLOT CHARACTERS IN FAST INTENSIFY MODE (VR14/20)
CONSOLE SW04=1*	PLOT CHARACTERS IN NORMAL INTENFISY MODE (611/613)
	*= ACTIVATE SWITCH BEFORE SELECTING TEST
CONSOLE SW00-02=0	DISPLAY A HORIZONTAL LINE
CONSOLE SW00-02=1	DISPLAY A VERTICAL LINE
CONSOLE SW00-02=2	DISPLAY A SQUARE
CONSOLE SW00-02=3	DISPLAY A "X"
CONSOLE SW00-02=4	DISPLAY CHARACTER SET
CONSOLE SW00-02=5	DISPLAY CHANNEL TEST (VR14/VR20)
CONSOLE SW00-02=6	DISPLAY COLOR PATTERN (VR20)
CONSOLE SW00-02=7	DISPLAY ERASE AND PHOSPOR (611/613)

D. ERRORS

NO PROVISIONS ARE MADE FOR LOGIC ERRORS. THE ONLY ERRORS IN THIS TEST ARE CHECKED VISUALLY.

E. RESTRICTIONS

IF VR14/VR20, CHANNEL SWITCH MUST BE SET TO "1 3 2" POSITION.
IF VR20, COLOR SWITCH MUST BE SET IN THE REMOTE POSITION.
IF 611/613, POWER MUST BE APPLIED.

F. EXECUTION TIME

IT TAKES APPROXIMATELY 90 SECONDS TO THIS TEST.

10. VISUAL DISPLAY TEST DESCRIPTIONS

DISPLAY HORIZONTAL LINE

A HORIZONTAL LINE IS DISPLAYED ON THE SCOPE BY INITIALLY SETTING THE X AND Y DAC'S TO ZERO AND THEN INCREMENTING THE X VALUE WHILE HOLDING THE Y VALUE AT ZERO. THE POINTS ARE DISPLAYED USING THE DISPLAY INTERRUPT ENABLED.

DISPLAY VERTICAL LINE

A VERTICAL LINE IS DISPLAYED ON THE SCOPE IN THE SAME MANNER AS FOR A HORIZONTAL LINE EXCEPT NOW THE Y VALUE IS INCREMENTED WHILE HOLDING THE X VALUE AT ZERO.

DISPLAY SQUARE

A SQUARE IS DISPLAYED BY INITIALLY SETTING THE X AND Y VALUES TO NEGATIVE FULL SCALE, THEN X IS INCREMENTED TO POSITIVE SCALE (BOTTOM LINE) THEY Y IS INCREMENTED TO POSITIVE FULL SCALE (RIGHT LINE) THEN X IS DECREMENTED TO NEGATIVE FULL SCALE (TOP LINE) AND FINALLY Y IS DECREMENTED TO NEGATIVE FULL SCALE (LEFT LINE). MODE 01 (INTENSIFY ON LOADING X) AND MODE 10 (INTENSIFY ON LOADING Y) ARE USED.

DISPLAY X

AN X IS DISPLAYED BY INITIALLY SETTING THE X AND Y VALUES TO NEGATIVE FULL SCALE AND THEN INCREMENTING BOTH TO POSITIVE FULL SCALE (LOWER LEFT TO UPPER RIGHT DIAGONAL) THEN X IS RESET TO NEGATIVE FULL SCALE, Y REMAINS AT POSITIVE FULL SCALE AND THEN X IS INCREMENTED WHILE Y IS DECREMENTED UNTIL BOTH REACH FULL SCALE AGAIN (UPPER LEFT TO LOWER RIGHT DIAGONAL). MODE 01 (INTENSIFY ON LOADING X) IS USED.

DISPLAY ALPHA-NUMERIC CHARACTER SET

THE ALPHABET AND NUMBERS 1 THRU 0 ARE DISPLAYED.

DISPLAY CHANNEL 1 AND CHANNEL 2

THE TEXT "CHANNEL 1" IS DISPLAYED ON CHANNEL 1 SWITCH POSITION.
THE TEXT "CHANNEL 2" IS DISPLAYED ON CHANNEL 2 SWITCH POSITION.
THE COMBINED MESSAGE WILL APPEAR IF THE CHANNEL SELECTOR SWITCH IS IN THE 1 & 2 POSITION.

DISPLAY COLOR PATTERN

THIS ROUTINE WILL DISPLAY A BOX AROUND THE OUTER DEGE OF THE SCREEN AND A SMALL "X" IS DISPLAYED IN THE CENTER. THIS PATTERN IS PLOTTED IN GREEN AND THEN IN RED. THE END RESULT IS THAT ALL DOTS (RED AND GREEN) CONVERGE AND THE PATTERN WILL APPEAR TO BE ORANGE IN COLOR. THIS TEST IS USED TO ADJUST THE COMPENSATION GAIN AMPLIFIER IN THE VR20 DISPLAY.

PHOSPHOR AND ERASE TEST

THIS ROUTINE WILL FIRST ERASE THE 611/613 SCREEN AND THEN START INT THE UPPER RIGHT CORNOR AND FILL THE SCREEN DOWNWARD. THIS TEST

11. ADDITIONAL STARTING ADDRESSES

INCLUDED IN THIS PROGRAM ARE SEVERAL 'MINI' TEST TO AID IN THE CHECKING OF THE UNIQUE NON-PROGRAMABLE HARDWARE TO THE LPS-11 OPTION BOX.

SA	TEST DESCRIPTION
204	MANUAL SA OF THE CLOCK LOGIC TEST
210	MANUAL SA OF THE DIGITAL I/O LOGIC TEST
214	MANUAL SA OF THE SCOPE LOGIC TEST
220	MANUAL SA OF THE VISUAL SCOPE TEST
224	MINI-TEST OF SCHMITT TRIGGER #1
230	MINI-TEST OF SCHMITT TRIGGER #2
234	MINI-TEST OF CLOCK OVERFLOW
240	MINI-TEST OF RELAYS

12. OPERATOR VARIABLE LOCATIONS

LOCATION 1000 CONTAINS THE LPS STARTING DEVICE ADRESS
LOCATION 1002 CONTAINS THE LPS STARTING DEVICE VECTOR
LOCATION 1004 CONTAINS THE LPS A TO D BR LEVEL
LOCATION 1006 CONTAINS THE LPS CLOCK BR LEVEL
LOCATION 1010 CONTAINS THE LPS DIGITAL I/O BR LEVEL
LOCATION 1012 CONTAINS THE LPS DISPLAY BR LEVEL
LOCATION 1014 CONTAINS THE DELAY CONSTANT FOR MEMORY AND/OR CPU SPEED
(1 IF AN 11/20, 2 IF AN 11/45 ETC.)
LOCATION 1016 CONTAINS THE TTY FILLER COUNT
LOCATION 1020 CONTAINS THE TTY FILLER CHARACTER
LOCATION 170 CONTAINS THE SOFTWARE SWITCH REGISTER VALUE
LOCATION 172 CONTAINS THE SOFTWARE DISPLAY REGISTER VALUE

13. MISC. INFORMATION

IF THE PROGRAM WAS LOADED BY ACT-11 OR DDP, THE CLOCK LOGIC, SCOPE LOGIC AND SCOPE VISUAL WILL BE RUN.
THIS PROGRAM DOES NOT SUPPORT THE "APT" HOOKS.

14. MINI-TEST DESCRIPTIONS

SCHMITT TRIGGER #1

THE PURPOSE OF THIS MINI-TEST IS TO QUICK VERIFY THE OPERATION
OF SCHMITT TRIGGER #1 ON THE CLOCK LOGIC MODULE. THIS IS DONE BY THE
OPERATOR ROTATING THE THRESHOLD KNOB FROM END TO END OR CHANGING
THE SLOPE SWITCH BETWEEN + OR -. THE PROGRAM WILL RING THE TTY BELL
AND UPDATE THE NUMBER IN THE LPS DISPLAY LEDS UPON EACH SCHMITT
TRIGGER #1 FLAG. ROTATING SCHMITT TRIGGER #2 THRESHOLD KNOB OR SWITCH
SHOULD NOT CAUSE SCHMITT TRIGGER #1 TO FIRE.

SCHMITT TRIGGER #2

THE PURPOSE OF THIS MINI-TEST IS TO QUICK VERIFY THE OPERATION
OF SCHMITT TRIGGER #2 ON THE CLOCK LOGIC MODULE. THIS IS DONE BY THE
OPERATOR ROTATING THE THRESHOLD KNOB FROM END TO END OR CHANGING
THE SLOPE SWITCH BETWEEN + OR -. THE PROGRAM WILL RING THE TTY BELL
AND UPDATE THE NUMBER IN THE LPS DISPLAY LEDS UPON EACH SCHMITT
TRIGGER #2 FLAG. ROTATING SCHMITT TRIGGER #1 THRESHOLD KNOB OR SWITCH
SHOULD NOT CAUSE SCHMITT TRIGGER #2 TO FIRE.

CLOCK OVERFLOW

THE PURPOSE OF THIS MINI-TEST IS TO VERIFY THE OUTPUT OF THE
CLOCK OVERFLOW LOGIC TO THE FRONT PANNEL. THE CLOCK IS ENABLED
TO RUN AND OVERFLOW AT A FAST RATE.
THE OUTPUT MUST BE VERIFIED WITH THE USE OF AN OSCILLOSCOPE.

RELAY TEST

THE PURPOSE OF THIS MINI-TEST, IS TO ALLOW THE OPERATOR
TO VERIFY THE PROPER OPERATION OF BOTH RELAYS.
THIS IS ACCOMPLISHED BY SWITCHING THE RELAYS AT A SLOW RATE
TO ALLOW THE OPERATOR TO CHECK THE CONTINUNITY OF THE RELAY CONTACTS.

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 OLD VALUE 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 SOFTWARE SWITCH REGISTER IS SET TO 0.
UPON TERMINAING, THE PROGRAM WILL RESUME THE APPROPATE TEST.

```
                                        .TITLE LPS DIAGNOSTIC TEST II MAINDEC-11-DZLPD-C
                                        .ENABL  ABS,AMA
                                        .LIST   ME
                                        .NLIST  MC,MD,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                    ;LPSVC SELECT TEST IN SR 0-2
            000200              SW07=200
            000100              SW06=100                    ;=1, LPSDR JUMPER NOT CONNECTED
            000040              SW05=40                     ;
            000020              SW04=20                     ;
            000010              SW03=10                     ;
            000004              SW02=4                      ;LPSVC VISUAL PATTERN
            000002              SW01=2                      ;LPSVC VISUAL PATTERN
            000001              SW00=1                      ;LPSVC VISUAL PATTERN

                                ;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
                 000024                         .=24
000024  012352                         PWRFAL                  ;POWER FAIL HANDLER
000026  000340                         340
                 000060                         .=60
000060  011734                         XTTYIN                  ;TELEPRINTER KEYBOARD ROUTINE
000062  000340                         340
                 000030                         .=30
000030  012452                         EMTSRV                  ;EMT TRAP, EMT DISPATCH SERVICE
000032  000340                         340
000034  013016                         LOGERR                  ;TRAP TRAP, LOGIC ERROR TRAP
000036  000340                         340
                 000046                         .-46
000046  002012                         LOGICAL
                 000052                         .=52
000052  000000                         0
                 000170                         .=170
000170  000000                 SOFTSW: 0                       ;SOFTWARE SWITCH REGISTER VALUE
000172  000000                 SOFTDI: 0
000174  000137  001352                 JMP     MONITR          ;PROGRAM 'RESTART' ADDRESS
000200  000137  001120                 JMP     INIT            ;INITIALIZATION ADDRESS
000204  000137  002054                 JMP     CKTEST          ;MANULAL SA OF CLOCK TEST
000210  000137  006014                 JMP     IOTEST          ;MANUAL SA OF DIGITAL I/O LOGIC TEST
000214  000137  010034                 JMP     VCTEST          ;MANUAL SA OF SCOPE LOGIC TEST
000220  000137  014534                 JMP     VISUAL          ;MANUAL SA OF SCOPE VISUAL TEST
000224  000137  017414                 JMP     ST1             ;MINI-TEST SCHMITT TRIGGER #1
000230  000137  017430                 JMP     ST2             ;MINI-TEST SCHMITT TRIGGER #2
000234  000137  017364                 JMP     CKOVFL          ;MINI-TEST CLOCK OVERFLOW
000240  000137  017300                 JMP     RELAY           ;MINI-TEST RELAY CONTACT
                                        ;TRAP EQUIVALENCE TABLE:
                 104400                 ERROR=TRAP              ;LOGIC TEST ERROR ROUTINE
                 104000                 PRINT=EMT               ;MESSAGE PRINTER ROUTINE
                 104001                 SCOPE0=EMT+1            ;SCOPE SUBROUTINE (1)
                 104002                 SCOPE=EMT+2             ;LOGIC TEST SCOPE SUBROUTINE (4000)
                 104003                 SCOPE1=EMT+3            ;LOGIC TEST SCOPE SUBROUTINE (10)
                 104004                 SPACE=EMT+4             ;TYPE 'N' SPACES
                 104005                 PRTOCT=EMT+5            ;OCTAL PRINT ROUTINE
                 104006                 TTYIN=EMT+6             ;TELETYPE INPUT ROUTINE
                 104007                 TSTTKS=EMT+7            ;SUBROUTINE TO TEST FOR KEYBOARD FLAG
                 001000                         .=1000
001000  170400                 LPSADD: 170400                  ;LPS STARTING ADDRESS
001002  000340                 LPSVCT: 340                     ;LPS STARTING VECTOR
001004  000300                 ADBRL:  300                     ;A TO D BR LEVEL
001006  000300                 CKBRL:  300                     ;CLOCK BR LEVEL
001010  000200                 DIOBRL: 200                     ;DIGITAL I/O BR LEVEL
001012  000200                 VCBRL:  200                     ;SCOPE BR LEVEL
001014  000001                 PDPDLY: 1                       ;1 FOR 11/20 2 FOR 11/45
001016  000002                 FILLS:  2                       ;TTY FILLER COUNT
001020  000000                 FILCHR: 0                       ;TTY FILLER CHARACTER
001022  177776                 PSW:    177776
001024  177560                 TKS:    177560
001026  177562                 TKB:    177562
001030  177564                 TPS:    177564
001032  177566                 TPB:    177566
001034  177570                 SWR:    177570  ;OR LOC. 170 IF RUNNING WITH NO SWITCH REGISTER
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```
                                DISPLA: 177570
                                PASSCT: 0
                                ICOUNT: 4000

                                ;LPS DEVICE ADDRESSES

                                ADCS:   170400          ;A TO D STATUS/CONTROL REGISTER
                                ADDBR:  170402          ;A TO D CONVERTED VALUE (READ ONLY)
                                                        ;A TO D LED DISPLAY LIGHTS (WRITE ONLY)

                                CSR:    170404          ;CLOCK STATUS/CONTROL REGISTER
                                CSB:    170406          ;CLOCK PRESET BUFFER

                                GRSTAT: 170410          ;DIGITAL I/O STATUS/COMMAND REGISTER
                                GRDAI:  170412          ;DIGITAL I/O INPUT REGISTER (READ ONLY)
                                GRDIO:  170414          ;DIGITAL I/O OUTPUT REGISTER

                                VCSTAT: 170416          ;POINT PLOT STATUS REGISTER
                                VCXREG: 170420          ;POINT PLOT X AXIS
                                VCYREG: 170422          ;POINT PLOT Y AXIS
                                VCEXT:  170424          ;EXTERNAL DAC REGISTER

                                GRBHIC: 170415          ;DIGITAL I/O OUTPUT REGISTER (HIGH BYTE)

                                ;LPS DEVICE INTERRUPT VECTORS

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

                                CKV:    344             ;CLOCK INTERRUPT VECTOR
                                CKVS:   346

                                GRIVA:  350             ;DIGITAL INPUT INTERRUPT VECTOR
                                GRIVSA: 352

                                GRIVB:  354             ;DIGITAL OUTPUT INTERRUPT VECTOR
                                GRIVSB: 356

                                VCIV:   360             ;DISPLAY INTERRUPT VECTOR
                                VCIVS:  362
```

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                                        ;THIS ROUTINE IS EXECUTED ON LOADING THE PROGRAM
                                        
001120  013706  014444          INIT:   MOV     STACK,SP        ;INIT STACK POINTER=1000
001124  012777  000340  177670          MOV     #340,@PSW
001132  000005                        RESET                   ;CLEAR THE WORLD
001134  012700  001044                MOV     #ADCS,R0
001140  013701  001000                MOV     LPSADD,R1
001144  012702  000013                MOV     #13,R2
001150  010120                INIT1A: MOV     R1,(0)+
001152  062701  000002                ADD     #2,R1
001156  005302                        DEC     R2
001160  001373                        BNE     INIT1A
001162  013737  001060  001072        MOV     GRDIO,GRBHIO
001170  052737  000001  001072        BIS     #1,GRBHIO
001176  012700  001074                MOV     #ADINT,R0
001202  013701  001002                MOV     LPSVCT,R1
001206  012702  000012                MOV     #12,R2
001212  010120                INIT1B: MOV     R1,(0)+
001214  062701  000002                ADD     #2,R1
001220  005302                        DEC     R2
001222  001373                        BNE     INIT1B
001224  012737  001240  000004        MOV     #1$,@#4         ;LOAD TRAP RETURN
001232  005777  177576                TST     @SWR            ;TEST IF SWITCH REGISTER
001236  000407                        BR      2$              ;BR IF YES
001240  022626                1$:     CMP     (SP)+,(SP)+
001242  012737  000170  001034        MOV     #170,SWR        ;LOAD LOC. 170 INTO ADDRESS
001250  012737  000172  001036        MOV     #172,DISPLA
001256  005037  013642          2$:   CLR     NOLEDS
001262  012737  001342  000004        MOV     #INIT1C,@#4
001270  005077  177552                CLR     @ADCBR
001274  000240                        NOP
001276  012737  000006  000004        MOV     #6,@#4
001304  005737  000042                TST     @#42
001310  001402                        BEQ     3$
001312  000137  001400                JMP     INIT2
001316  012777  000100  177500  3$:   MOV     #100,@TKS       ;ENABLE TTY INTERUPTS
001324  005037  014442                CLR     PRINT1
001330  104000                        PRINT                   ;CALL MESSAGE PRINTER VIA 'EMT'
001332  013644                        TITLE                   ;TYPE PROGRAM HEADER.
001334  104000                INITA:  PRINT
001336  014165                        MES4                    ;PRINT THE TEST CALL LETTERS.
001340  000417                        BR      INIT2           ;GO AND AWAIT COMMAND.
001342  012737  177777  013642  INIT1C: MOV    #-1,NOLEDS
001350  000002                        RTI
                                        ;MONITOR SUBROUTINE. ENTER VIA 'TC' OR A RESTART AT LOCATION '200'.
001352  000005                MONITR: RESET                   ;INITIALIZE ON ENTRY
001354  013706  014444                MOV     STACK,SP        ;RESET STACK POINTER
001360  012777  000340  177434        MOV     #340,@PSW
001366  012777  000100  177430        MOV     #100,@TKS       ;ENABLE TTY INTERRUPTS
001374  104000                        PRINT                   ;CALL MESSAGE PRINTER
001376  014353                        CNTRLC                  ;TYPE 'C
```

```
                                ;
001400  012737  012352  000024  INIT2:  MOV     #PWRFAL,@#24    ;SET UP POWER FAIL
001406  012737  000026  000004          MOV     #6,@#4          ;SET UP BUSS ERROR
001414  005037  000006                  CLR     @#6
001420  012737  010116  177446          MOV     ADINT1,@ADINT
001426  005037  177444                  CLR     @ADINT1
001432  012737  001102  177440          MOV     CKVS,@CKV
001440  005037  177436                  CLR     @CKVS
001444  012737  001106  177432          MOV     GRIVSA,@GRIVA
001452  005037  177430                  CLR     @GRIVSA
001456  012737  001112  177424          MOV     GRIVSB,@GRIVB
001464  005037  177422                  CLR     @GRIVSB
001470  005037  013412                  CLR     SCOPEF
001474  012737  001334  014446          MOV     #INITA,AVECTR   ;SET UP 'A' VECTOR ADDRESS.
001502  104524  013524                  TSR     RS.LEDS
001506  000006                          6
001510  005737  000042                  TST     @#42
001514  001402                          BEQ     .+6
001516  000137  001632                  JMP     WHAT
001522  012777  000100  177274          MOV     #100,@TKS       ;ENABLE KEYBOARD INTERRUPT
001530  104000                          PRINT
001532  014413                          DOT                     ;PRINT '.' TO INDICATE MONITOR READY
001534  104006                          TTYIN                   ;WAIT FOR TTY ENTRY
001536  042737  000040  012334          BIC     #BIT5,INBUF     ;ENABLE LOWER CASE
001544  122737  000101  012334          CMPB    #'A,INBUF       ;TEST FOR 'A'
001552  001002                          BNE     .+6
001554  000137  002054                  JMP     CKTEST          ;YES RUN 'CLOCK LOGIC TEST'
001560  122737  000102  012334          CMPB    #'B,INBUF       ;TEST FOR 'B'
001566  001002                          BNE     .+6             ;NOT 'B'
001570  000137  006014                  JMP     IOTEST          ;YES RUN 'I/O LOGIC TEST'
001574  122737  000103  012334          CMPB    #'C,INBUF       ;TEST FOR 'C'
001602  001002                          BNE     .+6             ;NOT 'C'
001604  000137  010034                  JMP     VCTEST          ;YES, RUN 'SCOPE LOGIC TEST'
001610  122737  000104  012334          CMPB    #'D,INBUF       ;TEST FOR 'D'
001616  001002                          BNE     .+6             ;NOT 'D'
001620  000137  014534                  JMP     VISUAL          ;YES, RUN 'VISUAL DISPLAY TEST'
001624  104000          INIT3:  PRINT                           ;ILLEGAL ENTRY
001626  044416                  GMARK                           ;TYPE '?'
001630  000660                  BR      INIT2                   ;WAIT AGAIN
```

```
                                        ;EXECUTE ONLY IF LOCATION 42 IS NON ZERO

001632  005037  002024          WHAT:   CLR     NOCLK           ;CLEAR NO CLOCK
001636  005037  002026                  CLR     NODIO           ;CLEAR NO DIGITAL I/O
001642  005037  002030                  CLR     NOSCOP          ;CLEAR NO SCOPE
001646  012737  002032  000004          MOV     #WHAT1,2#4
001654  005077  177160                  CLR     @CSR            ;TEST FOR CLOCK
001660  012737  002040  000004          MOV     #WHAT2,2#4
001666  005077  177162                  CLR     @GRSTAT         ;TEST FOR DIGITAL I/O
001674  012737  002046  000004          MOV     #WHAT3,2#4
001702  005077  177156                  CLR     @VCSTAT         ;TEST FOR SCOPE
001710  012737  000006  000004          MOV     #6,2#4
001716  005737  002024                  TST     NOCLK           ;TEST FOR NO CLOCK
001722  001410                          BEQ     WHATA           ;BRANCH IF CLOCK
001724  005737  002026                  TST     NODIO           ;TEST FOR NO DIGITAL I/O
001730  001405                          BEQ     WHATA           ;BRANCH IF DIGITAL I/O
001732  005737  002030                  TST     NOSCOP          ;TEST FOR NO SCOPE
001736  001402                          BEQ     WHATA           ;BRANCH IF SCOPE
001740  000000                          HALT                    ;FATAL ERROR, NO SLAVE SYNC FROM ANY LPS-11 DEVICE
001742  000777                          BR      .               ;HANG HERE

001746  005737  002024          WHATA:  TST     NOCLK           ;TEST FOR CLOCK
001752  001002                          BNE     WHAT3           ;BRANCH IF NO CLOCK
001754  000137  002062                  JMP     CTEST1          ;TEST CLOCK
001760  005737  002026          WHATB:  TST     NODIO           ;TEST FOR DIGITAL I/O
001764  000402                          BR      WHATC           ;DONT RUN LPS-11-DR IN CHAIN MODE (NEWER LPS-11-DRA)
001766  000137  006022                  JMP     ITEST1          ;RUN DIGITAL I/O TEST
001772  005737  002030          WHATC:  TST     NOSCOP          ;TEST FOR SCOPE
001776  001004                          BNE     WHATE           ;BRANCH IF NO SCOPE
002002  000137  010042                  JMP     \TEST1          ;TEST SCOPE LOGIC
002006  000137  014542          WHATD:  JMP     VTEST2          ;TEST VISUAL
002012  000005          WHATE:  RESET
002014  000005                  RESET
002016  013700  000042                  MOV     2#42,R0
002022  004710          LOGICAL:        JSR     PC,(R0)
002024  000240                  NOP
002026  000240                  NOP
002030  000240                  NOP
002032  000703                  BR      WHAT

002034  000000          NOCLK:  0
002036  000000          NODIO:  0
002040  000000          NOSCOP: 0

002042  005137  002024  WHAT1:  COM     NOCLK
002046  000002                  RTI
002050  005137  002026  WHAT2:  COM     NODIO
002054  000002                  RTI
002056  005137  002030  WHAT3:  COM     NOSCOP
002062  000002                  RTI
```

```
                                        ;*****************************************************************************
                                        ;       CLOCK LOGIC TEST
                                        ;*****************************************************************************

002054  000005                  CKTEST: RESET
002056  104000                          PRINT
002060  014030                          MES2                            ;IDENTIFY TEST
002062  005037  001040          CTEST1: CLR     PASSCT
002066  013777  001040  176742  BEGIN:  MOV     PASSCT,@DISPLA
002074  013706  014444                  MOV     STACK,SP
002100  005077  176716                  CLR     @PSW
002104  012737  002132  013414          MOV     #KWTO+2,RETURN  ;SET UP RESTART OF PROGRAM
002112  052777  000100  176734          BIS     #BIT6,@TKS

                                        ;TEST FOR NO BUSS ERRORS

002120  005077  176724                  CLR     @CSR
002124  005077  176722                  CLR     @CSB

                                        ;TEST THE COUNTER PRESET BUFFER

002130  104002                  KWTO:   SCOPE
002132  012777  177777  176712          MOV     #-1,@CSB        ;LOAD PRESET BUFFER
002140  022777  177777  176704          CMP     #-1,@CSB        ;
002146  001401                          BEQ     .+4             ;BRANCH IF EQUAL
002150  104400                          ERROR                   ;ERROR, COUNTER PRESET FAILED TO LOAD

002152  104002                  KWT2:   SCOPE
002154  012777  052525  176670          MOV     #52525,@CSB     ;LOAD PRESET BUFFER
002162  022777  052525  176662          CMP     #52525,@CSB
002170  001401                          BEQ     .+4             ;BRANCH IF EQUAL
002172  104400                          ERROR                   ;ERROR, COUNTER PRESET FAILED TO LOAD

002174  104002                  KWT3:   SCOPE
002176  012777  025252  176646          MOV     #25252,@CSB     ;LOAD PRESET
002204  022777  025252  176640          CMP     #25252,@CSB
002212  001401                          BEQ     .+4             ;BRANCH IF EQUAL
002214  104400                          ERROR                   ;ERROR, COUNTER PRESET FAILED TO LOAD

                                        ;TEST INIT TO CLEAR COUNT PRESET BUFFER WHEN IT IS =-1

002216  104003                  KWT4:   SCOPE1
002220  012777  177777  176624          MOV     #-1,@CSB
002226  000005                          RESET
002230  005777  176616                  TST     @CSB
002234  001401                          BEQ     .+4
002236  104400                          ERROR                   ;ERROR, INIT FAILED TO CLEAR CSB

002240  052777  000100  176556          BIS     #BIT6,@TKS
```

```
                                        ;TEST ENABLE COUNTER (BIT 0  CAN BE SET AND CLEARED

002246  104003                  kWT5:   SCOPE1
002250  012777  000001  176572          MOV     #BIT0,@CSR
002256  022777  000001  176564          CMP     #BIT0,@CSR
002264  001401                          BEQ     .+4
002266  104400                          ERROR                           ;ERROR COUNTER ENABLE FAILED TO SET

                                        ;TEST RATE SELECT (BIT 1) MAY BE SET AND CLEARED

002270  104002                  kWT6:   SCOPE
002272  012777  000002  176550          MOV     #2,@CSR
002300  022777  000002  176542          CMP     #2,@CSR
002306  001401                          BEQ     .+4
002310  104400                          ERROR                           ;ERROR, CSR NOT = 2

                                        ;TEST THAT RATE SELECT (BIT 2) MAY BE SET AND CLEARED

002312  104002                  kWT7:   SCOPE
002314  012777  000004  176526          MOV     #4,@CSR
002322  022777  000004  176520          CMP     #4,@CSR
002330  001401                          BEQ     .+4
002332  104400                          ERROR                           ;ERROR, CSR NOT = 4

                                        ;TEST THAT RATE SELECT (BIT 3) MAY BE SET AND CLEARED

002334  104002                  kWT8:   SCOPE
002336  012777  000010  176534          MOV     #10,@CSR
002344  022777  000010  176476          CMP     #10,@CSR
002352  001401                          BEQ     .+4
002354  104400                          ERROR                           ;ERROR, CSR NOT = 10
```

```
                                        ;TEST MODE INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED

002356  104002                  KWT10:  SCOPE
002360  012777  000100  176462          MOV     #100,@CSR
002366  022777  000100  176454          CMP     #100,@CSR
002374  001401                          BEQ     .+4
002376  104400                          ERROR                           ;ERROR, CSR NOT = 100

                                        ;TEST MODE (BIT 8) CAN BE SET AND CLEARED

002400  104002                  KWT11:  SCOPE
002402  012777  000400  176440          MOV     #400,@CSR
002410  022777  000400  176432          CMP     #400,@CSR
002416  001401                          BEQ     .+4
002420  104400                          ERROR                           ;ERROR, CSR NOT = 400

                                        ;TEST MODE (BIT 9) CAN BE SET AND CLEARED

002422  104002                  KWT12:  SCOPE
002424  012777  001000  176416          MOV     #1000,@CSR
002432  022777  001000  176410          CMP     #1000,@CSR
002440  001401                          BEQ     .+4
002442  104400                          ERROR                           ;ERROR, CSR NOT = 1000

                                        ;TEST ST#1 START ENABLE (BIT 13) CAN BE SET AND CLEARED

002444  104002                  kWT14:  SCOPE
002446  012777  020000  176374          MOV     #20000,@CSR
002454  022777  020000  176366          CMP     #20000,@CSR
002462  001401                          BEQ     .+4
002464  104400                          ERROR                           ;ERROR, CSR NOT = 20000
```

```
                                        ;TEST ST#1 INTERRUPT ENABLE (BIT 14) CAN BE SET AND CLEARED

002466  104002                  KWT15:  SCOPE
002470  012777  040000  176352          MOV     #40000,@CSR
002476  022777  040000  176344          CMP     #40000,@CSR
002504  001401                          BEQ     .+4
002506  104400                          ERROR                           ;ERROR, CSR NOT = 40000

                                        ;TEST THAT THE DONE (BIT 7) CAN BE SET AND CLEARED

002510  104002                  KWT16:  SCOPE
002512  012777  000200  176330          MOV     #BIT7,@CSR              ;SET THE DONE BIT
002520  105777  176324                  TSTB    @CSR
002524  100401                          BMI     .+4
002526  104400                          ERROR                           ;ERROR, CSR NOT = 200
002530  105777  176314                  TSTB    @CSR
002534  100401                          BMI     .+4
002536  104400                          ERROR                           ;ERROR CSR NOT = 200
002540  005077  176304                  CLR     @CSR
002544  005777  176300                  TST     @CSR
002550  001401                          BEQ     .+4
002552  104400                          ERROR                           ;ERROR CSR NOT = 0

                                        ;TEST THAT THE ST FLAG (BIT 15) CAN BE SET AND CLEARED

002554  104002                  KWT17:  SCOPE
002556  012777  100000  176264          MOV     #BIT15,@CSR             ;SET BIT 15
002564  005777  176260                  TST     @CSR
002570  100401                          BMI     .+4
002572  104400                          ERROR                           ;ERROR CSR NOT 100000
002574  005777  176250                  TST     @CSR
002600  100401                          BMI     .+4
002602  104400                          ERROR                           ;ERROR CSR NOT 100000
002604  005077  176240                  CLR     @CSR
002610  005777  176234                  TST     @CSR
002614  001401                          BEQ     .+4
002616  104400                          ERROR                           ;ERROR CSR NOT = 0

                                        ;TEST THAT THE ST FLAG DOES NOT SET FROM THE OUTSIDE SOURCE

002620  104002                  KWT18:  SCOPE
002622  005077  176222                  CLR     @CSR
002626  005037  014506                  CLR     TEMP
002632  005777  176212          KWT18A: TST     @CSR
002636  100001                          BPL     .+4
002640  104400                          ERROR                           ;ERROR ST1 SET IN ERROR
002642  005237  014502                  INC     TEMP
002646  001371                          BNE     KWT18A
```

```
                                        ;TEST MAINT ST1 CAN SET ST1 FLAG
                                        
002650  104003                  KWT19:  SCOPE1
002652  005077  176172                  CLR     @CSR
002656  052777  010000  176164          BIS     #BIT12,@CSR             ;MAINT ST1
002664  005777  176160                  TST     @CSR
002670  100401                          BMI     .+4
002672  104400                          ERROR                           ;ERROR, ST1 FLAG FAILED TO SET

                                        ;TEST THAT WHEN ST1 FIRES AND ST1 START ENABLE =1
                                        ; THAT THE ENABLE COUNTER GETS SET

002674  104002                  KWT20:  SCOPE
002676  005077  176146                  CLR     @CSR
002702  012777  020000  176140          MOV     #BIT13,@CSR             ;SET ST1 START ENABLE
002710  052777  010000  176132          BIS     #BIT12,@CSR             ;MAINT ST1
002716  032777  000001  176124          BIT     #BIT0,@CSR              ;TEST BIT 0
002724  001001                          BNE     .+4
002726  104400                          ERROR                           ;ST1 START ENABLE AND ST1
                                                                        ;FAILED TO SET ENABLE COUNTER
```

```
                                        ;TEST THAT MODE 1 AND BIT 10 (MAINT. ST 2) SET BIT 7

002730  104002                  KWT22:  SCOPE
002732  005077  176112                  CLR     @CSR                    ;CLEAR STATUS
002736  005077  176110                  CLR     @CSB                    ;CLEAR PRESET
002742  012777  001000  176100          MOV     #BIT9,@CSR              ;LOAD MODE
002750  052777  002000  176072          BIS     #BIT10,@CSR             ;FIRE ST 2
002756  105777  176066                  TSTB    @CSR                    ;TEST BIT 7
002762  100401                          BMI     .+4
002764  104400                          ERROR                           ;ERROR, ST 2 FAILED TO SET BIT 7

                                        ;TEST THAT THE COUNTER CAN BE LOADED

002766  104002                  KWT23:  SCOPE
002770  005077  176054                  CLR     @CSR                    ;CLEAR STATUS
002774  012777  177777  176050          MOV     #-1,@CSB                ;LOAD PRESET AND COUNTER
003002  012777  001401  176040          MOV     #1401,@CSR              ;LOAD MODE AND ENABLE COUNT
003010  005077  176036                  CLR     @CSB                    ;SHOULD ONLY CLEAR PRESET
003014  052777  002000  176026          BIS     #BIT10,@CSR             ;FIRE ST
003022  022777  177777  176022          CMP     #-1,@CSB                ;TEST THE NUMBER
003030  001401                          BEQ     .+4
003032  104400                          ERROR                           ;ERROR, COUNTER FAILED TO LOAD PROPERLY

                                        ;TEST THAT THE COUNTER CAN BE LOADED

003034  104002                  KWT24:  SCOPE
003036  005077  176006                  CLR     @CSR                    ;CLEAR STATUS
003042  012777  125252  176002          MOV     #125252,@CSB            ;LOAD PRESET AND COUNTER
003050  012777  001401  175772          MOV     #1401,@CSR              ;LOAD MODE AND ENABLE COUNT
003056  005077  175770                  CLR     @CSB                    ;SHOULD ONLY CLEAR PRESET
003062  052777  002000  175760          BIS     #BIT10,@CSR             ;FIRE ST
003070  022777  125252  175754          CMP     #125252,@CSB            ;TEST THE NUMBER
003076  001401                          BEQ     .+4
003100  104400                          ERROR                           ;ERROR, COUNTER FAILED TO LOAD PROPERLY

                                        ;TEST THAT THE COUNTER CAN BE LOADED

003102  104002                  KWT25:  SCOPE
003104  005077  175740                  CLR     @CSR                    ;CLEAR STATUS
003110  012777  052525  175734          MOV     #52525,@CSB             ;LOAD PRESET AND COUNTER
003116  012777  001401  175724          MOV     #1401,@CSR              ;LOAD MODE AND ENABLE COUNT
003124  005077  175722                  CLR     @CSB                    ;SHOULD ONLY CLEAR PRESET
003130  052777  002000  175712          BIS     #BIT10,@CSR             ;FIRE ST
003136  022777  052525  175706          CMP     #52525,@CSB             ;TEST THE NUMBER
003144  001401                          BEQ     .+4
003146  104400                          ERROR                           ;ERROR, COUNTER FAILED TO LOAD PROPERLY
```

```
                                        ;TEST THAT THE COUNTER COUNTS UP
                                        ;USE MAINT COUNT
                                        ;USE MAINT ST2
                                        ;USE MODE 2
                                        ;USE RATE 1 (1MHZ)

003150  005037  014506                  CLR     TEMP
003154  104002                  KWT26:  SCOPE
003156  005077  175666                  CLR     @CSR
003162  005077  175664                  CLR     @CSB
003166  012777  001002  175654          MOV     #1002,@CSR
003174  052777  002000  175646  KWT26A: BIS     #BIT10,@CSR             ;MAINT ST2
003202  027737  175644  014506          CMP     @CSB,TEMP
003210  001402                          BEQ     .+6
003212  104400                          ERROR                           ;MAINT COUNT FAILED
003214  000416                          BR      KWT30
003216  105777  175626                  TSTB    @CSR                    ;TEST DONE FLAG
003222  100402                          BMI     1$
003224  104400                          ERROR                           ;ERROR, CKBF TO BF FAILED TO SET DONE
003226  000411                          BR      KWT30
003230  052777  004000  175612  1$:     BIS     #BIT11,@CSR             ;MAINT COUNT
003236  042777  000200  175604          BIC     #BIT7,@CSR              ;CLEAR BIT 7
003244  005237  014506                  INC     TEMP
003250  001351                          BNE     KWT26A                  ;BRANCH IF NOT FULL COUNT
```

```
1004
1005                                    ;TEST THAT THE COUNTER COUNTS UP
1006                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1007                                    ;USE MAINT COUNT <100KHZ>
1008                                    ;USE MAINT ST2
1009                                    ;USE MODE 2
1010                                    ;RATE #100KHZ
1011
1012  003252  104003                   KWT30:  SCOPE1
1013  003254  005077  175570                   CLR     @CSR                    ;CLEAR CLOCK STATUS
1014  003260  005077  175566                   CLR     @CSB                    ;CLEAR PRESET
1015  003264  012777  001004  175556           MOV     #1004,@CSR              ;LOAD STATUS
1016  003272  052777  002000  175550           BIS     #BIT10,@CSR             ;MAINT ST2
1017  003300  005777  175546                   TST     @CSB                    ;TEST PRESET
1018  003304  001401                           BEQ     .+4
1019  003306  104400                           ERROR                           ;ERROR PRESET INCREMENTED IN ERROR
1020  003310  012737  000012  014454           MOV     #10.,COUNT              ;SET UP A COUNTER
1021  003316  052777  004000  175524  KWT30A:  BIS     #BIT11,@CSR             ;GENERATE MAINT COUNT
1022  003324  005337  014454                   DEC     COUNT
1023  003330  001372                           BNE     KWT30A                  ;BR
1024  003332  052777  002000  175510           BIS     #BIT10,@CSR             ;MAINT ST2
1025  003340  022777  000001  175504           CMP     #1,@CSB                 ;
1026  003346  001401                           BEQ     .+4
1027  003350  104400                           ERROR                           ;ERROR, CLOCK PRESET BUFFER
1028                                                                   ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
1029                                                                   ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
1030
1031                                    ;TEST THAT THE COUNTER COUNTS UP
1032                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1033                                    ;USE MAINT COUNT <10KHZ>
1034                                    ;USE MAINT ST2
1035                                    ;USE MODE 2
1036                                    ;RATE #10KHZ
1037
1038  003352  104003                   KWT31:  SCOPE1
1039  003354  005077  175470                   CLR     @CSR                    ;CLEAR CLOCK STATUS
1040  003360  005077  175466                   CLR     @CSB                    ;CLEAR PRESET
1041  003364  012777  001006  175456           MOV     #1006,@CSR              ;LOAD STATUS
1042  003372  052777  002000  175450           BIS     #BIT10,@CSR             ;MAINT ST2
1043  003400  005777  175446                   TST     @CSB                    ;TEST PRESET
1044  003404  001401                           BEQ     .+4
1045  003406  104400                           ERROR                           ;ERROR PRESET INCREMENTED IN ERROR
1046  003410  012737  000144  014454           MOV     #100.,COUNT             ;SET UP A COUNTER
1047  003416  052777  004000  175424  KWT31A:  BIS     #BIT11,@CSR             ;GENERATE MAINT COUNT
1048  003424  005337  014454                   DEC     COUNT
1049  003430  001372                           BNE     KWT31A                  ;BR
1050  003432  052777  002000  175410           BIS     #BIT10,@CSR
1051  003440  022777  000001  175404           CMP     #1,@CSB                 ;
1052  003446  001401                           BEQ     .+4
1053  003450  104400                           ERROR                           ;ERROR, CLOCK PRESET BUFFER
1054                                                                   ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
1055                                                                   ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
1056
```

```
1057
1058                                    ;TEST THAT THE COUNTER COUNTS UP
1059                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1060                                    ;USE MAINT COUNT <1KHZ>
1061                                    ;USE MAINT ST2
1062                                    ;USE MODE 2
1063                                    ;RATE #1KHZ
1064
1065  003452  104003                    KWT32:  SCOPE1
1066  003454  005077  175370                   CLR     @CSR                    ;CLEAR CLOCK STATUS
1067  003460  005077  175366                   CLR     @CSB                    ;CLEAR PRESET
1068  003464  012777  001010  175356           MOV     #1010,@CSR              ;LOAD STATUS
1069  003472  052777  002000  175350           BIS     #BIT10,@CSR             ;MAINT ST2
1070  003500  005777  175346                   TST     @CSB                    ;TEST PRESET
1071  003504  001401                           BEQ     .+4
1072  003506  104400                           ERROR                           ;ERROR PRESET INCREMENTED IN ERROR
1073  003510  012737  001750  014454           MOV     #1000.,COUNT            ;SET UP A COUNTER
1074  003516  052777  004000  175324  KWT32A:  BIS     #BIT11,@CSR             ;GENERATE MAINT COUNT
1075  003524  005337  014454                   DEC     COUNT
1076  003530  001372                           BNE     KWT32A                  ;BR
1077  003532  052777  002000  175310           BIS     #BIT10,@CSR
1078  003540  022777  000001  175304           CMP     #1,@CSB                 ;
1079  003546  001401                           BEQ     .+4
1080  003550  104400                           ERROR                           ;ERROR, CLOCK PRESET BUFFER
1081                                                                    ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
1082                                                                    ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
1083
1084                                    ;TEST THAT THE COUNTER COUNTS UP
1085                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1086                                    ;USE MAINT COUNT <100HZ>
1087                                    ;USE MAINT ST2
1088                                    ;USE MODE 2
1089                                    ;RATE #100HZ
1090
1091  003552  104003                    KWT33:  SCOPE1
1092  003554  005077  175270                   CLR     @CSR                    ;CLEAR CLOCK STATUS
1093  003560  005077  175266                   CLR     @CSB                    ;CLEAR PRESET
1094  003564  012777  001012  175256           MOV     #1012,@CSR              ;LOAD STATUS
1095  003572  052777  002000  175250           BIS     #BIT10,@CSR             ;MAINT ST2
1096  003600  005777  175246                   TST     @CSB                    ;TEST PRESET
1097  003604  001401                           BEQ     .+4
1098  003606  104400                           ERROR                           ;ERROR PRESET INCREMENTED IN ERROR
1099  003610  012737  023420  014454           MOV     #10000.,COUNT           ;SET UP A COUNTER
1100  003616  052777  004000  175224  KWT33A:  BIS     #BIT11,@CSR             ;GENERATE MAINT COUNT
1101  003624  005337  014454                   DEC     COUNT
1102  003630  001372                           BNE     KWT33A                  ;BR
1103  003632  052777  002000  175210           BIS     #BIT10,@CSR
1104  003640  022777  000001  175204           CMP     #1,@CSB                 ;
1105  003646  001401                           BEQ     .+4
1106  003650  104400                           ERROR                           ;ERROR, CLOCK PRESET BUFFER
1107                                                                    ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
1108                                                                    ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
```

```
1109
1110                                    ;TEST THAT THE COUNTER COUNTS UP
1111                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1112                                    ;USE MODE 2
1113                                    ;USE MAINT ST1
1114                                    ;RATE #EXTURNAL
1115
1116  003652  005037  014506                      CLR     TEMP
1117  003656  104003                KWT34:  SCOPE1
1118  003660  005077  175164                      CLR     @CSR
1119  003664  005077  175162                      CLR     @CSB
1120  003670  012777  001014  175152              MOV     #1014,@CSR              ;MODE 2 EXTURNAL CLOCK RATE
1121  003676  052777  002000  175144  KWT34A:     BIS     #BIT10,@CSR             ;MAINT ST 2
1122  003704  027737  175142  014506              CMP     @CSB,TEMP               ;COMPARE BUFFER TO PRESET
1123  003712  001402                              BEQ     .+6
1124  003714  104400                              ERROR                           ;EXTURNAL CLOCOIDAILED TO COUNT
1125  003716  000406                              BR      KWT35                   ; THE COUNTER, CHECK THE RATE SELECTION
1126  003720  052777  010000  175122              BIS     #BIT12,@CSR             ;MAINT ST1
1127  003726  005237  014506                      INC     TEMP
1128  003732  001361                              BNE     KWT34A
1129
1130                                    ;TEST EXTURNAL INTERVAL FROM ZERO BASE (MODE 3)
1131
1132  003734  104003                KWT35:  SCOPE1
1133  003736  005077  175106                      CLR     @CSR
1134  003742  012777  025252  175102              MOV     #25252,@CSB
1135  003750  012777  001402  175072              MOV     #1402,@CSR
1136  003756  052777  002000  175064              BIS     #BIT10,@CSR
1137  003764  022777  025252  175060              CMP     #25252,@CSB
1138  003772  001401                              BEQ     .+4
1139  003774  104400                              ERROR                           ;ERROR, MODE 3 FAILED TO LOAD CLOCK
1140                                                                            ; PRESET BUFFER
1141  003776  052777  002000  175044              BIS     #BIT10,@CSR
1142  004004  022777  000000  175040              CMP     #0,@CSB
1143  004012  001401                              BEQ     .+4
1144  004014  104400                              ERROR                           ;ERROR, MODE 3 FAILED TO ZERO CLOCK COUNTER
```

```
1145
1146                                        ;TEST THAT RESET CLEARS RATE SELECT BITS
1147
1148  004016  104002                        KWT36:  SCOPE
1149  004020  012777  000016  175022                MOV     #BIT3!BIT2!BIT1,@CSR    ;SET MODE BITS
1150  004026  000005                                RESET
1151  004030  005777  175014                        TST     @CSR
1152  004034  001401                                BEQ     .+4
1153  004036  104400                                ERROR                           ;ERROR, RESET FAILED TO CLEAR RATE BITS
1154
1155                                        ;TEST THAT RESET CLEARS MODE SELECT BITS
1156
1157  004040  104003                        KWT37:  SCOPE1
1158  004042  012777  001400  175000                MOV     #BIT9!BIT8,@CSR         ;SET MODE BITS
1159  004050  000005                                RESET
1160  004052  005777  174772                        TST     @CSR
1161  004056  001401                                BEQ     .+4
1162  004060  104400                                ERROR                           ;ERROR, RESET FAILED TO CLEAR MODE BITS
1163
1164                                        ;TEST THAT RESET CLEARS ST1 FLAG,ST1 INTERRUPT ENABLE AND ST1 START ENABLE
1165
1166  004062  104003                        KWT38:  SCOPE1
1167  004064  012777  160000  174756                MOV     #BIT15!BIT14!BIT13,@CSR ;SET ST1 FLAG,INT ENABLE AND ST1 START ENABLE
1168  004072  000005                                RESET
1169  004074  005777  174750                        TST     @CSR
1170  004100  001401                                BEQ     .+4
1171  004102  104400                                ERROR                           ;ERROR, RESET FAILED TO CLEAR ST1 LOGIC
1172
1173                                        ;TEST THAT RESET CLEARS DONE FLAG AND DONE INTERRUPT ENABLE
1174
1175  004104  104003                        KWT39:  SCOPE1
1176  004106  012777  000300  174734                MOV     #BIT7!BIT6,@CSR         ;SET DONE FLAG AND INTERRUPT ENABLE
1177  004114  000005                                RESET
1178  004116  005777  174726                        TST     @CSR
1179  004122  001401                                BEQ     .+4
1180  004124  104400                                ERROR                           ;ERROR, RESET FAILED TO CLEAR DONE FLAG OR DONE
1181
1182                                        ;TEST THAT RESET CLEARS COUNTER ENABLE
1183
1184  004126  104003                        KWT40:  SCOPE1
1185  004130  012777  000001  174712                MOV     #BIT0,@CSR              ;LOAD COUNTER ENABLE
1186  004136  000005                                RESET
1187  004140  005777  174704                        TST     @CSR                    ;TEST STATUS
1188  004144  001401                                BEQ     .+4
1189  004146  104400                                ERROR                           ;ERROR, RESET FAILED TO CLEAR COUNTER ENABLE
1190
1191
1192  004150  052777  000100  174646                BIS     #BIT6,@TKS
```

```
                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES (MODE 0)
                                        ;TEST THAT CLOCK ENABLE DOES CLEAR ON DONE FLAG
                                        ;1MHZ

004156  104003                          KWT41:  SCOPE1
004160  012737  000003  006004                  MOV     #3,RATE                 ;SELECT MODE 0, 1MHZ., GO
004166  004737  004470                          JSR     PC,UPCNT
004172  105777  174652                          TSTB    @CSR
004176  100401                                  BMI     .+4
004200  104400                                  ERROR                           ;ERROR, 1MHZ FAILED TO COUNT
004202  032777  000001  174640                  BIT     #BIT0,@CSR
004210  001401                                  BEQ     .+4
004212  104400                                  ERROR                           ;ERROR, MODE 0 FAILED TO CLEAR COUNTER ENABLE

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;100 KHZ

004214  104003                          KWT42:  SCOPE1
004216  012737  000005  006004                  MOV     #5,RATE                 ;SELECT MODE 0, 100KHZ., GO
004224  004737  004470                          JSR     PC,UPCNT
004230  105777  174614                          TSTB    @CSR
004234  100401                                  BMI     .+4
004236  104400                                  ERROR                           ;ERROR, 100KHZ. FAILED TO COUNT
004240  032777  000001  174602                  BIT     #BIT0,@CSR
004246  001401                                  BEQ     .+4
004250  104400                                  ERROR                           ;ERROR MODE 0 FAILED TO CLEAR COUNT ENABLE

                                        ;10 KHZ

004252  104003                          KWT43:  SCOPE1
004254  012737  000007  006004                  MOV     #7,RATE                 ;SELECT MODE 0, 10KHZ., GO
004260  004737  004470                          JSR     PC,UPCNT
004266  105777  174556                          TSTB    @CSR
004272  100401                                  BMI     .+4
004274  104400                                  ERROR                           ;ERROR, 10 KHZ. FAILED TO COUNT

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;1KHZ

004276  104003                          KWT44:  SCOPE1
004300  012737  000011  006004                  MOV     #11,RATE                ;SELECT MODE 0, 1 KHZ. GO
004306  004737  004470                          JSR     PC,UPCNT
004312  105777  174532                          TSTB    @CSR
004316  100401                                  BMI     .+4
004320  104400                                  ERROR                           ;ERROR, 1KHZ FAILED TO COUNT
```

```
                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;TEST 100 HZ
                                        
004322  104003                  KWT45:  SCOPE1
004324  012737  000013  006004          MOV     #13,RATE                ;SELECT MODE 0, 100 HZ, GO
004332  004737  004470                  JSR     PC,UPCNT
004336  105777  174506                  TSTB    @CSR
004342  100401                          BMI     .+4
004344  104400                          ERROR                           ;ERROR, 100HZ FAILED TO COUNT

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;LINE FREQ.

004346  104003                  KWT46:  SCOPE1
004350  012737  000017  006004          MOV     #17,RATE                ;SELECT MODE 0, LINE FREQ. GO
004356  004737  004470                  JSR     PC,UPCNT
004362  105777  174462                  TSTB    @CSR
004366  100401                          BMI     .+4
004370  104400                          ERROR                           ;ERROR, LINE FREQUENCY FAILED TO COUNT

                                        ;REPEAT T12 WITH MODE 1
                                        ;TEST THAT CLOCK ENABLE DOES NOT CLEAR ON DONE
                                        ; 1 MHZ.

004372  104003                  KWT47:  SCOPE1
004374  012737  000403  006004          MOV     #403,RATE               ;SELECT MODE 1, 1MHZ., GO
004402  004737  004470                  JSR     PC,UPCNT
004406  105777  174436                  TSTB    @CSR
004412  100401                          BMI     .+4
004414  104400                          ERROR                           ;ERROR, 1 MHZ. FAILED TO COUNT
                                                                        ; MODE 1
004416  032777  000001  174424          BIT     #BIT0,@CSR
004424  001001                          BNE     .+4
004426  104400                          ERROR                           ;MODE 1 CLEARED COUNTER ENABLE IN ERROR

                                        ;100KHZ.

004430  104003                  KWT48:  SCOPE1
004432  012737  000405  006004          MOV     #405,RATE               ;MODE 1 100KHZ GO
004440  004737  004470                  JSR     PC,UPCNT
004444  105777  174400                  TSTB    @CSR
004450  100401                          BMI     .+4
004452  104400                          ERROR                           ;ERROR, 100KHZ FAILED TO COUNT MODE 1
004454  032777  000001  174366          BIT     #BIT0,@CSR
004462  001001                          BNE     .+4
004464  104400                          ERROR                           ;MODE 1 CLEARED COUNTER ENABLE IN ERROR
004466  000425                          BR      KWT49
```

```
                                        ;SUBROUTINE TO LOAD -2 INTO THE CLOCK PRESET REGISTER
                                        ; AND LOAD CLOCK RATE INTO CLOCK STATUS REGISTER
                                        ; AND START THE CLOCK. WAIT A PERIOD OF TIME THEN EXIT

004470  005077  174354          UPCNT:  CLR     @CSR                    ;CLEAR CLOCK STATUS
004474  012777  177776  174350          MOV     #-2,@CSB                ;MOVE -2 INT PRESET
004502  013777  000004  174340          MOV     RATE,@CSR               ;LOAD RATE AND ENABLE CLOCK
004510  005037  014456                  CLR     DELAY                   ;DELAY
004514  105777  174330          UPCNTA: TSTB    @CSR                    ;
004520  100407                          BMI     UPCNTB                  ;
004522  027777  174322  174320          CMP     @CSR,@CSR
004530  062737  000001  014456          ADD     #1,DELAY                ;
004536  001366                          BNE     UPCNTA                  ;
004540  000207                  UPCNTB: RTS     7                       ;EXIT

                                        ;PRE-INTERRUPT SETUP

004542  104003                  KWT49:  SCOPE1
004544  000005                          RESET
004546  042737  177437  001006          BIC     #177437,CKBRL
004554  001001                          BNE     .+4
004556  000000                          HALT                            ;ERROR, BR LEVEL INDICATED FOR CLOCK WAS 0
004560  022737  000340  001006          CMP     #340,CKBRL
004566  001001                          BNE     .+4
004570  000000                          HALT                            ;ERROR BR LEVEL FOR CLOCK WAS 7

004572  013737  001006  014514          MOV     CKBRL,BRLEV1
004600  162737  000040  014514          SUB     #40,BRLEV1
004606  013737  001006  014516          MOV     CKBRL,BRLEV2
004614  013737  001006  014520          MOV     CKBRL,BRLEV3
004622  062737  000040  014520          ADD     #40,BRLEV3
```

```
                                        ;TEST THAT THE SCHMITT TRIGGER INTERRUPTS AT LEVEL INDICATED -1

004630  104003                  KWT50:  SCOPE1
004632  000005                          RESET
004634  012777  000340  174160          MOV     #340,@PSW
004642  005077  174202                  CLR     @CSR
004646  012777  004712  174224          MOV     #KWT50A,@CKV            ;SET UP INTERRUPT RETURN VECTOR
004654  012777  040000  174166          MOV     #BIT14,@CSR             ;ENABLE INTERRUPT
004662  012700  000010                  MOV     #10,R0
004666  013777  014514  174126          MOV     BRLEV1,@PSW             ;LOWER PRIOR.
004674  052777  010000  174146          BIS     #BIT12,@CSR
004702  005300                          DEC     R0
004704  001376                          BNE     .-2
004706  104400                          ERROR                           ;ERROR, CLOCK INTERRUPT FAILED TO OCCUR.
004710  000415                          BR      KWT51                   ;CHECK FOR PROPER BR LEVEL
                                                                        ;SHOULD BE LEVEL 6 (300)

                                        ;SUBTEST, TEST THAT IF PRIORITY IS LOWERED AGAIN
                                        ;NO INTERRUPT SHOULD OCCUR

004712  022626                  KWT50A: CMP     (SP)+,(SP)+
004714  012777  004740  174156          MOV     #KWT50B,@CKV            ;RESET THE VECTOR
004722  012700  000010                  MOV     #10,R0
004726  005077  174073                  CLR     @PSW
004732  005300                          DEC     R0
004734  001376                          BNE     .-2                     ;DELAY
004736  000402                          BR      KWT51
004740  022626                  KWT50B: CMP     (SP)+,(SP)+
004742  104400                          ERROR                           ;ERROR, INT DONE B FAILED TO CLEAR INT REQ B
```

```
1350
1351
1352                                    ;TEST THAT THE CLOCK INTERRUPTS AT LEVEL INDICATED -1 (MODE 0)
1353
1354  004744  104003                    KWT51:  SCOPE1
1355  004746  000005                            RESET
1356  004750  012777  000340  174044            MOV     #340,@PSW
1357  004756  012777  005042  174114            MOV     #KWT51A,@CKV            ;LOAD VECTOR
1358  004764  012777  000340  174110            MOV     #340,@CKVS
1359  004772  005077  174052                    CLR     @CSR
1360  004776  012777  177774  174046            MOV     #-4,@CSB                ;LOAD PRESET
1361  005004  012777  000102  174036            MOV     #BIT6!BIT1,@CSR         ;LOAD RATE AND INT ENABLE
1362  005012  012700  000200                    MOV     #200,R0                 ;SET UP DELAY
1363  005016  013777  014514  173776            MOV     BRLEV1,@PSW
1364  005024  052777  000001  174016            BIS     #BIT0,@CSR              ;CLOCK
1365  005032  005300                            DEC     R0
1366  005034  001376                            BNE     .-2                     ;DELAY
1367  005036  104400                            ERROR                           ;ERROR, CLOCK FAILED TO INTERRUPT
1368  005040  000401                            BR      KWT52
1369
1370  005042  022626                    KWT51A: CMP     (SP)+,(SP)+
1371
1372                                    ;TEST THAT RESET CLEARS INT REQ B
1373
1374  005044  104003                    KWT52:  SCOPE1
1375  005046  012777  000340  173746            MOV     #340,@PSW
1376  005054  005077  173770                    CLR     @CSR                    ;CLEAR STATUS
1377  005060  013777  001102  174012            MOV     CKVS,@CKV               ;LOAD VECTOR
1378  005066  012777  000000  174006            MOV     #0,@CKVS
1379  005074  012777  040000  173746            MOV     #BIT14,@CSR             ;LOAD INT ENABLE
1380  005102  012700  000010                    MOV     #10,R0
1381  005106  052777  010000  173734            BIS     #BIT12,@CSR             ;FIRE ST
1382  005114  005300                            DEC     R0
1383  005116  001376                            BNE     .-2                     ;DELAY
1384  005120  012700  000100                    MOV     #100,R0
1385  005124  000005                            RESET
1386  005126  005077  173670                    CLR     @PSW
1387  005132  005300                            DEC     R0
1388  005134  001376                            BNE     .-2
```

```
1389                                    ;TEST THAT THE CLOCK DOES NOT INTERRUPT AT LEVEL INDICATED
1390
1391  005136  104003                    KWT53:  SCOPE1
1392  005140  012777  000340  173654            MOV     #340,@PSW               ;SET PROCESSOR PRIORITY 5
1393  005146  012777  005230  173724            MOV     #KWT53A,@CKV            ;SET UP INTERRUPT RETURN STATUS
1394  005154  012777  000340  173720            MOV     #340,@CKVS
1395  005162  005077  173662                    CLR     @CSR
1396  005166  012777  177774  173656            MOV     #-4,@CSB
1397  005174  012777  000102  173646            MOV     #102,@CSR               ;ENABLE INTERRUPT
1398  005202  013777  014516  173612            MOV     BRLEV2,@PSW
1399  005210  052777  000001  173632            BIS     #BIT0,@CSR
1400  005216  012700  000100                    MOV     #100,R0
1401  005222  005300                            DEC     R0
1402  005224  001376                            BNE     .-2
1403  005226  000401                            BR      .+4
1404  005230  104400                    KWT53A: ERROR                           ;ERROR, INTERRUPT OCCUR IN ERROR AT LEVEL INDICA
1405  005232  000005                            RESET
1406
1407                                    ;TEST THAT THE CLOCK DOES NOT INTERRUPT AT LEVEL INDICATED +1
1408
1409  005234  104003                    KWT54:  SCOPE1
1410  005236  012777  000340  173556            MOV     #340,@PSW               ;SET PROCESSOR PRIORITY 6
1411  005244  012777  005326  173626            MOV     #KWT54A,@CKV            ;SET UP INTERRUPT RETURN
1412  005252  012777  000340  173622            MOV     #340,@CKVS
1413  005260  005077  173564                    CLR     @CSR
1414  005264  012777  177774  173560            MOV     #-4,@CSB
1415  005272  012777  000102  173550            MOV     #102,@CSR               ;INTERRUPT ENABLE
1416  005300  013777  014520  173514            MOV     BRLEV3,@PSW
1417  005306  052777  000001  173534            BIS     #BIT0,@CSR
1418  005314  012700  000100                    MOV     #100,R0
1419  005320  005300                            DEC     R0
1420  005322  001376                            BNE     .-2                     ;DELAY LONG ENOUGH TO ALLOW INTERRUPT
1421  005324  000401                            BR      .+4
1422  005326  104400                    KWT54A: ERROR                           ;ERROR, INT SHOULDN'T HAVE OCCURRED
1423  005330  005077  173514                    CLR     @CSR                    ;STOP CLOCK
1424  005334  013777  001102  173536            MOV     CKVS,@CKV
1425  005342  005077  173534                    CLR     @CKVS
1426  005346  000005                            RESET
1427  005350  005077  173446                    CLR     @PSW
1428  005354  052777  000100  173442            BIS     #BIT6,@TKS
```

```
1429
1430                                    ;TEST 1MHZ REPEATABILITY
1431
1432  005362  104003                    KWT55:  SCOPE1
1433  005364  004537  005604                    JSR     R5,REPEAT       ;TEST REPEATIBILITY
1434  005370  000002                            2                       ;CLOCK RATE
1435  005372  000002                            2                       ;CLOCK DEV.
1436  005374  000001                            1                       ;MIN. COUNT
1437  005376  000036                            30.                     ;DELAY
1438  005400  104400                            ERROR                   ;ERROR, FAILED TO REACH MIN. COUNT
1439  005402  003401                            BLE     .+4
1440  005404  104400                            ERROR                   ;ERROR, CLOCK REPEATIBILITY >2
1441
1442                                    ;TEST 100 KHZ REPEATABILITY
1443
1444  005406  104003                    KWT56:  SCOPE1
1445  005410  004537  005604                    JSR     R5,REPEAT       ;TEST REPEATIBILITY
1446  005414  000004                            4                       ;CLOCK RATE
1447  005416  000002                            2                       ;CLOCK DEV.
1448  005420  000001                            1                       ;MIN. COUNT
1449  005422  000454                            300.                    ;DELAY
1450  005424  104400                            ERROR                   ;ERROR, FAILED TO REACH MIN. COUNT
1451  005426  003401                            BLE     .+4
1452  005430  104400                            ERROR                   ;ERROR, CLOCK REPEATIBILITY >2
1453
1454                                    ;TEST 10 KHZ REPEATABILITY
1455
1456  005432  104003                    KWT57A: SCOPE1
1457  005434  004537  005604                    JSR     R5,REPEAT
1458  005440  000006                            6                       ;CLOCK RATE
1459  005442  000002                            2                       ;CLOCK DEV.
1460  005444  000001                            1                       ;MIN. COUNT
1461  005446  005670                            3000.                   ;DELAY
1462  005450  104400                            ERROR                   ;ERROR, FAILED TO REACH MIN. COUNT
1463  005452  003401                            BLE     .+4
1464  005454  104400                            ERROR                   ;ERROR CLOCK REPEATABILITY >2
1465
1466                                    ;TEST 1KHZ REPEATABILITY
1467
1468  005456  104003                    KWT60:  SCOPE1
1469  005460  004537  005604                    JSR     R5,REPEAT       ;
1470  005464  000010                            10                      ;CLOCK RATE
1471  005466  000002                            2                       ;CLOCK DEV.
1472  005470  000001                            1                       ;MIN. COUNT
1473  005472  072460                            30000.                  ;DELAY
1474  005474  104400                            ERROR                   ;ERROR, FAILED TO REACH MIN. COUNT
1475  005476  003401                            BLE     .+4
1476  005500  104400                            ERROR                   ;ERROR CLOCK REPEATABILITY >2
1477
```

```
1478
1479                                    ;TEST 100HZ REPEATIBILITY
1480
1481  005502  104003                    KWT61:  SCOPE1
1482  005504  004537  005604                    JSR     R5,REPEAT               ;
1483  005510  000012                            12                              ;CLOCK RATE
1484  005512  000002                            2                               ;CLOCK DEV.
1485  005514  000001                            1                               ;MIN. COUNT
1486  005516  177777                            -1                              ;DELAY
1487  005520  104400                            ERROR                           ;ERROR, FAILED TO REACH MIN. COUNT
1488  005522  003401                            BLE     .+4
1489  005524  104400                            ERROR                           ;ERROR CLOCK REPEATABILITY >2
1490
1491                                    ;TEST LINE REPEATABILITY
1492
1493  005526  104003                    KWT62:  SCOPE1
1494  005530  004537  005604                    JSR     R5,REPEAT               ;
1495  005534  000016                            16                              ;CLOCK RATE
1496  005536  000001                            1                               ;CLOCK DEV
1497  005540  000001                            1                               ;MIN. COUNT
1498  005542  000000                            0                               ;DELAY
1499  005544  104400                            ERROR                           ;ERROR, FAILED TO REACH MIN COUNT
1500  005546  003401                            BLE     .+4
1501  005550  104400                            ERROR                           ;ERROR, CLOCK REPEATABILITY >+1
1502
1503                                    ;BELL ON PASS COMPLETE
1504
1505  005552  104002                    TSTEND: SCOPE1                  ;LOGICAL END OF THE TEST
1506  005554  000005                            RESET
1507  005556  005737  000042                    TST     @#42
1508  005562  001402                            BEQ     HERE
1509  005564  000137  001752                    JMP     WHATB
1510
1511  005570  004737  013472            HERE:   JSR     PC,BELL         ;REPORT END OF PASS
1512  005574  005237  001040                    INC     PASSCT
1513  005600  000137  003066                    JMP     BEGIN
```

```
1514
1515                                    ;SUBROUTINE TO TEST THE CLOCK REPEATIBILITY
1516                                    ;FIRST CLEAR CLOCK STATUS AND PRESET BUFFER
1517                                    ; THEN ENABLE THE CLOCK TO COUNT AT A RATE.
1518                                    ; DECREMENT R0 FOR SOME PERIOD OF TIME, WHEN R0 = 0
1519                                    ; FIRE THE ST #2 AND CAUSE THE COUNTER TO LOAD THE PRESET REGISTER
1520                                    ; SAVE THE PRESET VALUE AND REPEAT THIS OPERATION AGAIN
1521                                    ;THEN COMPARE THE FIRST TIMED VALUE TO THE SECOND TIMED VALUE
1522                                    ; (MACHINE AND MEMORY TIMING NOT IMPORTANT)
1523                                    ; TO BE WITHIN THE VALUE SPECIFIED BY LOCATION CNTDEV
1524                                    ; IF GREATER THAN EXPECTED IT IS AN ERROR.
1525                                    ;ALSO TEST THAT THE COUNTER HAS REACHED A MIN. COUNT
1526
1527  005604  005077  173240    REPEAT: CLR     @CSR                    ;STOP THE CLOCK
1528  005610  005077  173236            CLR     @CSB                    ;CLEAR THE BUFFER
1529  005614  012537  006004            MOV     (R5)+,RATE              ;SET UP RATE
1530  005620  012537  006006            MOV     (R5)+,CNTDEV            ;SET UP CNT. DEV
1531  005624  012537  006010            MOV     (R5)+,MINCNT            ;SET UP MIN COUNT
1532  005630  012537  006012            MOV     (R5)+,CKDLY             ;SAVE DELAY
1533  005634  004737  005724            JSR     PC,10$                  ;DUMMY - TO CHARGE THE "CACHE"
1534  005640  004737  005724            JSR     PC,10$                  ;ENABLE THE CLOCK
1535  005644  010037  006000            MOV     R0,$GDDAT               ;SAVE 1ST RESULTS
1536  005650  004737  005724            JSR     PC,10$                  ;ENABLE THE CLOCK
1537  005654  010037  006002            MOV     R0,$BDDAT               ;SAVE THE 2ND RESULT
1538  005660  013700  006000            MOV     $GDDAT,R0               ;GET 1ST RESULT
1539  005664  163700  006002            SUB     $BDDAT,R0               ;SUBTRACT SECOND RESULT
1540  005670  100001                    BPL     3$
1541  005672  005400                    NEG     R0
1542  005674  023737  006002  006010  3$:     CMP     $BDDAT,MINCNT           ;COMPARE TO MIN. COUNT
1543  005702  002004                    BGE     4$                      ;BRANCH IF GREATER
1544  005704  013737  006010  014506        MOV     MINCNT,TEMP             ;LOAD TEMP FOR TYPE-OUT
1545  005712  000205                    RTS     R5
1546  005714  005725              4$:   TST     (R5)+                   ;UPDATE THE STACK
1547  005716  020037  006006            CMP     R0,CNTDEV               ;COMPARE TO DEVEATION
1548  005722  000205                    RTS     R5
1549
1550  005724  013700  006012      10$:  MOV     CKDLY,R0                ;LOAD DELAY COUNT
1551  005730  052737  003000  006004    BIS     #BIT10!BIT9,RATE        ;ENABLE ST MODE
1552  005736  013777  006004  173104    MOV     RATE,@CSR               ;LOAD RATE
1553  005744  005277  173100            INC     @CSR                    ;ENABLE THE CLOCK
1554  005750  005300              1$:   DEC     R0                      ;DELAY
1555  005752  001376                    BNE     1$
1556  005754  052777  002000  173066    BIS     #BIT10,@CSR             ;MAINT ST FIRE
1557  005762  017700  173064            MOV     @CSB,R0                 ;READ THE RESULT
1558  005766  005077  173056            CLR     @CSR                    ;STOP CLOCK
1559  005772  005077  173054            CLR     @CSB                    ;CLEAR BUFFER
1560  005776  000207                    RTS     PC                      ;EXIT
1561
1562  006000  000000          $GDDAT: 0
1563  006002  000000          $BDDAT: 0
1564  006004  000000          RATE:   0                               ;CLOCK RATE
1565  006006  000000          CNTDEV: 0                               ;CLOCK DEV.
1566  006010  000000          MINCNT: 0                               ;MIN. COUNT
1567  006012  000000          CKDLY:  0
```

```
1568
1569                                    ;*************************************************************
1570                                    ;DIGITAL INPUT-OUTPUT LOGIC TEST
1571                                    ;*************************************************************
1572
1573  006014  000005                   IOTEST: RESET
1574  006016  104000                           PRINT
1575  006020  014055                           MES3                        ;IDENTIFY TEST
1576  006022  005037  001040           ITEST1: CLR     PASSCT
1577  006026  012737  006076  013414   IOTSTA: MOV     #DRT0+2,RETURN
1578  006034  013777  001040  172774           MOV     PASSCT,@DISPLA
1579  006042  013706  014444                   MOV     STACK,SP
1580  006046  005077  172750                   CLR     @PSW
1581  006052  052777  000100  172744           BIS     #BIT6,@TKS
1582
1583                                    ;TEST FOR NO BUSS ERRORS
1584
1585  006060  005077  172770                   CLR     @GRSTAT
1586  006064  005077  172766                   CLR     @GRDAI
1587  006070  005077  172764                   CLR     @GRDIO
1588
1589  006074  104003                   DRT0:   SCOPE1
1590  006076  012777  177777  172754           MOV     #-1,@GRDIO          ;ALL ONES TO REGISTER
1591  006104  022777  177777  172746           CMP     #-1,@GRDIO
1592  006112  001401                           BEQ     .+4
1593  006114  104400                           ERROR                       ;REG WILL NOT HOLD ONES
1594
1595  006116  104002                   DRT1:   SCOPE
1596  006120  012777  177777  172732           MOV     #-1,@GRDIO
1597  006126  000005                           RESET                       ;SET DATA TO ALL ONES
1598  006130  005777  172724                   TST     @GRDIO              ;SHOULD CLEAR REGISTER
1599  006134  001401                           BEQ     .+4
1600  006136  104400                           ERROR                       ;REG FAILED TO CLEAR
1601
1602  006140  052777  000100  172656           BIS     #BIT6,@TKS
1603  006146  104003                   DRT2:   SCOPE1
1604  006150  012777  052525  172702           MOV     #52525,@GRDIO
1605  006156  022777  052525  172674           CMP     #52525,@GRDIO
1606  006164  001401                           BEQ     .+4
1607  006166  104400                           ERROR                       ;DATA NOT=52525
1608
1609  006170  104002                   DRT3:   SCOPE
1610  006172  012777  125252  172660           MOV     #125252,@GRDIO
1611  006200  022777  125252  172652           CMP     #125252,@GRDIO
1612  006206  001401                           BEQ     .+4
1613  006210  104400                           ERROR                       ;DATA NOT=125252
1614
```

```
1615  006212  104003                    DRT4:   SCOPE1
1616  006214  012777  177777  172636            MOV     #-1,@GRDIO
1617  006222  105077  172632                    CLRB    @GRDIO          ;CLEAR LOW BYTE
1618  006226  017737  172626  014506            MOV     @GRDIO,TEMP
1619  006234  022737  177400  014506            CMP     #177400,TEMP
1620  006242  001401                            BEQ     .+4
1621  006244  104400                            ERROR                   ;BYTE LOW FAILED TO CLEAR
1622
1623  006246  104002                    DRT5:   SCOPE
1624  006250  012777  177777  172602            MOV     #-1,@GRDIO
1625  006256  105077  172610                    CLRB    @GRBHIO         ;CLEAR HIGH BYTE
1626  006262  017737  172572  014506            MOV     @GRDIO,TEMP
1627  006270  022737  000377  014506            CMP     #377,TEMP
1628  006276  001401                            BEQ     .+4
1629  006300  104400                            ERROR                   ;HIGH BYTE CLEAR FAILED
1630
1631  006302  005037  014506                    CLR     TEMP
1632  006306  104002                    DRT6:   SCOPE
1633  006310  113777  014506  172542  DRT6A:  MOVB    TEMP,@GRDIO     ;LOAD THE OUTPUT
1634  006316  123777  014506  172534            CMPB    TEMP,@GRDIO
1635  006324  001402                            BEQ     .+6             ;BRANCH IF EQUAL
1636  006326  104400                            ERROR                   ;ERROR, LOW BYTE HAS BAD DATA
1637  006330  000405                            BR      DRT7
1638  006332  105237  014506                    INCB    TEMP
1639  006336  001364                            BNE     DRT6A
1640
1641  006340  005037  014506                    CLR     TEMP
1642  006344  104002                    DRT7:   SCOPE
1643  006346  113777  014506  172516  DRT7A:  MOVB    TEMP,@GRBHIO    ;LOAD THE HIGH BYTE
1644  006354  123777  014506  172510            CMPB    TEMP,@GRBHIO
1645  006362  001402                            BEQ     .+6             ;BRANCH IF EQUAL
1646  006364  104400                            ERROR                   ;ERROR, HIGH BYTE IN ERROR
1647  006366  000403                            BR      DRT8
1648  006370  105237  014505                    INCB    TEMP
1649  006374  001364                            BNE     DRT7A
```

```
1650
1651                                    ;RELAY #1 TEST
1652
1653  006376  104003                    DRT8:   SCOPE1
1654  006400  012777  000001  172446            MOV     #BIT0,@GRSTAT   ;SET BIT 0
1655  006406  022777  000001  172440            CMP     #BIT0,@GRSTAT   ;TEST IT
1656  006414  001401                            BEQ     .+4
1657  006416  104400                            ERROR                   ;ERROR, RELAY 1 FAILED TO SET
1658
1659                                    ;RELAY #2 TEST
1660
1661  006420  104002                    DRT9:   SCOPE
1662  006422  012777  000400  172424            MOV     #BIT8,@GRSTAT   ;SET RELAY 2
1663  006430  022777  000400  172416            CMP     #BIT8,@GRSTAT
1664  006436  001401                            BEQ     .+4
1665  006440  104400                            ERROR                   ;ERROR, RELAY 2 FAILED TO SET
1666
1667                                    ;TEST OUTPUT DATA ACCEPT FLAG
1668
1669  006442  104002                    DRT10:  SCOPE
1670  006444  012777  100000  172402            MOV     #BIT15,@GRSTAT          ;SET BIT 15
1671  006452  022777  100000  172374            CMP     #BIT15,@GRSTAT
1672  006460  001401                            BEQ     .+4
1673  006462  104400                            ERROR                           ;ERROR, BIT 15 FAILED TO SET
1674
1675                                    ;TEST OUTPUT INTERRUPT ENABLE
1676
1677  006464  104002                    DRT11:  SCOPE
1678  006466  012777  000340  172326            MOV     #340,@PSW               ;RAISE PRIORITY
1679  006474  012777  040000  172352            MOV     #BIT14,@GRSTAT          ;LOAD BIT 14
1680  006502  022777  040000  172344            CMP     #BIT14,@GRSTAT
1681  006510  001401                            BEQ     .+4
1682  006512  104400                            ERROR                           ;ERROR BIT 14 FAILED TO SET
1683
```

```
1684
1685                                    ;TEST INPUT DATA READY FLAG
1686
1687  006514  104002                    DRT12:  SCOPE
1688  006516  012777  000200  172330            MOV     #BIT7,@GRSTAT           ;SET BIT 7
1689  006524  022777  000200  172322            CMP     #BIT7,@GRSTAT
1690  006532  001401                            BEQ     .+4
1691  006534  104400                            ERROR                           ;ERROR, BIT 7 FAILED TO SET
1692
1693                                    ;TEST INPUT INTERRUPT ENABLE
1694
1695  006536  104002                    DRT13:  SCOPE
1696  006540  012777  000340  172254            MOV     #340,@PSW
1697  006546  012777  000100  172300            MOV     #BIT6,@GRSTAT           ;SET BIT 6
1698  006554  022777  000100  172272            CMP     #BIT6,@GRSTAT
1699  006562  001401                            BEQ     .+4
1700  006564  104400                            ERROR                           ;ERROR, BIT 6 FAILED TO SET
1701
1702                                    ;TEST THAT RESET CLEARS THE DIGITAL STATUS REGISTER
1703
1704  006566  104002                    DRT14:  SCOPE
1705  006570  012777  000340  172224            MOV     #340,@PSW
1706  006576  012777  140701  172250            MOV     #BIT15!BIT14!BIT8!BIT7!BIT6!BIT0,@GRSTAT
1707  006604  000005                            RESET
1708  006606  005777  172242                    TST     @GRSTAT
1709  006612  001401                            BEQ     .+4
1710  006614  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR DIGITAL STATUS REG
1711
1712  006616  005077  172200                    CLR     @PSW
1713  006622  052777  000100  172174            BIS     #BIT6,@TKS
```

```
                                        ;TEST EXTERNAL TRANSFERS - CABLE MUST BE CONNECTED
006630  104003                  DRT15:  SCOPE1
006632  005777  000100  172174          BIT     #BIT6,@SWR      ;TEST SWITCH BIT
006636  001402                  .       BEQ     .+6             ;BRANCH IF DOWN
006640  000137  007044          .       JMP     DRT21           ;BYPASS SOME TEST USING THE EXTERNAL CABLE
006644  012777  000000  172204          MOV     #0,@GRDIO       ;LOAD THE OUTPUT
006652  022777  000000  172174          CMP     #0,@GRDAI       ;READ THE INPUT
006660  001401                          BEQ     .+4             ;BRANCH IF EQUAL
006662  104400                          ERROR                   ;ERROR, INPUT DID NOT EQUAL THE OUTPUT REG.

006664  104003                  DRT16:  SCOPE
006666  012777  177777  172162          MOV     #-1,@GRDIO      ;LOAD THE OUTPUT
006674  022777  177777  172152          CMP     #-1,@GRDAI      ;READ THE INPUT
006702  001401                          BEQ     .+4             ;BRANCH IF EQUAL
006704  104400                          ERROR                   ;ERROR, INPUT DID NOT EQUAL THE OUTPUT
                                                        ;IS THIS REALLY A LPS-11-DR [illegible] OR IS IT AN
                                                        ;LPS-11-DRA [illegible] IF DRA  USE MD-11-D2LPI TEST

006710  104003                  DRT17:  SCOPE
006712  012777  052525  172140          MOV     #52525,@GRDIO   ;LOAD THE OUTPUT
006720  022777  052525  172130          CMP     #52525,@GRDAI   ;READ THE INPUT
006726  001401                          BEQ     .+4             ;BRANCH IF EQUAL
006730  104400                          ERROR                   ;ERROR, INPUT DID NOT EQUAL OUTPUT

006732  104003                  DRT18:  SCOPE
006734  012777  025252  172116          MOV     #25252,@GRDIO   ;LOAD THE OUTPUT
006742  022777  025252  172106          CMP     #25252,@GRDAI   ;READ THE INPUT
006750  001401                          BEQ     .+4             ;BRANCH IF EQUAL
006752  104400                          ERROR                   ;ERROR, INPUT DID NOT EQUAL OUTPUT

                                        ;TEST THAT WHEN OUTPUTTING THE INPUT DATA READY FLAG SETS

006754  104003                  DRT19:  SCOPE1
006756  005777  172072                  CLR     @GRSTAT
006762  012777  000000  172070          MOV     #0,@GRDIO               ;OUTPUT 0
006770  022727  000000  000000          CMP     #0,#0                   ;DELAY
006776  105777  172052                  TSTB    @GRSTAT                 ;TEST BIT 7
007002  100401                          BMI     .+4
007004  104400                          ERROR                           ;INPUT DATA READY FLAG FAILED TO SET

                                        ;TEST THAT WHEN THE INPUT BUFFER IS READ THE OUTPUT FLAG IS SET

007006  104003                  DRT20:  SCOPE
007010  005777  172040                  CLR     @GRSTAT
007014  012777  000000  172036          MOV     #0,@GRDIO
007022  022727  000000  000000          CMP     #0,#0
007030  017700  172022                  MOV     @GRDAI,R0               ;READ INPUT
007034  005777  172014                  TST     @GRSTAT                 ;TEST BIT 15
007040  100401                          BMI     .+4
007042  104400                          ERROR                           ;INPUT DATA READY FLAG FAILED TO SET
```

```
                                                ;TEST THAT THE DIGITAL I/O DOES NOT INTERRUPT
                                                ;SET INPUT-OUTPUT FLAGS BUT DO NOT ENABLE INTERRUPTS

007044  104002                          DRT21:  SCOPE
007046  000005                                  RESET
007050  012777  000340  171744                  MOV     #340,@PSW               ;RAISE PRIORITY
007056  005077  171772                          CLR     @GRSTAT
007062  012777  007132  172014                  MOV     #DRT21A,@GRIVA          ;SET UP INTERRUPT INPUT VECTOR
007070  012777  007136  172012                  MOV     #DRT21B,@GRIVB          ;SET UP INTERRUPT OUTPUT VECTOR
007076  005077  171720                          CLR     @PSW
007102  012777  000000  171750                  MOV     #0,@GRDIO               ;OUTPUT
007110  017700  171742                          MOV     @GRDAI,R0               ;INPUT
007114  000240                                  NOP
007116  000240                                  NOP
007120  000240                                  NOP
007122  000240                                  NOP
007124  005077  171724                          CLR     @GRSTAT                 ;CLEAR STATUS
007130  000406                                  BR      DRT22

007132  104400                          DRT21A: ERROR                           ;ERROR, DIGITAL INPUT INTERRUPTED
007134  000002                                  RTI

007136  104400                          DRT21B: ERROR                           ;ERROR, DIGITAL OUTPUT INTERRUPTED
007140  000002                                  RTI
```

```
                                        ;TEST THAT THE INPUT CAN INTERRUPT
                                        ;USE MAINT. BIT

007142  005077  171706                  CLR     @GRSTAT
007146  104003                  DRT22:  SCOPE!
007150  000005                          RESET
007152  005077  171676                  CLR     @GRSTAT                 ;CLEAR STATUS
007156  012777  000340  171636          MOV     #340,@PSW               ;RAISE PRIOR
007164  012777  007232  171712          MOV     #DRT22A,@GRIVA          ;LOAD RETURN VECTOR
007172  012777  000340  171706          MOV     #340,@GRIVSA            ;
007200  013777  001112  171702          MOV     GRIVSB,@GRIVB           ;LOAD OUTPUT VECTOR
007206  012777  000000  171676          MOV     #0,@GRIVSB
007214  005077  171602                  CLR     @PSW
007220  052777  000040  171626          BIS     #BIT5,@GRSTAT           ;MAINT. INT C
007226  000240                          NOP
007230  000000                          HALT                            ;ERROR, INPUT FAILED TO INTERRUPT

                                        ;SUB-TEST, TEST THAT IF PSW IS LOWERED AGAIN NO INTERRUPT WILL OCCUR
                                        ; IF INTERRUPT OCCURS 'INT DONE C' FAILED TO CLEAR INT C FLOP

007232  013777  001106  171644  DRT22A: MOV     GRIVSA,@GRIVA           ;LOAD INPUT VECTOR
007240  005077  171642                  CLR     @GRIVSA
007244  005077  171552                  CLR     @PSW                    ;LOWER PRIOR.
007250  000240                          NOP
007252  000240                          NOP


                                        ;TEST THAT THE OUTPUT DOES INTERRUPT
                                        ;USE MAINT. BIT

007254  005077  171574                  CLR     @GRSTAT                 ;CLEAR STATUS
007260  104003                  DRT25:  SCOPE!
007262  000005                          RESET
007264  005077  171564                  CLR     @GRSTAT                 ;CLEAR STATUS
007270  012777  000340  171524          MOV     #340,@PSW
007276  013777  001106  171600          MOV     GRIVSA,@GRIVA   ;LOAD INPUT VECTOR
007304  012777  000000  171574          MOV     #0,@GRIVSA
007312  012777  007344  171570          MOV     #DRT25A,@GRIVB          ;LOAD OUTPUT VECTOR
007320  012777  000340  171564          MOV     #340,@GRIVSB
007326  005077  171470                  CLR     @PSW
007332  052777  020000  171514          BIS     #BIT13,@GRSTAT          ;MAINT. INTERRUPT
007340  000240                          NOP
007342  000000                          HALT                            ;OUTPUT FAILED TO INTERRUPT


                                        ;SUB-TEST, TEST THAT IF PSW IS LOWERED AGAIN, NO INTERRUPT WILL OCCUR
                                        ; IF IT DOES, 'INT DONE D HIGH' FAILED TO CLEAR 'INT D' FLOP

007344  013777  001112  171536  DRT25A: MOV     GRIVSB,@GRIVB           ;LOAD OUTPUT VECTOR
007352  005077  171534                  CLR     @GRIVSB
007356  005077  171440                  CLR     @PSW
007362  000240                          NOP
007364  000240                          NOP
```

```
1843                                        ;PRE INTERRUPT SETUP
1844  007366  104003                  DRT29:  SCOPE1
1845  007370  042737  177437  001010          BIC     #177437,@#DIOBRL
1846  007376  001001                          BNE     .+4
1847  007400  000000                          HALT                            ;BR LEVEL INDICATED FOR DIGITAL I/O WAS 0
1848  007402  022737  000340  001010          CMP     #340,@#DIOBRL
1849  007410  001001                          BNE     .+4
1850  007412  000000                          HALT                            ;BR LEVEL INDICATED FOR DIGITAL I/O WAS 7
1851  007414  013737  001010  014514          MOV     @#DIOBRL,@#BRLEV1
1852  007422  162737  000040  014514          SUB     #40,@#BRLEV1
1853  007430  013737  001010  014516          MOV     @#DIOBRL,@#BRLEV2
1854  007436  013737  001010  014520          MOV     @#DIOBRL,@#BRLEV3
1855  007444  062737  000040  014520          ADD     #40,@#BRLEV3
1856
1857                                        ;TEST FOR INTERRUPT FROM DIGITAL I/O ON LEVEL INDICATED -1
1858  007452  104002                  DRT29:  SCOPE
1859  007454  000005                          RESET
1860  007456  012777  000340  171336          MOV     #340,@#PSW              ;RAISE PSW
1861  007464  005077  171364                  CLR     @#GRSTAT                ;CLEAR ENABLES
1862  007470  012777  007532  171406          MOV     #DRT29A,@#GRIVA         ;SET UP VECTORS
1863  007476  012777  007532  171404          MOV     #DRT29A,@#GRIVB
1864  007504  013777  014514  171310          MOV     @#BRLEV1,@#PSW          ;LOWER PSW
1865  007512  052777  020040  171334          BIS     #BIT13!BIT5,@#GRSTAT    ;GENERATE MAINT. INTERRUPT
1866  007520  000240                          NOP
1867  007522  000240                          NOP
1868  007524  000240                          NOP
1869  007526  000240                          NOP
1870  007530  104400                          ERROR                           ;ERROR, NO INTERRUPT FROM DIGITAL I/O
1871
1872  007532  022626                  DRT29A: CMP     (SP)+,(SP)+
1873
1874                                        ;TEST FOR INTERRUPT FROM DIGITAL I/O ON LEVEL INDICATED -1
1875  007534  104003                  DRT29B: SCOPE1
1876  007536  000005                          RESET
1877  007540  032777  000100  171266          BIT     #BIT6,@#SWR             ;TEST SWITCH
1878  007546  001402                          BEQ     .+6
1879  007550  000137  007654                  JMP     @#DRT30                 ;BYPASS THIS TEST
1880  007554  012777  000340  171240          MOV     #340,@#PSW
1881  007562  005077  171266                  CLR     @#GRSTAT
1882  007566  012777  007652  171310          MOV     #DRT29C,@#GRIVA         ;IN CASE OF INTERRUPT
1883  007574  012777  007652  171306          MOV     #DRT29C,@#GRIVB
1884  007602  013777  014514  171212          MOV     @#BRLEV1,@#PSW
1885  007610  012777  040100  171236          MOV     #BIT14!BIT6,@#GRSTAT
1886  007616  012777  000000  171234          MOV     #0,@#GRDIO              ;OUTPUT
1887  007624  017700  171226                  MOV     @#GRDAI,R0              ;INPUT
1888  007630  000240                          NOP                             ;LET INTERRUPT OCCUR
1889  007632  000240                          NOP
1890  007634  000240                          NOP
1891  007636  042777  040100  171210          BIC     #BIT14!BIT6,@#GRSTAT
1892  007644  000240                          NOP
1893  007646  104400                          ERROR                           ;ERROR, NO DIGITAL I O INTERRUPT OCCURED
1894  007650  000401                          BR      DRT30
1895  007652  022626                  DRT29C: CMP     (SP)+,(SP)+
1896
1897                                        ;TEST FOR NO INTERRUPT FROM DIGITAL I O ON LEVEL INDICATED
```

```
 1998  007654  104003                    DRT3D:  SCOPE1
 1999  007656  000005                            RESET
 1900  007660  012777  000340  171134            MOV     #340,@PSW
 1901  007666  005077  171162                    CLR     @GRSTAT                 ;CLEAR STATUS
 1902  007672  012777  007752  171204            MOV     #DRT3DA,@GRIVA  ;IN CASE OF INTERRUPT
 1903  007700  012777  007752  171202            MOV     #DRT3DA,@GRIVB  ;
 1904  007706  013777  014516  171106            MOV     BRLEV2,@PSW
 1905  007714  012777  040100  171132            MOV     #BIT14!BIT6,@GRSTAT     ;LOAD INT. ENABLE
 1906  007722  012777  000000  171130            MOV     #0,@GRDIO               ;OUTPUT
 1907  007730  017700  171122                    MOV     @GRDAI,R0               ;INPUT
 1908  007734  000240                            NOP
 1909  007736  000240                            NOP
 1910  007740  000240                            NOP
 1911  007742  042777  040100  171104            BIC     #BIT14!BIT6,@GRSTAT     ;DON'T LEAVE IT SET
 1912  007750  000401                            BR      .+4                     ;WITH NO INTERRUPT, BRANCH OVER HALT
 1913  007752  104400                    DRT3DA: ERROR                           ;ERROR, INTERRUPT OCCURED AT BR INDICATED
 1914
 1915  007754  104003                            SCOPE1
 1916  007756  000005                            RESET
 1917  007760  013777  001106  171116            MOV     GRIVSA,@GRIVA   ;FOR FALSE INTERRUPT
 1918  007766  005077  171114                    CLR     @GRIVSA
 1919  007772  013777  001112  171110            MOV     GRIVSB,@GRIVB
 1920  010000  005077  171106                    CLR     @GRIVSB
 1921
 1922                                    ;LOGICAL END OF 'DIGITAL I/O LOGIC TEST'
 1923
 1924  010004  000005                            RESET
 1925  010006  005737  000042                    TST     @#42
 1926  010012  001402                            BEQ     .+6
 1927  010014  000137  001764                    JMP     WHATC
 1928  010020  004737  013472                    JSR     7,BELL          ;REPORT END OF PASS
 1929  010024  005237  001040                    INC     PASSCT
 1930  010030  000137  006026                    JMP     IOTSTA
```

```
                                        ;*************************************************************
                                        ;       LPSVC POINT PLOT SCOPE CONTROL
                                        ;*************************************************************

010034  000005                  VCTEST: RESET
010036  104000                          PRINT
010040  014110                          MESS                            ;IDENTIFY TEST
010042  005037  001040          VTEST1: CLR     PASSCT

010046  013706  014444          VCTST0: MOV     STACK,SP
010052  013777  001040  170756          MOV     PASSCT,@DISPLA
010060  012737  010116  013414          MOV     #VCTO+2,RETURN
010066  005077  170730                  CLR     @PSW
010072  052777  000100  170724          BIS     #BIT6,@TKS

                                        ;TEST FOR NO BUSS ERRORS

010100  005077  170756                  CLR     @VCSTAT
010104  005077  170754                  CLR     @VCXREG
010110  005077  170752                  CLR     @VCYREG

                                        ;TEST THAT RESET SETS READY BIT

010114  104002                  VCTO:   SCOPE
010116  000005                          RESET
010120  105777  170736                  TSTB    @VCSTAT         ;TEST READY
010124  100401                          BMI     .+4
010126  104400                          ERROR                           ;ERROR, VCSTAT NOT = 200

                                        ;TEST THAT FAST INTENSIFY (BIT 1) CAN BE SET AND CLEARED

010130  104003                  VCT1:   SCOPE1
010132  052777  000100  170664          BIS     #BIT6,@TKS
010140  012777  000002  170714          MOV     #BIT1,@VCSTAT           ;LOAD DISPLAY STATUS
010146  022777  000202  170706          CMP     #BIT7!BIT1,@VCSTAT      ;TEST STATUS
010154  001401                          BEQ     .+4
010156  104400                          ERROR                           ;ERROR, VC STATUS NOT = 202

                                        ;TEST THAT MODE (BIT 2) CAN BE SET AND CLEARED

010160  104002                  VCT2:   SCOPE
010162  012777  000004  170672          MOV     #BIT2,@VCSTAT           ;LOAD DISPLAY STATUS
010170  022777  000204  170664          CMP     #BIT7!BIT2,@VCSTAT      ;TEST STATUS
010176  001401                          BEQ     .+4
010200  104400                          ERROR                           ;ERROR, VC STATUS NOT = 204

                                        ;TEST THAT MODE (BIT 3) CAN BE SET AND CLEARED

010202  104002                  VCT3:   SCOPE
010204  012777  000010  170650          MOV     #BIT3,@VCSTAT           ;LOAD DISPLAY STATUS
010212  022777  000210  170642          CMP     #BIT7!BIT3,@VCSTAT      ;TEST STATUS
010220  001401                          BEQ     .+4
010222  104400                          ERROR                           ;ERROR, VC STATUS NOT = 210
```

```
 1985
 1986                                   ;TEST THAT EXT DEL (BIT 4) CAN BE SET AND CLEARED
 1987
 1988  010224  104002                   VCT4:   SCOPE
 1989  010226  012777  000020  170626           MOV     #BIT4,@VCSTAT           ;LOAD DISPLAY STATUS
 1990  010234  022777  000220  170620           CMP     #BIT7!BIT4,@VCSTAT      ;TEST STATUS
 1991  010242  001401                           BEQ     .+4
 1992  010244  104400                           ERROR                           ;ERROR, VC STATUS NOT = 220
 1993
 1994                                   ;TEST THAT INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
 1995
 1996  010246  104002                   VCT5:   SCOPE
 1997  010250  012777  000100  170604           MOV     #BIT6,@VCSTAT           ;LOAD DISPLAY STATUS
 1998  010256  022777  000300  170576           CMP     #BIT7!BIT6,@VCSTAT      ;TEST STATUS
 1999  010264  001401                           BEQ     .+4
 2000  010266  104400                           ERROR                           ;ERROR, VC STATUS NOT = 300
 2001
 2002                                   ;TEST THAT CHANNEL (BIT 9) CAN BE SET AND CLEARED
 2003
 2004  010270  104002                   VCT6:   SCOPE
 2005  010272  012777  001000  170562           MOV     #BIT9,@VCSTAT           ;LOAD DISPLAY STATUS
 2006  010300  022777  001200  170554           CMP     #BIT9!BIT7,@VCSTAT      ;TEST STATUS
 2007  010306  001401                           BEQ     .+4
 2008  010310  104400                           ERROR                           ;ERROR, VC STATUS NOT = 1200
 2009
 2010                                   ;TEST THAT STORE (BIT 10) CAN BE SET AND CLEARED
 2011
 2012  010312  104002                   VCT7:   SCOPE
 2013  010314  012777  002000  170540           MOV     #BIT10,@VCSTAT          ;LOAD DISPLAY STATUS
 2014  010322  022777  002200  170532           CMP     #BIT10!BIT7,@VCSTAT     ;TEST STATUS
 2015  010330  001401                           BEQ     .+4
 2016  010332  104400                           ERROR                           ;ERROR, VC STATUS NOT = 2200
 2017
 2018                                   ;TEST THAT WRITE THRU (BIT 11) CAN BE SET AND CLEARED
 2019
 2020  010334  104002                   VCT8:   SCOPE
 2021  010336  012777  004000  170516           MOV     #BIT11,@VCSTAT          ;LOAD DISPLAY STATUS
 2022  010344  022777  004200  170510           CMP     #BIT11!BIT7,@VCSTAT     ;TEST STATUS
 2023  010352  001401                           BEQ     .+4
 2024  010354  104400                           ERROR                           ;ERROR, VC STATUS NOT = 4200
 2025
```

```
                                        ;TEST THAT THE X REGISTER (BITS 0-11) CAN BE SET AND CLEARED
                                
010356  104002                  VCT11:  SCOPE
010360  012777  002525  170476          MOV     #2525,@VCXREG           ;LOAD X REGISTER
010366  022777  002525  170470          CMP     #2525,@VCXREG
010374  001401                        BEQ     .+4
010376  104400                        ERROR                           ;ERROR, VC X REGISTER NOT = 2525

010400  104002                  VCT12:  SCOPE
010402  012777  005252  170454          MOV     #5252,@VCXREG           ;LOAD X REGISTER
010410  022777  005252  170446          CMP     #5252,@VCXREG
010416  001401                        BEQ     .+4
010420  104400                        ERROR                           ;ERROR, VC X REGISTER NOT = 5252

                                        ;TEST THAT THE Y REGISTER (BITS 0-11) CAN BE SET AND CLEARED

010422  104002                  VCT15:  SCOPE
010424  012777  002525  170434          MOV     #2525,@VCYREG           ;LOAD Y REGISTER
010432  022777  002525  170426          CMP     #2525,@VCYREG
010440  001401                        BEQ     .+4
010442  104400                        ERROR                           ;ERROR, VC Y REGISTER NOT = 2525

010444  104002                  VCT16:  SCOPE
010446  012777  005252  170412          MOV     #5252,@VCYREG           ;LOAD Y REGISTER
010454  022777  005252  170404          CMP     #5252,@VCYREG
010462  001401                        BEQ     .+4
010464  104400                        ERROR                           ;ERROR, VC Y REGISTER NOT = 5252

                                        ;TEST THAT THE X-Y REGISTER CAN HOLD DIFFERENT DATA

010466  104002                  VCT17:  SCOPE
010470  012777  001234  170366          MOV     #1234,@VCXREG           ;LOAD X REGISTER
010476  012777  004321  170362          MOV     #4321,@VCYREG           ;LOAD Y REGISTER
010504  022777  001234  170352          CMP     #1234,@VCXREG
010512  001401                        BEQ     .+4
010514  104400                        ERROR                           ;ERROR, SELECT X REGISTER INCORRECTLY

010516  022777  004321  170342          CMP     #4321,@VCYREG
010524  001401                        BEQ     .+4
010526  104400                        ERROR                           ;ERROR, SELECTED Y REGISTER INCORRECTLY
```

```
                                        ;TEST THAT WHEN INTENSIFY BIT IS SET THAT THE READY BIT CLEARS
                                        ; AND THEN SETS AFTER A DELAY
                                        
010530  104002                          SCOPE
010532  012700  000100                  MOV     #100,R0
010536  012777  000001  170316          MOV     #BIT0,@VCSTAT           ;INTENSIFY
010544  105777  170312                  TSTB    @VCSTAT                 ;TEST READY
010550  100001                          BPL     .+4                     ;IS IT CLEARED ?
010552  104400                          ERROR                           ;READY FAILED TO CLEAR
010554  105777  170302          VCTST2: TSTB    @VCSTAT                 ;TEST READY
010560  100403                          BMI     VCTST3                  ;SET EXIT
010562  005300                          DEC     R0                      ;DELAY
010564  001373                          BNE     VCTST2                  ;
010566  104400                          ERROR                           ;READY FAILED TO SET AFTER A DELAY
                                        
                                        ;TEST THAT WHEN COLOR IS CHANGED READY CLEARS AND THEN SETS AFTER A DELAY
                                        
010570  104003                  VCTST3: SCOPE1
010572  012700  000400                  MOV     #400,R0                 ;SET UP A DELAY
010576  012777  000400  170256          MOV     #BIT8,@VCSTAT           ;CHANGE TO RED
010604  032777  000400  170250          BIT     #BIT8,@VCSTAT           ;TEST COLOR BIT
010612  001001                          BNE     .+4                     ;IS IT SET ?
010614  104400                          ERROR                           ;ERROR, COLOR BIT FAILED TO SET
010616  105777  170240                  TSTB    @VCSTAT                 ;TEST READY
010622  100001                          BPL     .+4                     ;IS IT CLEARED ?
010624  104400                          ERROR                           ;ERROR, VC STATUS READY FAILED TO CLEAR
010626  105777  170230          VCTST4: TSTB    @VCSTAT                 ;TEST READY
010632  100403                          BMI     VCTST5                  ;IS IT SET ?
010634  005300                          DEC     R0                      ;NO, DELAY
010636  001373                          BNE     VCTST4                  ;
010640  104400                          ERROR                           ;ERROR, READY FAILED TO SET AFTER A COLOR CHANGE
                                        
                                        ;TEST THAT WHEN COLOR IS CHANGED READY CLEARS AND THEN SETS AFTER A DELAY
                                        
010642  104001                  VCTST5: SCOPE0
010644  012700  020000                  MOV     #20000,R0               ;SET UP A DELAY
010650  012777  000000  170204          MOV     #0,@VCSTAT              ;CHANGE TO GREEN
010656  032777  000400  170176          BIT     #BIT8,@VCSTAT           ;TEST COLOR BIT
010664  001401                          BEQ     .+4
010666  104400                          ERROR                           ;ERROR, COLOR BIT FAILED TO CLEAR
010670  105777  170166                  TSTB    @VCSTAT                 ;TEST READY
010674  100001                          BPL     .+4                     ;DID IT CLEAR
010676  104400                          ERROR                           ;ERROR, READY FAILED TO CLEAR
010700  105777  170156          VCTST6: TSTB    @VCSTAT                 ;TEST READY
010704  100403                          BMI     VCTST7
010706  005300                          DEC     R0
010710  001373                          BNE     VCTST6
010712  104400                          ERROR                           ;ERROR, READY FAILED TO SET AFTER A COLOR CHANGE
```

```
2117
2118                                    ;TEST THAT MODE 1 (INTENSIFY ON X)
2119                                    ;CLEARS THE READY FLAG AND THEN SETS IT
2120
2121  010714  104001                    VCTST7: SCOPE0
2122  010716  012700  000100                    MOV     #100,R0                 ;SET UP DELAY
2123  010722  012777  000004  170132            MOV     #BIT2,@VCSTAT           ;LOAD MODE 1
2124  010730  105777  170126                    TSTB    @VCSTAT                 ;TEST READY
2125  010734  100401                            BMI     .+4
2126  010736  104400                            ERROR                           ;ERROR, MODE 1 SHOULD NOT CLEAR READY UNTIL X IS
2127
2128  010740  005077  170120                    CLR     @VCXREG                 ;ADDRESS X AXIS
2129  010744  105777  170112                    TSTB    @VCSTAT                 ;TEST READY
2130  010750  100001                            BPL     .+4
2131  010752  104400                            ERROR                           ;EPROR, MODE 1 LOAD X FAILED TO CLEAR READY FLAG
2132
2133  010754  105777  170102            VCTST8: TSTB    @VCSTAT                 ;TEST READY
2134  010760  100403                            BMI     VCTST9                  ;SET, NEXT TEST
2135  010762  005300                            DEC     R0                      ;DELAY
2136  010764  001373                            BNE     VCTST8                  ;TEST READY AGAIN
2137  010766  104400                            ERROR                           ;ERROR, READY FAILED TO SET
2138                                                                            ; AFTER MODE 1 OPERATION
2139
2140                                    ;TEST THAT MODE 2 (INTENSIFY ON Y)
2141                                    ;CLEARS THE READY FLAG AND THEN SETS IT
2142
2143  010770  104003                    VCTST9: SCOPE1
2144  010772  012700  000100                    MOV     #100,R0                 ;SET UP DELAY
2145  010776  012777  000010  170056            MOV     #BIT3,@VCSTAT           ;LOAD MODE 2
2146  011004  105777  170052                    TSTB    @VCSTAT                 ;TEST READY
2147  011010  100401                            BMI     .+4
2148  011012  104400                            ERROR                           ;ERROR, MODE 2 SHOULD NOT CLEAR READY UNTIL Y IS
2149
2150  011014  005077  170046                    CLR     @VCYREG                 ;ADDRESS Y AXIS
2151  011020  105777  170036                    TSTB    @VCSTAT                 ;TEST READY
2152  011024  100001                            BPL     .+4
2153  011026  104400                            ERROR                           ;ERROR, MODE 2 LOAD Y FAILED TO CLEAR READY FLAG
2154
2155  011030  105777  170026            VCTS10: TSTB    @VCSTAT                 ;TEST READY
2156  011034  100403                            BMI     VCTS11                  ;SET, NEXT TEST
2157  011036  005300                            DEC     R0                      ;DELAY
2158  011040  001373                            BNE     VCTS10                  ;TEST READY AGAIN
2159  011042  104400                            ERROR                           ;ERROR, READY FAILED TO SET
2160                                                                            ; AFTER MODE 2 OPERATION
2161
```

```
                                        ;TEST THAT WHEN ERASE BIT IS SET THAT THE READY BIT
                                        ;CLEARS AND THEN SETS AFTER A DELAY
                                        
011044  104003                  VCTS11: SCOPE1
011046  032777  000040  167760          BIT     #BIT5,@SWR
011054  001424                        BEQ     AVCT12
011056  012700  000002                MOV     #2,R0
011062  005037  014506                CLR     TEMP                    ;CLEAR DELAY
011066  052777  012000  167766        BIS     #BIT12!BIT10,@VCSTAT    ;SET BIT 12
011074  105777  167762                TSTB    @VCSTAT                 ;TEST THAT READY CLEARS
011100  100001                        BPL     .+4
011102  104400                        ERROR                           ;ERROR, READY FAILED TO RESET
                                                                        ; UPON SETTING ERASE BIT
                                        
011104  105777  167752          TST11A: TSTB    @VCSTAT                 ;TEST FOR READY
011110  100406                        BMI     AVCT12                  ;BRANCH IF SET
011112  005337  014506                DEC     TEMP                    ;DELAY
011116  001372                        BNE     TST11A                  ;BRANCH IF NOT READY
011120  005300                        DEC     R0                      ;DECREMENT COUNTER
011122  001370                        BNE     TST11A                  ;BRANCH IF NOT COMPLETED
011124  104400                        ERROR                           ;ERROR, ERASE CLEARED READY AND FAILED
                                                                        ;TO SET READY AFTER A DELAY
                                        
                                        ;TEST THAT THERE IS A TIME DIFFERENCE BETWEEN FAST INTENSIFY
                                        ; AND NOT FAST INTENSIFY
                                        
011126  104001                  AVCT12: SCOPE0
011130  005000                        CLR     R0                      ;CLEAR R0
011132  012777  000001  167722        MOV     #BIT0,@VCSTAT           ;START DISPLAY NOT FAST INTEN.
011140  105777  167716          VCTS12: TSTB    @VCSTAT                 ;TEST READY
011144  100403                        BMI     VCTS13                  ;IT IS SET
011146  005200                        INC     R0                      ;INCREMENT R0
011150  001373                        BNE     VCTS12                  ;TEST AGAIN
011152  104400                        ERROR                           ;ERROR, READY FAILED TO SET
                                        
011154  005001                  VCTS13: CLR     R1                      ;CLEAR R1
011156  012777  000002  167676        MOV     #BIT1,@VCSTAT           ;FAST INTEN.
011164  052777  000001  167670        BIS     #BIT0,@VCSTAT           ;START DISPLAY
011172  105777  167664          VCTS14: TSTB    @VCSTAT                 ;TEST READY
011176  100403                        BMI     VCTS15                  ;IS IT SET
011200  005201                        INC     R1                      ;NO, INCREMENT R1
011202  001373                        BNE     VCTS14                  ;TEST AGAIN
011204  104400                        ERROR                           ;ERROR, READY FAILED TO SET
                                                                        ; WHEN IN FAST INTENSIFY
011206  160001                  VCTS15: SUB     R0,R1
011210  042701  000007                BIC     #7,R1
011214  001001                        BNE     .+4                     ;ARE THEY EQUAL ?
011216  104400                        ERROR                           ;ERROR, NO TIME DIFFERENCE BETWEEN FAST INTENSIF
```

```
2210
2211                                    ;PRE-INTERRUPT SETUP
2212
2213  011220  042737  177437  001012        BIC     #177437,VCBRL   :MASK TO  PSW
2214  011226  001001                        BNE     .+4
2215  011230  000000                        HALT                            ;LOACATION VCBRL CONTAILED A BR LEVEL 0
2216  011232  022737  000340  001012        CMP     #340,VCBRL              ;
2217  011240  001001                        BNE     .+4                     ;TEST FOR BR 7
2218  011242  000000                        HALT                            ;LOCATION VCBRL CONTAINS BR LEVEL 7
2219
2220  011244  013737  001012  014514        MOV     VCBRL,BRLEV1            ;SET UP BR LEVELS
2221  011252  162737  000040  014514        SUB     #40,BRLEV1              ; -1
2222  011260  013737  001012  014516        MOV     VCBRL,BRLEV2            ; 0
2223  011266  013737  001012  014520        MOV     VCBRL,BRLEV3            ; +1
2224  011274  062737  000040  014520        ADD     #40,BRLEV3
2225
2226                                    ;TEST THAT THE LPSVC DOES NOT INTERRUPT
2227
2228  011302  104003                        SCOPE1
2229  011304  012777  000340  167510        MOV     #340,@PSW
2230  011312  013706  014444                MOV     STACK,SP                ;SET UP THE STACK POINTER
2231  011316  000005                        RESET
2232  011320  012777  011354  167566        MOV     #1$,@VCIV               ;SET VECTOR
2233  011326  005077  167470                CLR     @PSW
2234  011332  012777  000100  167522        MOV     #BIT6,@VCSTAT           ;SET INTERRUPT ENABLE
2235  011340  005000                        CLR     R0
2236  011342  005300                        DEC     R0
2237  011344  001376                        BNE     .-2
2238  011346  005077  167510                CLR     @VCSTAT                 ;CLEAR INTERRUPT ENABLE
2239  011352  000401                        BR      VCTS20                  ;NEXT TEST
2240
2241  011354  104400                1$:     ERROR                           ;UNEXPECTED DISPLAY INTERRUPT
```

```
2242
2243                                    ;TEST THAT THE DISPLAY DOES INTERRUPT A LEVEL INDICATED -1
2244
2245  011356  104003                    VCTS20: SCOPE1
2246  011360  000005                            RESET
2247  011362  012777  000340  167432            MOV     #340,@PSW
2248  011370  013706  014444                    MOV     STACK,SP                ;SET UP STACK
2249  011374  012777  011434  167512            MOV     #VCRET1,@VCIV           ;SET INTERRUPT VECTOR
2250  011402  012700  000400                    MOV     #400,R0                 ;SET UP DELAY
2251  011406  013777  014514  167406            MOV     BRLEV1,@PSW
2252  011414  012777  000101  167440            MOV     #BIT6!BIT0,@VCSTAT      ;START DISPLAY
2253  011422  005300                            DEC     R0                      ;DELAY
2254  011424  001376                            BNE     .-2
2255  011426  005077  167430                    CLR     @VCSTAT                 ;DO NOT LET INTERRUPT ENABLE SET
2256  011432  104400                            ERROR                           ;DISPLAY FAILED TO INTERRUPT
2257
2258                                    ;TEST THAT THE DISPLAY DOES NOT INTERRUPT A LEVEL INDICATED
2259
2260  011434  104003                    VCRET1: SCOPE1
2261  011436  000005                            RESET
2262  011440  012777  000340  167354            MOV     #340,@PSW
2263  011446  013706  014444                    MOV     STACK,SP                ;SET UP STACK
2264  011452  012777  011506  167434            MOV     #VCRET2,@VCIV           ;SET INTERRUPT VECTOR
2265  011460  012700  000400                    MOV     #400,R0                 ;SET UP DELAY
2266  011464  013777  014516  167330            MOV     BRLEV2,@PSW
2267  011472  012777  000101  167362            MOV     #BIT6!BIT0,@VCSTAT      ;START DISPLAY
2268  011500  005300                            DEC     R0                      ;DELAY
2269  011502  001376                            BNE     .-2
2270  011504  000403                            BR      OPS5
2271  011506  005077  167350            VCRET2: CLR     @VCSTAT                 ;DO NOT LET INTERRUPT ENABLE SET
2272  011512  104400                            ERROR                           ;DISPLAY INTERRUPTED IN ERROR
2273
2274  011514  013777  001116  167372    OPS5:   MOV     VCIVS,@VCIV             ;RESTORE INTERRUPT VECTOR
2275  011522  000005                            RESET
```

```
                                        ;TEST THAT RESET CLEARS MODE 0,2 ,FAST INTEN. AND EXT DELAY

011524  104003                          SCOPE1
011526  012777  000036  167326          MOV     #BIT4!BIT3!BIT2!BIT1,@VCSTAT
011534  000005                          RESET
011536  017700  167320                  MOV     @VCSTAT,R0                      ;READ STATUS
011542  042700  000200                  BIC     #BIT7,R0
011546  005700                          TST     R0
011550  001401                          BEQ     .+4
011552  104400                          ERROR                                   ;ERROR, RESET FAILED TO CLEAR VC STATUS REG

                                        ;TEST THAT RESET CLEARS INTERRUPT ENABLE, CHANNEL, STORE, WRITE THRU

011554  104003                          SCOPE1
011556  012777  007100  167276          MOV     #BIT11!BIT10!BIT9!BIT6,@VCSTAT
011564  000005                          RESET
011566  017700  167270                  MOV     @VCSTAT,R0                      ;READ STATUS
011572  042700  000200                  BIC     #BIT7,R0
011576  005700                          TST     R0
012000  001401                          BEQ     .+4
012002  104400                          ERROR                                   ;ERROR, RESET FAILED TO CLEAR VC STATUS

                                        ;TEST THAT RESET CLEARS X REGISTER

012004  104003                          SCOPE1
012006  012777  177777  167250          MOV     #-1,@VCXREG
012014  000005                          RESET
012016  005777  167242                  TST     @VCXREG
012022  001401                          BEQ     .+4
012024  104400                          ERROR                                   ;ERROR, RESET FAILED TO CLEAR VC X REGISTER

                                        ;TEST THAT RESET CLEARS Y REGISTER

012026  104003                          SCOPE1
012030  012777  177777  167230          MOV     #-1,@VCYREG
012036  000005                          RESET
012040  005777  167222                  TST     @VCYREG
012044  001401                          BEQ     .+4
012046  104400                          ERROR                                   ;ERROR, RESET FAILED TO CLEAR VC Y REGISTER

012050  104003                          SCOPE1
012052  000005                          RESET
012054  005737  000042                  TST     @#42
012060  001402                          BEQ     .+6
012062  000137  001776                  JMP     WHATD
012066  004737  013472                  JSR     7,BELL                          ;LOGICAL END OF THIS TEST
012072  005237  001040                  INC     PASSCT
012076  000137  012046                  JMP     VCTST0
```

```
                                        ;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

011702  105777  167122          XSPACE: TSTB    @TPS            ;WAIT FOR TTY READY
011706  100375                  BPL     .-4
011710  012777  000240  167114          MOV     #240,@TPB       ;OUTPUT A SPACE
011716  005337  011732                  DEC     SPACEX          ;DECREMENT COUNT
011722  003367                  BGT     XSPACE          ;LOOP IF NOT DONE
011724  005037  011732                  CLR     SPACEX          ;RESET COUNT TO ZERO
011730  000002                  RTI                     ;RETURN
011732  000000          SPACEX: 0

                                        ;KEYBOARD SERVICE ROUTINE

011734  010046          XTTYIN: MOV     R0,-(SP)
011736  010146                  MOV     R1,-(SP)
011740  010246                  MOV     R2,-(SP)
011742  010346                  MOV     R3,-(SP)
011744  010446                  MOV     R4,-(SP)
011746  010546                  MOV     R5,-(SP)
011750  012704  012334  NEWIN:  MOV     #INBUF,R4       ;SETUP CHARACTER BUFFER
011754  042777  000100  167342          BIC     #BIT6,@TKS
011762  005037  014452                  CLR     CHRCNT          ;CLEAR CHARACTER COUNTER
011766  005037  012334                  CLR     INBUF
011772  005037  012336                  CLR     INBUF+2
011776  005037  012340                  CLR     INBUF+4
012002  005037  012342                  CLR     INBUF+6
012006  005037  012344                  CLR     INBUF+10
012012  005037  012346                  CLR     INBUF+12
012016  005037  012350                  CLR     INBUF+14
012022  105777  166776          INPUTA: TSTB    @TKS            ;CHARACTER READY?
012026  100375                  BPL     INPUTA          ;NO, WAIT IT OUT
012030  017701  166772                  MOV     @TKB,R1         ;SAVE CHARACTER
012034  042701  177600                  BIC     #177600,R1      ;STRIP PARITY BIT
012040  120127  000060                  CMPB    R1,#60          ;IS IT A SPECIAL CHARACTER
012044  100420                  BMI     SPCHR           ;YES, TEST IT
012046  122701  000173                  CMPB    #173,R1
012052  100415                  BMI     SPCHR
012054  010124          INPUTB: MOV     R1,(R4)+        ;SAVE CHARACTER
012056  005237  014452                  INC     CHRCNT          ;INCREMENT THE CHARACTER COUNT.
012062  022737  000006  014452          CMP     #6,CHRCNT
012070  100516                  BMI     SPCHRS
012072  105777  166732          OUTPTA: TSTB    @TPS            ;ECHO CHARACTER
012076  100375                  BPL     OUTPTA
012100  110177  166726                  MOVB    R1,@TPB
012104  000746                  BR      INPUTA          ;WAIT FOR NEXT CHARACTER

                                        ;SUBROUTINE TO TEST FOR SPECIAL CHARACTERS :'^A','^C','S','CR','.' OR 'RUBOUT'

012106  122701  000001          SPCHR:  CMPB    #1,R1           ;CHAR.='^A'
012112  001013                  BNE     SPCHR1          ;NO, NOT '^A'
012114  104000                  PRINT                   ;ECHO '^A'
012116  014357                  CNTRLA                  ;RESTORE 'SP'
012120  012605                  MOV     (SP)+,R5
```

```
2391  012122  012604                    MOV     (SP)+,R4
2392  012124  012603                    MOV     (SP)+,R3
2393  012126  012602                    MOV     (SP)+,R2
2394  012130  012601                    MOV     (SP)+,R1
2395  012132  012600                    MOV     (SP)+,R0
2396  012134  022626                    CMP     (SP)+,(SP)+
2397  012136  000177  002304            JMP     @#VECTR         ;YES, EXIT VIA 'A' VECTOR ADDRESS.
2398  012142  122701  000003    SPCHR1: CMPB    #3,R1           ;CHAR.='C
2399  012146  001002                    BNE     .+6             ;NO, NOT 'C'
2400  012150  000137  001352            JMP     MONITR          ;YES, EXIT TO MONITOR
2401  012154  122701  000177            CMPB    #177,R1         ;CHAR. = 'RUBOUT'
2402  012160  001011                    BNE     SPCHR3          ;IGNORE CHAR. & EXIT
2403  012162  005737  014452            TST     CHRCNT          ;IS RUBOUT LEGAL?
2404  012166  001715                    BEQ     INPUTA          ;NO, IGNORE IT
2405  012170  005337  014452            DEC     CHRCNT
2406  012174  012701  000134            MOV     #134,R1         ;TYPE '\' TO INDICATE RUBOUT
2407  012200  005744                    TST     -(R4)           ;POP OFF LAST CHARACTER
2408  012202  000733                    BR      OUTPTA          ;WAIT FOR NEXT CHARACTER
2409  012204  122701  000056    SPCHR3: CMPB    #56,R1          ;TEST FOR '.'
2410  012210  001721                    BEQ     INPUTB          ;LEGAL CHAR., SAVE IT
2411  012212  122701  000015    SPCHR4: CMPB    #15,R1          ;=TO 'CARRIAGE RETURN' TO TERMINATE
2412  012216  001011                    BNE     1$              ;NO, CONTINUE
2413  012220  104000                    PRINT                   ;YES, TYPE 'CR-LF'
2414  012222  014411                    CRLF
2415  012224  012605            4$:     MOV     (SP)+,R5
2416  012226  012604                    MOV     (SP)+,R4
2417  012230  012603                    MOV     (SP)+,R3
2418  012232  012602                    MOV     (SP)+,R2
2419  012234  012601                    MOV     (SP)+,R1
2410  012236  012600                    MOV     (SP)+,R0
2411  012240  000002                    RTI                     ;EXIT
2412  012242  122701  000007    1$:     CMPB    #7,R1           ;TEST IF CTRL G
2413  012246  001027                    BNE     SPCHR5  ;BR IF NOT
2414  012250  104000                    PRINT
2415  012252  014362                    CNTRLG
2416  012254  104005                    PRTOCT                  ;REPORT OLD
2417  012256  000170                    SOFTSW
2418  012260  104000                    PRINT
2419  012262  014400                    NEWSWR                  ;ASK FOR NEW
2420  012264  104006                    TTYIN
2421  012266  005001                    CLR     R1              ;CLEAR NEW
2422  012270  012700  012334            MOV     #INBUF,R0       ;LOAD NEW POINTER
2423  012274  005710            2$:     TST     (R0)            ;TEST FOR TERM
2424  012276  001410                    BEQ     3$              ;BR IF TERM
2425  012300  012002                    MOV     (R0)+,R2        ;GET A VALUE
2426  012302  042702  177770            BIC     #177770,R2      ;MASK
2427  012306  006301                    ASL     R1
2428  012310  006301                    ASL     R1
2429  012312  006301                    ASL     R1
2430  012314  060201                    ADD     R2,R1
2431  012316  000766                    BR      2$
2432  012320  010137  000170    3$:     MOV     R1,SOFTSW       ;SAVE SWITCH VALUE
2433  012324  000737                    BR      4$
2434
2435  012326  104000            SPCHR5: PRINT                   ;OTHERWISE TYPE '?'
2436  012330  014416                    QMARK
```

```
                                        BR NEWIN                ; WAIT FOR NEW ENTRY
012334  000000                INBUF:    0                       ;CHARACTER STORAGE BUFFER


        012352                          .=.+14
                                ;POWER FAIL HANDLER

012352  010046                PWRFAL:   MOV     R0,-(SP)
012354  010146                          MOV     R1,-(SP)
012356  010246                          MOV     R2,-(SP)
012360  010346                          MOV     R3,-(SP)
012362  010446                          MOV     R4,-(SP)
012364  010546                          MOV     R5,-(SP)
012366  012746  000024                  MOV     #24,-(SP)
012372  010637  014450                  MOV     SP,PROC
012376  012737  012406  000024          MOV     #PWRUP,24
012404  000000                          HALT

                                ;POWER UP HANDLER

012406  012777  000340  166406  PWRUP:   MOV     #340,@PSW
012414  013706  014450                  MOV     PROC,SP
012420  012637  000024                  MOV     (SP)+,24
012424  012605                          MOV     (SP)+,R5
012426  012604                          MOV     (SP)+,R4
012430  012603                          MOV     (SP)+,R3
012432  012602                          MOV     (SP)+,R2
012434  012601                          MOV     (SP)+,R1
012436  012600                          MOV     (SP)+,R0
012440  000005                          RESET
012442  104000                          PRINT
012444  014421                          MES2:
012446  000137  000352                  JMP     MONITR
```

```
2470
2471
2472
2473
2474
2475
2476  012452  011646                EMTSRV: MOV     (SP),-(SP)      ;GET PC FOR TO RETURN
2477  012454  162716  000002                SUB     #2,(SP)         ;PC OF EMT
2478  012460  017616  000000                MOV     @(SP),(SP)      ;GET EMT
2479  012464  005716                        TST     (SP)            ;IS EMT VALID?
2480  012466  001001                        BNE     EMTOK
2481  012470  000000                        HALT                    ;INVALID EMT
2482  012472  006316                EMTOK:  ASL     (SP)            ;MULTIPLY EMT ARG BY '2'
2483  012474  042716  177001                BIC     #177001,(SP)    ;CLEAR UNWANTED BITS
2484  012500  062716  012512                ADD     #EMTTAB,(SP)    ;POINTER TO SUBROUTINE ADDRESS
2485  012504  017616  000000                MOV     @(SP),(SP)      ;SUBROUTINE ADDRESS
2486  012510  000136                        JMP     @(SP)+          ;GO TO SUBROUTINE
2487
2488                                ;EMT DISPATCH TABLE
2489
2490  012512  012534                EMTTAB: TYPMES                  ;MESSAGE PRINT ROUTINE
2491  012514  013456                        SCOPEI                  ;SCOPE ROUTINE
2492  012516  013322                        SCOPEC                  ;LOGIC TEST SCOPE ROUTINE
2493  012520  013416                        SCOPEH                  ;LOGIC TEST SCOPE LOOP (IO)
2494  012522  011702                        XSPACE                  ;SUBROUTINE TO TYPE SPACES
2495  012524  012662                        OCTPRT                  ;OCTAL PRINT ROUTINE
2496  012526  011734                        XTTYIN                  ;TELEPRINTER SERVICE ROUTINE
2497  012530  013004                        TKSFLG                  ;SUBROUTINE TO TEST FOR KEYBOARD FLAG
2498  012532  013456                        SCOPEI                  ;SCOPE ROUTINE
2499
```

```
2500                                    ;MESSAGE PRINT ROUTINE, ENTERED VIA EMT DISPATCH HANDLER.
2501                                    ;ROUTINE PICKS UP CONTENTS OF THE 'PC' AND USES THIS AS
2502                                    ;THE ADDRESS OF MESSAGE TO BE TYPED.
2503
2504  012534  000240            TYPMES: NOP
2505  012536  000240                    NOP
2506  012540  017605  000000            MOV     @(SP),R5        ;GET THE MESSAGE ADDRESS FROM START
2507  012544  062716  000002            ADD     #2,(SP)         ;SET UP STACK TO EXIT
2508  012550  105777  166254    TYPERA: TSTB    @TPS
2509  012554  100375                    BPL     TYPERA          ;WAIT FOR TTY DONE
2510  012556  122715  000100            CMPB    #100,(R5)       ;TEST FOR '@'
2511  012562  001001                    BNE     TYPER1          ;BRANCH IF NO EQUAL
2512  012564  000002                    RTI                     ;OTHERWISE EXIT
2513  012566  122715  000045    TYPER1: CMPB    #45,(R5)        ;TEST FOR '%'
2514  012572  001403                    BEQ     TYPECL          ;IF = TYPE 'CR-LF'
2515  012574  112577  166232    TYPER2: MOVB    (R5)+,@TPB      ;OUTPUT CHAR.
2516  012600  000763                    BR      TYPERA
2517  012602  012777  000015  166222  TYPECL: MOV     #15,@TPB        ;TYPE 'CR'
2518  012610  105777  166214            TSTB    @TPS
2519  012614  100375                    BPL     .-4
2520  012616  012777  000012  166206        MOV     #12,@TPB
2521  012624  013737  001016  012660        MOV     FILLS,2$        ;LOAD COUNTER
2522  012632  105777  166172    1$:     TSTB    @TPS            ;TEST FLAG
2523  012636  100375                    BPL     1$
2524  012640  113777  001020  166164        MOVB    FILCHR,@TPB     ;LOAD FILLER CHARACTER
2525  012646  005337  012660            DEC     2$              ;DONE
2526  012652  100367                    BPL     1$
2527  012654  105725                    TSTB    (R5)+           ;INCREMENT BUFFER
2528  012656  000734                    BR      TYPERA
2529  012660  000000            2$:     0
2530
2531                                    ;SUBROUTINE TO TYPEOUT A '6' DIGIT OCTAL NO. THE 'PC' CONTAINS
2532                                    ;THE ADDRESS OF 'WORD' TO BE TYPED
2533
2534  012662  000240            OCTPRT: NOP
2535  012664  000240                    NOP
2536  012666  017605  000000            MOV     @(SP),R5        ;THE ADDRESS OF WORD TO BE TYPED
2537  012672  062716  000002            ADD     #2,(SP)         ;SET UP STACK TO EXIT
2538  012676  012737  000006  012776        MOV     #6,10$
2539  012704  012737  000376  013002        MOV     #376,MASK       ;MASK FOR FIRST BIT
2540  012712  000401                    BR      .+4
2541  012714  006115            1$:     ROL     (R5)
2542  012716  006115                    ROL     (R5)
2543  012720  006115                    ROL     (R5)
2544  012722  111537  013000            MOVB    (R5),11$
2545  012726  143737  013002  013000        BICB    MASK,11$
2546  012734  052737  000260  013000        BIS     #260,11$
2547  012742  132777  000200  166060        BITB    #200,@TPS
2548  012750  100374                    BPL     .-6             ;WAIT FOR PRINTER READY
2549  012752  113777  013000  166052        MOVB    11$,@TPB        ;PRINT CHAR.
2550  012760  012737  000370  013002        MOV     #370,MASK       ;MASK FOR NEXT '5' DIGITS
2551  012766  005337  012776            DEC     10$
2552  012772  001350                    BNE     1$
2553  012774  000002                    RTI
2554  012776  000000            10$:    0
2555  013000  000000            11$:    0
```

```
2556  013002  000376                  MASK:   376
2557                                  ;SUBROUTINE TO TEST FOR THE KEYBOARD FLAG BEING SET
2558  013004  105777  166014          TKSFLG: TSTB    @TKS            ;FLAG SET?
2559  013010  100001                          BPL     .+4             ;NO, EXIT
2560  013012  104006                          TTYIN                   ;YES,INQUIRE
2561  013014  000002                          RTI
2562
2563                                  ;ENTERED WITH SYSTEM TRAP CALL (ERROR)
2564  013016  104007                  LOGERR: TSTTKS                  ;TEST FOR KEYBOARD INTERRUPT
2565  013020  037727  166010  020000          BIT     @SWR,#20000     ;TEST FOR INHIBIT PRINT OUT
2566  013026  001125                          BNE     CK              ;INHIBIT,CHECK FOR HALT
2567  013030  012737  013314  000004          MOV     #LGERR2,@#4     ;SET UP FOR BUSS ERROR
2568  013036  011637  014462                  MOV     (SP),KSTOR3     ;PC OF FAILING ROUTINE
2569  013042  162737  000002  014462          SUB     #2,KSTOR3
2570  013050  004537  013524                  JSR     5,LEDS
2571  013054  014462                          KSTOR3
2572  013056  017737  165766  014470          MOV     @CSR,KSTOR6     ;SAVE CLOCK STATUS
2573  013064  017737  165762  014472          MOV     @CSB,KSTOR7     ;SAVE CLOCK PRESET
2574  013072  017737  165756  014474          MOV     @GRSTAT,KSTOR8  ;SAVE I/O STATUS
2575  013100  017737  165754  014476          MOV     @GRDIO,KSTOR9   ;SAVE I/O OUTPUT
2576  013106  017737  165744  014500          MOV     @GRDAI,KSTR10   ;SAVE I/O INPUT
2577  013114  017737  165742  014464          MOV     @VCSTAT,KSTOR4  ;SAVE VC STATUS
2578  013122  017737  165736  014466          MOV     @VCXREG,KSTOR5  ;SAVE X AXIS
2579  013130  017737  165732  014504          MOV     @VCYREG,KSTR12  ;SAVE Y AXIS
2580  013136  013737  014506  014502          MOV     TEMP,KSTR11     ;SAVE TEMP
2581  013144  012737  000006  000004          MOV     #6,@#4          ;RESET BUSS ERROR
2582  013152  005737  014442                  TST     PRINT1
2583  013156  001006                          BNE     LGERR1
2584  013160  104000                          PRINT
2585  013162  014411                          CRLF
2586  013164  104000                          PRINT
2587  013166  013723                          MES1
2588  013170  005237  014442                  INC     PRINT1
2589  013174  104000          LGERR1: PRINT                   ;OUTPUT CARRIAGE RETURN AND LINE FEED
2590  013176  014411                  CRLF
2591  013200  104005                  PRTOCT                  ;PRINT FAILING PC+2
2592  013202  014462                  KSTOR3
2593  013204  104004                  SPACE
2594  013206  104005                  PRTOCT
2595  013210  014470                  KSTOR6
2596  013212  104004                  SPACE
2597  013214  104005                  PRTOCT
2598  013216  014472                  KSTOR7
2599  013220  104004                  SPACE
2600  013222  104005                  PRTOCT
2601  013224  014474                  KSTOR8
2602  013226  104004                  SPACE
2603  013230  104005                  PRTOCT
2604  013232  014476                  KSTOR9
2605  013234  104004                  SPACE
2606  013236  104005                  PRTOCT
2607  013240  014500                  KSTR10
2608  013242  104004                  SPACE
2609  013244  104005                  PRTOCT
2610  013246  014464                  KSTOR4
2611  013250  104004                  SPACE
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2612  013252  104005                          PRTOCT
2613  013254  014466                          KSTOR5
2614  013256  104004                          SPACE
2615  013260  104005                          PRTOCT
2616  013262  014504                          KSTR12
2617  013264  104004                          SPACE
2618  013266  104005                          PRTOCT
2619  013270  014502                          KSTR11
2620  013272  104004                          SPACE
2621  013274  105777  165530                  TSTB    @TPS
2622  013300  100375                          BPL     .-4
2623  013302  005777  165526          CK:     TST     @SWR            ;CHECK SR FOR HALT SWITCH
2624  013306  100001                          BPL     .+4             ;BRANCH IF NOT SET
2625  013310  000000                          HALT                    ;HALT ON ERROR UP
2626  013312  000002                          RTI                     ;RETURN TO MAIN LINE
2627  013314  062716  000002          LGERR2: ADD     #2,(SP)
2628  013320  000002                          RTI
2629
2630
2631                                  ;SCOPE AND/OR ITERATION LOOP FOR SOME TEST 4000 TIMES
2632
2633  013322  104007                  SCOPEC: TSTTKS                  ;TEST FOR KEYBOARD INIT
2634  013324  032777  040000  165502          BIT     #40000,@SWR     ;TEST SR FOR SCOPE
2635  013332  001015                          BNE     SCOPEB          ;YES, SCOPE
2636  013334  032777  004000  165472          BIT     #4000,@SWR      ;NO-TEST FOR ITERATION
2637  013342  001016                          BNE     SCOPEG          ;INHIBIT ITERATION
2638  013344  005737  001040                  TST     PASSCT          ;TEST IF FIRST PASS
2639  013350  001413                          BEQ     SCOPEG          ;BR IF FIRST PASS -- QUICKK PASS
2640  013352  023737  013412  001042          CMP     SCOPEF,ICOUNT   ;COMPARE CURRENT COUNT TO MAX NUMBER
2641  013360  001407                  SCOPEJ: BEQ     SCOPEG          ;EXIT-DONE
2642  013362  005237  013412                  INC     SCOPEF          ;INCREMENT COUNT
2643  013366  022606                  SCOPEB: CMP     (6)+,SP         ;REPOSITION STACK
2644  013370  012677  165426                  MOV     (6)+,@PSW       ;RESTORE PREVIOUS PROCESSOR STATUS
2645  013374  000177  000014                  JMP     @RETURN         ;REPEAT TEST
2646  013400  005037  013412          SCOPEG: CLR     SCOPEF          ;CLEAR COUNT
2647  013404  011637  013414                  MOV     @SP,RETURN      ;SAVE SCOPE RETURN POINTER
2648  013410  000002                          RTI                     ;RETURN INLINE-NEXT TEST
2649  013412  000000                  SCOPEF: 0                       ;COUNT LOCATION FOR ITERATION LOOP
2650  013414  002130                  RETURN: KWTO                    ;ADDRESS OF LAST TEST
2651
2652                                  ;SCOPE AND/OR INTERATION LOOP FOR SOME TESTS 10 TIMES
2653
2654  013416  104007                  SCOPEH: TSTTKS
2655  013420  032777  040000  165406          BIT     #40000,@SWR
2656  013426  001357                          BNE     SCOPEB
2657  013430  032777  004000  165376          BIT     #4000,@SWR
2658  013436  001360                          BNE     SCOPEG
2659  013440  005737  001040                  TST     PASSCT          ;TEST IF FIRST PASS
2660  013444  001755                          BEQ     SCOPEG          ;BR IF YES
2661  013446  023727  013412  000010          CMP     SCOPEF,#10
2662  013454  000741                          BR      SCOPEJ
2663
2664                                  ;SCOPE LOOP FOR SOME TEST 1 TIME
2665
2666  013456  104007                  SCOPEI: TSTTKS                          ;TEST KEYBOARD
2667  013460  032777  040000  165346          BIT     #40000,@SWR
```

```
2668  013466  001337                          BNE     SCOPEB
2669  013470  000743                          BR      SCOPEG
2670
2671  013472  104000                  BELL:   PRINT
2672  013474  013504                          ENDPAS
2673  013476  104000                  BELLA:  PRINT
2674  013500  013521                          RING
2675  013502  000207                          RTS     PC              ;EXIT
2676
2677  013504  042445  042116  050040  ENDPAS: .ASCII  '%END PASS   @'
2678  013512  051501  020123  020040
2679  013520     100
2680  013521     007     007     100  RING:   .BYTE   7,7,100
2681                                          .EVEN
2682
2683
2684                                  ;LOAD THE LPS DISPLAY LIGHTS
2685
2686  013524  012737  000006  013632  LEDS:   MOV     #6,CNTLED
2687  013532  005037  013640                  CLR     LEDSV3
2688  013536  013537  013634                  MOV     @(5)+,LEDSV1
2689  013542  005737  013642                  TST     NOLEDS
2690  013546  001401                          BEQ     LEDSA
2691  013550  000205                          RTS     R5
2692  013552  013737  013634  013636  LEDSA:  MOV     LEDSV1,LEDSV2
2693  013560  042737  177770  013636          BIC     #177770,LEDSV2
2694  013566  113737  013640  013637          MOVB    LEDSV3,LEDSV2+1
2695  013574  013777  013636  165244          MOV     LEDSV2,@ADDBR
2696  013602  006237  013634                  ASR     LEDSV1
2697  013606  006237  013634                  ASR     LEDSV1
2698  013612  006237  013634                  ASR     LEDSV1
2699  013616  005237  013640                  INC     LEDSV3
2700  013622  005337  013632                  DEC     CNTLED
2701  013626  001351                          BNE     LEDSA
2702  013630  000205                          RTS     5
2703
2704  013632  000006                  CNTLED: 6
2705  013634  000000                  LEDSV1: 0
2706  013636  000000                  LEDSV2: 0
2707  013640  000000                  LEDSV3: 0
2708  013642  000000                  NOLEDS: 0
2709
```

```
2710
2711                                        ;MESSAGES
2712  013644  022445  046045  051520  TITLE:  .ASCII  '%%%LPS DIAGNOSTIC TEST II (MAINDEC-11-DZLPD-C)@'
2713  013652  042040  040511  047107
2714  013660  051517  044524  020103
2715  013666  042524  052123  044440
2716  013674  020111  046450  044501
2717  013702  042116  041505  030455
2718  013710  026461  055104  050114
2719  013716  026504  024503     100
2720
2721  013723     040  050040  020103  MES1:   .ASCII  "  PC   "
2722  013730  020040
2723  013732  045503  052123  052101          .ASCII  "CKSTAT "
2724  013740     040
2725  013741     103  041113  043125          .ASCII  "CKBUFF "
2726  013746  020106
2727  013750  047511  052123  052101          .ASCII  "IOSTAT "
2728  013756     040
2729  013757     111  026517  052517          .ASCII  "IO-OUT "
2730  013764  020124
2731  013766  044440  026517  047111          .ASCII  " IO-IN "
2732  013774     040
2733  013775     126  051503  040524          .ASCII  "VCSTAT "
2734  014002  020124
2735  014004  041526  040530  051530          .ASCII  "VCXAXS "
2736  014012     040
2737  014013     126  054503  054101          .ASCII  "VCYAXS "
2738  014020  020123
2739  014022  052040  046505  040120          .ASCII  " TEMP@"
2740
2741  014030  021045  046103  041517  MES2:   .ASCII  '%"CLOCK LOGIC TEST"%@'
2742  014036  020113  047514  044507
2743  014044  020103  042524  052123
2744  014052  022442     100
2745  014055     045  042042  043511  MES3:   .ASCII  '%"DIGITAL I/O LOGIC TEST"%@'
2746  014062  052111  046101  044440
2747  014070  047457  046040  043517
2748  014076  041511  052040  051505
2749  014104  021124  040045
2750  014110  021045  041523  050117  MES5:   .ASCII  '%"SCOPE LOGIC TEST"%@'
2751  014116  020105  047514  044507
2752  014124  020103  042524  052123
2753  014132  022442     100
2754  014135     045  053042  051511  MES6:   .ASCII  '%"VISUAL DISPLAY TEST"%@'
2755  014142  040525  020114  044504
2756  014150  050123  040514  020131
2757  014156  042524  052123  022442
2758  014164     100
2759  014165     045  054524  042520  MES4:   .ASCII  "%TYPE LETTER ' ' TO RUN DESIRED TEST:%"
2760  014172  046040  052105  042524
2761  014200  020122  020047  020047
2762  014206  047524  051040  047125
2763  014214  042040  051505  051111
2764  014222  042105  052040  051505
2765  014230  035124     045
```

```
2766  014233  047  023501  041475          .ASCII  "'A'=CLOCK LOGIC%"
2767  014240  047514  045503  046040
2768  014246  043517  041511  045
2769  014253  047  023502  044475          .ASCII  "'B'=I/O LOGIC%"
2770  014260  047457  046040  043517
2771  014266  041511  045
2772  014271  047  023503  051475          .ASCII  "'C'=SCOPE CONTROL LOGIC%"
2773  014276  047503  042520  041440
2774  014304  047117  051124  046117
2775  014312  046040  043517  041511
2776  014320  045
2777  014321  047  023504  053075          .ASCII  "'D'=VISUAL SCOPE DISPLAY%@"
2778  014326  051511  040525  020114
2779  014334  041523  050117  020105
2780  014342  044504  050123  040514
2781  014350  022531  100
2782
2783  014353  136  022503  100  CNTRLC: .ASCII  '↑C%@'
2784
2785  014357  136  040101       CNTRLA: .ASCII  '↑A@'
2786  014362  043536  047445  042114  CNTRLG: .ASCII  '↑G%OLD SWR = @'
2787  014370  051440  051127  036440
2788  014376  040040
2789  014400  020040  042516  020127  NEWSWR: .ASCII  '  NEW = @'
2790  014406  020075  100
2791
2792  014411  045  100          CRLF:   .ASCII  '%@'
2793
2794  014413  045  040056       DOT:    .ASCII  '%.@'
2795
2796  014416  020077  100        QMARK:  .ASCII  '? @'
2797  014421  045  047520  042527  MES21:  .ASCII  '%POWER FAILURE @'
2798  014426  020122  040506  046111
2799  014434  051125  020105  100
2800
2801          014442                   .EVEN
2802
2903
```

```
2804                                    ;ADDRESS AND CONSTANTS TABLE
2805
2806  014442  000000                    PRINT1: 0
2807  014444  001000                    STACK:  1000                    ;INITIAL SP. ADDRESS
2808  014446  001334                    AVECTR: INITA                   ;'tA' VECTOR ADDRESS
2809  014450  000000                    PROC:   0                       ;TEMP STORAGE FOR 'PSW'
2810  014452  000000                    CHRCNT: 0                       ;TEMP STORAGE
2811  014454  000000                    COUNT:  0                       ;TEMP STORAGE
2812  014456  000000                    DELAY:  0
2813  014460  000000                    KSTOR1: 0                       ;PERMANENT STORAGE
2814  014462  000000                    KSTOR3: 0                       ;PERMANENT STORAGE
2815  014464  000000                    KSTOR4: 0                       ;PERMANENT STORAGE
2816  014466  000000                    KSTOR5: 0
2817  014470  000000                    KSTOR6: 0
2818  014472  000000                    KSTOR7: 0
2819  014474  000000                    KSTOR8: 0
2820  014476  000000                    KSTOR9: 0
2821  014500  000000                    KSTR10: 0
2822  014502  000000                    KSTR11: 0
2823  014504  000000                    KSTR12: 0
2824  014506  000000                    TEMP:   0
2825  014510  000000                    TEMP1:  0                       ;TEMPORARY STORAGE
2826  014512  000000                    TEMP2:  0                       ;TEMPORARY STORAGE
2827  014514  000000                    BRLEV1: 0
2828  014516  000000                    BRLEV2: 0
2829  014520  000000                    BRLEV3: 0
2830  014522  000000                    LOW:    0
2831  014524  000000                    HIGH:   0
2832  014526  000020                    INCR:   20
2833  014530  000000                    TIMSV:  0
2834  014532  000000                    TICKS:  0
```

```
                                        ;*****************************************************************************
                                        ;       VISUAL DISPLAY TEST
                                        ;*****************************************************************************

014534  000005                  VISUAL: RESET
014536  104000                          PRINT
014540  014135                          MES6
014542  005037  001040          VTEST2: CLR     PASSCT
014546  013706  014444          VSUAL0: MOV     STACK,SP        ;LOAD THE STACK POINTER
014552  013777  001040  164256          MOV     PASSCT,@DISPLA  ;LOAD PASS COUNT
014560  012737  014626  013414          MOV     #PIC0+2,RETURN  ;LOAD RETURN ADDRESS
014566  005077  164230                  CLR     @PSW
014572  042737  000002  015564          BIC     #BIT1,MODE
014600  032777  000020  16422.          BIT     #BIT4,@SWR
014606  001003                          BNE     VSLOA
014610  052737  000002  015564          BIS     #BIT1,MODE
014616  052777  000100  164200  VSLOA:  BIS     #BIT6,@TKS      ;ENABLE KEYBOARD

                                        ;DISPLAY HORIZONTAL LINE USING INTERRUPT, NON STORE DISPLAY.
014624  013700  001064          PIC0:   MOV     VCXREG,R0
014630  013701  001066                  MOV     VCYREG,R1
014634  004737  014656                  JSR     PC,PBB

                                        ;DISPLAY A VERTICAL LINE

014640  013700  001066          PIC1:   MOV     VCYREG,R0
014644  013701  001064                  MOV     VCXREG,R1
014650  004737  014656                  JSR     PC,PBB
014654  000433                          BR      PIC3

014656  005077  164200          PBB:    CLR     @VCSTAT
014662  013704  001062                  MOV     VCSTAT,R4
014666  012737  000700  014532          MOV     #700,TICKS
014674  004737  017254                  JSR     PC,CHTIME       ;CHECK TIMER
014700  012703  007760          PB:     MOV     #7760,R3        ;SET HIGH LIMIT
014704  013702  014526          PD:     MOV     INCR,R2         ;INITIALIZE INCREMENTS BETWEEN POINTS
014710  012711  004000          PEEA:   MOV     #4000,(1)
014714  012710  000000                  MOV     #0,(0)
014720  060210                  PE:     ADD     R2,(0)          ;INCREMENT
014722  005214                          INC     (4)             ;INTENSIFY
014724  105714                          TSTB    (4)
014726  100376                          BPL     .-2
014730  021003                          CMP     (0),R3          ;DONE ALL POINTS?
014732  001372                          BNE     PE              ;NO
014734  004737  017142                  JSR     PC,TIMER
014740  000763                          BR      PEEA
014742  000207                          RTS     PC
```

```
                                        ;PINCUSHION
                                        ;PLOT A SQUARE FROM LOWER LEFT TO LOWER RIGHT TO
                                        ;UPPER RIGHT TO UPPER LEFT TO LOWER LEFT.
                                        ;NON STORE DISPLAY
014744  012737  007770  014524  PIC3:   MOV     #7770,HIGH
014752  012737  000000  014522          MOV     #0,LOW
014760  005077  164076                  CLR     @VCSTAT
014764  012737  000200  014532          MOV     #200,TICKS
014772  004737  017254                  JSR     PC,CHTIME
014776  013701  001064                  MOV     VCXREG,R1
015002  013702  001066                  MOV     VCYREG,R2
015006  013703  001062                  MOV     VCSTAT,R3
015012  013704  014526                  MOV     INCR,R4
015016  013777  014522  164040  P3:     MOV     LOW,@VCXREG
015024  013777  014522  164034          MOV     LOW,@VCYREG
                                        ;DRAW BOTTOM LINE
015032  012700  000377                  MOV     #377,R0
015036  012713  000004                  MOV     #4,(3)          ;ENABLE INTENSIFY ON LOADING X
015042  060411                  P3A:    ADD     R4,(1)
015044  105713                          TSTB    (3)
015046  100376                          BPL     .-2             ;WAIT FOR READY
015050  005300                          DEC     R0
015052  001373                          BNE     P3A             ;NO
                                        ;DRAW RIGHT LINE
015054  012713  000010                  MOV     #10,(3)         ;ENABLE INTENSIFY ON LOADING Y
015060  012700  000377                  MOV     #377,R0
015064  060412                  P3B:    ADD     R4,(2)
015066  105713                          TSTB    (3)
015070  100376                          BPL     .-2             ;WAIT FOR READY
015072  005300                          DEC     R0
015074  001373                          BNE     P3B             ;NO
                                        ;DRAW TOP LINE
015076  012713  000004                  MOV     #4,(3)          ;ENABLE INTENSIFY ON LOADING X
015102  012700  000377                  MOV     #377,R0
015106  160411                  P3C:    SUB     R4,(1)
015110  105713                          TSTB    (3)
015112  100376                          BPL     .-2             ;WAIT FOR READY
015114  005300                          DEC     R0
015116  001373                          BNE     P3C             ;NO
                                        ;DRAW LEFT LINE
015120  012713  000010                  MOV     #10,(3)         ;ENABLE INTENSIFY LOADING Y
015124  012700  000377                  MOV     #377,R0
015130  160412                  P3D:    SUB     R4,(2)
015132  105713                          TSTB    (3)
015134  100376                          BPL     .-2             ;WAIT FOR READY
015136  005300                          DEC     R0
015140  001373                          BNE     P3D             ;NO
015142  004737  017142                  JSR     PC,TIMER
015146  000723                          BR      P3
```

```
                                        ;PLOT AN X WITH NON STORE DISPLAY
015150  012737  000000  014522  PIC4:   MOV     #0,LOW
015156  012737  007770  014524          MOV     #7770,HIGH
015164  005077  163672                  CLR     @VCSTAT
015170  012737  000400  014532          MOV     #400,TICKS
015176  004737  017254                  JSR     PC,CHTIME       ;CHECK TIME
015202  013701  001064          PIC4B:  MOV     VCXREG,R1
015206  013702  001066                  MOV     VCYREG,R2
015212  013703  001062                  MOV     VCSTAT,R3
015216  013700  014524                  MOV     HIGH,R0
015222  013704  014526                  MOV     INCR,R4
015226  013712  014522          P4:     MOV     LOW,(2)
015232  011211                          MOV     (2),(1)

                                        ;PLOT LINE BEGINNING IN LOWER LEFT CORNER
015234  012713  000004                  MOV     #4,(3)          ;ENABLE INTENSIFY ON LOADING X
015240  012700  000377                  MOV     #377,R0
015244  105713          P4A:    TSTB    (3)
015246  100376                  BPL     .-2
015250  060412                  ADD     R4,(2)          ;+4 TO Y
015252  060411                  ADD     R4,(1)          ;+4 TO X
015254  005300                  DEC     R0
015256  001372                  BNE     P4A             ;NO
015260  105713                  TSTB    (3)
015262  100376                  BPL     .-2
                                        ;PLOT LINE BEGINNING IN UPPER LEFT CORNER
015264  013712  014524                  MOV     HIGH,(2)
015270  013711  014522                  MOV     LOW,(1)
015274  012700  000377                  MOV     #377,R0
015300  105713          P4B:    TSTB    (3)
015302  100376                  BPL     .-2
015304  160412                  SUB     R4,(2)          ;-4 TO Y
015306  060411                  ADD     R4,(1)          ;+4 TO X
015310  005300                  DEC     R0
015312  001372                  BNE     P4B             ;NO
015314  004737  017142                  JSR     PC,TIMER
015320  000742                  BR      P4
```

```
                                        ;PLOT NON STORE CHARACTER SET
015332  012737  000140  014532  PIC6:   MOV     #140,TICKS
015330  004737  017254          PIC6A:  JSR     PC,CHTIME       ;CHECK TIME
015334  012737  170000  015570          MOV     #170000,XPOS
015342  012737  004000  015566          MOV     #4000,YPOS
015350  005077  163506                  CLR     @VCSTAT
015354  004737  015372                  JSR     PC,PIC6B
015360  004737  017142                  JSR     PC,TIMER
015364  000763                          BR      PIC6A
015366  000137  016070                  JMP     PIC7
015372  012737  177734  015572  PIC6B:  MOV     #-36.,CHRCOL    ;CHARACTERS PER ROW
015400  013705  001062                  MOV     VCSTAT,R5
015404  012702  015576                  MOV     #A,R2
015410  004737  015424          GEN1:   JSR     PC,CHAR
015414  005237  015572                  INC     CHRCOL          ;
015420  001373                          BNE     GEN1
015422  000207                          RTS     PC

                                        ;PLOT CHARACTER
015424  013737  015566  015574  CHAR:   MOV     YPOS,YPT
015432  042715  000016                  BIC     #16,(5)
015436  013777  015570  163420          MOV     XPOS,@VCXREG
015444  013777  015566  163414          MOV     YPOS,@VCYREG
015452  105777  163404          CHAR4:  TSTB    @VCSTAT
015456  100375                          BPL     CHAR4
015460  053715  015564                  BIS     MODE,(5)                ;ENABLE FAST INTENSIFY ON LOADING Y
015464  012704  000020                  MOV     #20,R4
015470  012700  177773                  MOV     #-5,R0          ;INITIALIZE COLUMN COUNT
015474  012701  177771          CHAR1:  MOV     #-7,R1          ;INITIALIZE ROW COUNT
015500  112203                          MOVB    (2)+,R3         ;PUT CHARACTER POINTS IN R3
015502  106103                  CHAR2:  ROLB    R3
015504  100006                          BPL     CHAR3           ;NO
015506  013777  015570  163350          MOV     XPOS,@VCXREG
015514  013777  015566  163344          MOV     YPOS,@VCYREG
015522  105777  163334          CHAR3:  TSTB    @VCSTAT
015526  100375                          BPL     CHAR3
015530  060437  015566                  ADD     R4,YPOS
015534  005201                          INC     R1              ;+1 TO ROW
015536  001361                          BNE     CHAR2           ;FINISH ROW
015540  013737  015574  015566          MOV     YPT,YPOS        ;REINITIALIZE ROW FOR NEXT COLUMN
015546  060437  015570                  ADD     R4,XPOS
015552  005200                          INC     R0              ;+1 TO COLUMN COUNT
015554  001347                          BNE     CHAR1
015556  060437  015570                  ADD     R4,XPOS
015562  000207                          RTS     PC              ;EXIT

015564  000010          MODE:   10
015566  000000          YPOS:   0               ;CONTAINS Y POSITION AT ANY GIVEN TIME
015570  000000          XPOS:   0               ;CONTAINS X POSITION AT ANY GIVEN TIME
015572  000000          CHRCOL: 0
015574  000000          YPT:    0
```

```
3023
3024  015576  176  021  021  A:   .BYTE 176,21,21,21,176
3025  015601  021  176
3026  015603  177  111  111  B:   .BYTE 177,111,111,111,66
3027  015606  111  066
3028  015610  076  101  101  C:   .BYTE 76,101,101,101,42
3029  015613  101  042
3030  015615  177  101  101  D:   .BYTE 177,101,101,101,76
3031  015620  101  076
3032  015622  177  111  111  E:   .BYTE 177,111,111,111,101
3033  015625  111  101
3034  015627  177  011  011  F:   .BYTE 177,11,11,11,1
3035  015632  011  001
3036  015634  076  101  121  G:   .BYTE 76,101,121,121,62
3037  015637  121  062
3038  015641  177  010  010  H:   .BYTE 177,10,10,10,177
3039  015644  010  177
3040  015646  000  101  177  I:   .BYTE 0,101,177,101,0
3041  015651  101  000
3042  015653  060  100  100  J:   .BYTE 60,100,100,100,77
3043  015656  100  077
3044  015660  177  010  024  K:   .BYTE 177,10,24,42,101
3045  015663  042  101
3046  015665  177  100  100  L:   .BYTE 177,100,100,100,100
3047  015670  100  100
3048  015672  177  004  010  M:   .BYTE 177,4,10,4,177
3049  015675  004  177
3050  015677  177  004  010  N:   .BYTE 177,4,10,20,177
3051  015702  020  177
3052  015704  076  101  101  O:   .BYTE 76,101,101,101,76
3053  015707  101  076
3054  015711  177  011  011  P:   .BYTE 177,11,11,11,6
3055  015714  011  006
3056  015716  076  101  121  Q:   .BYTE 76,101,121,141,176
3057  015721  141  176
3058  015723  177  011  031  R:   .BYTE 177,11,31,51,106
3059  015726  051  106
3060  015730  046  111  111  S:   .BYTE 46,111,111,111,62
3061  015733  111  062
3062  015735  001  001  177  T:   .BYTE 1,1,177,1,1
3063  015740  001  001
3064  015742  077  100  100  U:   .BYTE 77,100,100,100,77
3065  015745  100  077
3066  015747  037  040  100  V:   .BYTE 37,40,100,40,37
3067  015752  040  037
3068  015754  177  020  010  W:   .BYTE 177,20,10,20,177
3069  015757  020  177
3070  015761  143  024  010  X:   .BYTE 143,24,10,24,143
3071  015764  024  143
3072  015766  003  004  170  Y:   .BYTE 3,4,170,4,3
3073  015771  004  003
3074  015773  141  121  111  Z:   .BYTE 141,121,111,105,103
3075  015776  105  103
3076  016000  000  102  177  N1:  .BYTE 0,102,177,100,0
3077  016003  100  000
3078  016005  142  121  111  N2:  .BYTE 142,121,111,105,102
```

```
 3079  016010  105  102
 3080  016012  042  101  111  N3:    .BYTE 42,101,111,111,66
 3081  016015  111  066
 3082  016017  030  024  022  N4:    .BYTE 30,24,22,177,20
 3083  016022  177  020
 3084  016024  047  105  105  N5:    .BYTE 47,105,105,105,71
 3085  016027  105  071
 3086  016031  076  111  111  N6:    .BYTE 76,111,111,111,62
 3087  016034  111  062
 3088  016036  101  041  021  N7:    .BYTE 101,41,21,11,7
 3089  016041  011  007
 3090  016043  066  111  111  N8:    .BYTE 66,111,111,111,66
 3091  016046  111  066
 3092  016050  046  111  111  N9:    .BYTE 46,111,111,111,76
 3093  016053  111  076
 3094  016055  076  121  111  N0:    .BYTE 76,121,111,105,76
 3095  016060  105  076
 3096  016062  000  000  000  SPACEA: .BYTE 0,0,0,0,0
 3097  016065  000  000
 3098
 3099          016070                .EVEN
```

```
3100                                        ;CHANNEL 1 CHANNEL 2
3101  016070  012737  000300  014532  PIC7:   MOV     #300,TICKS      ;SET UP A TIMER
3102  016076  004737  017254                  JSR     PC,CHTIME       ;CHECK TIMER
3103  016102  013705  001062                  MOV     VCSTAT,R5       ;SET UP R5 FOR STATUS REGISTER POINTER
3104  016106  012777  000000  162746  PIC7AA: MOV     #0,@VCSTAT      ;SET UP SCOPE CONTROL
3105  016114  012737  003000  015570          MOV     #3000,XPOS      ;LOAD X POSITION
3106  016122  012737  005000  015566          MOV     #5000,YPOS      ;LOAD Y POSITION
3107  016130  012737  000011  016264          MOV     #9.,P7CNT       ;SAVE THE NUMBER OF CHARACTERS
3108  016136  012737  016270  016266          MOV     #CH1,P7PNT      ;SAVE CHANNEL 1 POINTER
3109  016144  017702  000116          PIC7A:  MOV     @P7PNT,R2       ;MOVE MESSAGE POINTER INTO R2 FOR DISPLAY ROUTINE
3110  016150  004737  015424                  JSR     PC,CHAR         ;DISPLAY A CHARACTER
3111  016154  062737  000002  016266          ADD     #2,P7PNT        ;ADD 2 TO THE MESSAGE POINTER
3112  016162  005337  016264                  DEC     P7CNT           ;DECREMENT CHARACTER COUNT
3113  016166  001366                          BNE     PIC7A           ;NOT FINISHED WITH ALL CHARACTERS
3114  016170  012777  001000  162664          MOV     #1000,@VCSTAT
3115  016176  012737  003000  015570          MOV     #3000,XPOS      ;SET UP X POS FOR CHANNEL 2
3116  016204  012737  003000  015566          MOV     #3000,YPOS      ;SET UP Y
3117  016212  012737  000011  016264          MOV     #9.,P7CNT       ;SET UP CHARACTER COUNT
3118  016220  012737  016312  016266          MOV     #CH2,P7PNT      ;SET UP CHANNEL 2 POINTER
3119  016226  017702  000034          PIC7B:  MOV     @P7PNT,R2       ;SET UP
3120  016232  004737  015424                  JSR     PC,CHAR         ;DISPLAY A CHARACTER
3121  016236  062737  000002  016266          ADD     #2,P7PNT        ;ADD 2 TO THE POINTER
3122  016244  005337  016264                  DEC     P7CNT           ;DECREMENT COUNT
3123  016250  001366                          BNE     PIC7B           ;NOT FINISHED
3124  016252  004737  017142                  JSR     PC,TIMER        ;CHECK THE RUNTIME OF THIS ROUTINE
3125  016256  000713                          BR      PIC7AA          ;NOT FINISHED
3126  016260  000137  016334                  JMP     PIC100          ;FINISHED, NEXT TEST
3127  016264  000000          P7CNT:  0
3128  016266  000000          P7PNT:  0
3129  016270  015610          CH1:    C
3130  016272  015641                  H
3131  016274  015576                  A
3132  016276  015677                  N
3133  016300  015677                  N
3134  016302  015622                  E
3135  016304  015665                  L
3136  016306  016062                  SPACEA
3137  016310  016000                  N1
3138  016312  015610          CH2:    C
3139  016314  015641                  H
3140  016316  015576                  A
3141  016320  015677                  N
3142  016322  015677                  N
3143  016324  015622                  E
3144  016326  015665                  L
3145  016330  016062                  SPACEA
3146  016332  016005                  N2
3147
```

```
3148
3149
3150                                    ;COLOR PINCUSHION-COLORS SHOULD OVERLAY TO BECOME ORANGE
3151                                    ;DRAW A BOX AROUND THE SCREEN AND A "X" IN THE CENTER
3152                                    ;DRAW IN GREEN THEN IN RED
3153
3154  016334  005005                  PIC10D: CLR     R5              ;SET UP FOR COLOR PATTERN
3155  016336  012737  000240  014532          MOV     #240,TICKS
3156  016344  004737  017254                  JSR     PC,CHTIME       ;CHECK TIMER
3157  016350  013701  001064          PIC1D:  MOV     VCXREG,R1
3158  016354  013702  001066                  MOV     VCYREG,R2
3159  016360  013703  001062                  MOV     VCSTAT,R3
3160  016364  012704  000100                  MOV     #100,R4
3161  016370  012777  000000  152466  PIC1DA: MOV     #0,@VCXREG
3162  016376  012777  000000  162462          MOV     #0,@VCYREG
3163  016404  105713                          TSTB    (3)             ;TEST CONTROL FOR READY
3164  016406  100376                          BPL     .-2
3165                                  ;BOTTOM LINE
3166  016410  012713  000004                  MOV     #4,(3)          ;SET UP MODE
3167  016414  050513                          BIS     R5,(3)          ;SET UP COLOR BIT
3168  016416  012700  000077                  MOV     #77,R0
3169  016422  105713                  PIC1DB: TSTB    (3)             ;CHANGE IN COLOR, WAIT FOR DONE
3170  016424  100376                          BPL     .-2
3171  016426  060411                          ADD     R4,(1)          ;ADD R4 TO XPOS
3172  016430  005300                          DEC     R0
3173  016432  001373                          BNE     PIC1DB          ;NO,
3174  016434  105713                          TSTB    (3,             ;WAIT FOR LAST DOT
3175  016436  100376                          BPL     .-2
3176                                  ;RIGHT LINE
3177  016440  112713  000010                  MOVB    #10,(3)         ;CHANGE MODE
3178  016444  050513                          BIS     R5,(3)          ;COLOR BIT
3179  016446  012700  000077                  MOV     #77,R0
3180  016452  105713                  PIC1DC: TSTB    (3)             ;WAIT
3181  016454  100376                          BPL     .-2
3182  016456  060412                          ADD     R4,(2)          ;ADD R4 TO YPOS
3183  016460  005300                          DEC     R0
3184  016462  001373                          BNE     PIC1DC          ;NO
3185  016464  105713                          TSTB    (3)             ;WAIT FOR LAST DOT
3186  016466  100376                          BPL     .-2
3187                                  ;TOP LINE
3188  016470  112713  000004                  MOVB    #4,(3)          ;CHANGE MODE
3189  016474  050513                          BIS     R5,(3)          ;COLOR BIT
3190  016476  012700  000077                  MOV     #77,R0          ;
3191  016502  105713                  PIC1DD: TSTB    (3)             ;READY
3192  016504  100376                          BPL     .-2
3193  016506  160411                          SUB     R4,(1)          ;SUB R4 FROM XPOS
3194  016510  005300                          DEC     R0
3195  016512  001373                          BNE     PIC1DD          ;NO
3196  016514  105713                          TSTB    (3)             ;WAIT FOR LAST DOT
3197  016516  100376                          BPL     .-2
3198                                  ;LEFT LINE
3199  016520  112713  000010                  MOVB    #10,(3)         ;CHANGE MODE
3200  016524  050513                          BIS     R5,(3)          ;COLOR BIT
3201  016526  012700  000077                  MOV     #77,R0
3202  016532  105713                  PIC1DE: TSTB    (3)             ;READY
3203  016534  100376                          BPL     .-2
```

```
3204  016536  160412                          SUB     R4,(2)          ;SUB R4 FROM YPOS
3205  016540  005300                          DEC     R0
3206  016542  001373                          BNE     PIC10E          ;NO
3207  016544  105713                          TSTB    (3)             ;WAIT FOR LAST DOT
3208  016546  100376                          BPL     .-2
3209
3210                                  ;NOW DRAW THE X
3211  016550  105013                  PIC11:  CLRB    (3)             ;CLEAR CONTROL
3212  016552  012704  000040                  MOV     #40,R4          ;SET UP R4
3213  016556  012712  002000                  MOV     #2000,(2)               ;SET UP Y POS
3214  016562  011211                          MOV     (2),(1)         ;SET UP X POS
3215  016564  112713  000004                  MOVB    #4,(3)          ;SET UP CONTROL
3216  016570  050513                          BIS     R5,(3)          ;COLOR BIT
3217  016572  012700  000100                  MOV     #100,R0
3218  016576  105713                  PIC11A: TSTB    (3)             ;WAIT FOR READY
3219  016600  100376                          BPL     .-2
3220  016602  060412                          ADD     R4,(2)          ;ADD R4 TO YPOS
3221  016604  060411                          ADD     R4,(1)          ;ADD R4 TO XPOS
3222  016606  005300                          DEC     R0
3223  016610  001372                          BNE     PIC11A          ;NO
3224  016612  105713                          TSTB    (3)
3225  016614  100376                          BPL     .-2
3226  016616  012712  006000                  MOV     #6000,(2)       ;CHANGE Y POS
3227  016622  012711  002000                  MOV     #2000,(1)               ;CHANGE X POS
3228  016626  012700  000100                  MOV     #100,R0
3229  016632  105713                  PIC11B: TSTB    (3)             ;READY
3230  016634  100376                          BPL     .-2
3231  016636  160412                          SUB     R4,(2)          ;SUB R4 FROM YPOS
3232  016640  060411                          ADD     R4,(1)          ;ADD R4 TO XPOS
3233  016642  005300                          DEC     R0
3234  016644  001372                          BNE     PIC11B          ;NO
3235  016646  105713                          TSTB    (3)             ;WAIT FOR LAST POINT
3236  016650  100376                          BPL     .-2
3237  016652  032705  000400                  BIT     #400,R5         ;TEST COLOR BIT
3238  016656  001006                          BNE     PIC11C
3239  016660  052705  001400                  BIS     #1400,R5
3240  016664  005013                          CLR     (3)
3241  016666  105713                          TSTB    (3)
3242  016670  100376                          BPL     .-2
3243  016672  000626                          BR      PIC10
3244  016674  005005                  PIC11C: CLR     R5
3245  016676  005013                          CLR     (3)
3246  016700  105713                          TSTB    (3)
3247  016702  100376                          BPL     .-2
3248  016704  004737  017142                  JSR     PC,TIMER        ;HAS TIME EXPIRED ?
3249  016710  000617                          BR      PIC10
3250
```

```
3251
3252                                        ;PHOSPHOR AND ERASE TEST
3253
3254  016712  012737  000002  014532  PIC12:  MOV     #2,TICKS
3255  016720  004737  017254                  JSR     PC,CHTIME       ;CHECK TIMER
3256  016724  004737  016776          PIC12A: JSR     PC,CLRVC        ;ERASE THE SCREEN
3257  016730  004737  017042                  JSR     PC,LOADVC       ;LOAD THE SCREEN
3258  016734  004737  017142                  JSR     PC,TIMER        ;CHECK THE TIME
3259  016740  000771                          BR      PIC12A
3260  016742  004737  016776                  JSR     PC,CLRVC
3261
3262  016746  000005          PIC20:  RESET
3263  016750  005737  000042                  TST     @#42
3264  016754  001402                          BEQ     .+6
3265  016756  000137  002002                  JMP     WHATE
3266  016762  004737  013472                  JSR     PC,BELL         ;REPORT END OF PASS
3267  016766  005237  001040                  INC     PASSCT
3268  016772  000137  014546                  JMP     VSJALO
3269
3270  016776  012777  002000  162056  CLRVC:  MOV     #BIT10,@VCSTAT  ;ENABLE STORE
3271  017004  052777  010000  162050          BIS     #BIT12,@VCSTAT  ;ERASE THE SCREEN
3272  017012  012700  000020                  MOV     #20,R0          ;SET UP DELAY
3273  017016  005001                          CLR     R1
3274
3275  017020  105777  162036          CLRVCA: TSTB    @VCSTAT         ;TEST FOR READY
3276  017024  100405                          BMI     CLRVCB          ;BRANCH IF SET
3277  017026  005301                          DEC     R1              ;DELAY
3278  017030  001373                          BNE     CLRVCA
3279  017032  005300                          DEC     R0              ;DELAY
3280  017034  001371                          BNE     CLRVCA
3281  017036  104400                          ERROR                   ;ERROR, ERASE FAILED TO SET READY AFTER A DELAY
3282
3283  017040  000207          CLRVCB: RTS     PC
3284
3285  017042  005077  162014          LOADVC: CLR     @VCSTAT         ;CLEAR STATUS
3286  017046  012737  007777  014510          MOV     #7777,TEMP1
3287  017054  013700  001062                  MOV     VCSTAT,R0
3288  017060  013701  001064                  MOV     VCXREG,R1
3289  017064  013702  001066                  MOV     VCYREG,R2
3290  017070  012710  002000                  MOV     #BIT10,(0)      ;SET STORE MODE
3291  017074  013712  014510                  MOV     TEMP1,(2)
3292  017100  012711  007777          LODVCA: MOV     #7777,(1)
3293  017104  000402                          BR      LODVCC
3294  017106  162711  000010          LODVCB: SUB     #10,(1)
3295  017112  005210          LODVCC: INC     (0)
3296  017114  000240                          NOP
3297  017116  105710                          TSTB    (0)
3298  017120  100376                          BPL     .-2
3299  017122  022711  000007                  CMP     #7,(1)
3300  017126  001367                          BNE     LODVCB
3301  017130  104007                          TSTTKS                  ;TEST FOR INPUT FLAG
3302  017132  162712  000003                  SUB     #3,(2)
3303  017136  001360                          BNE     LODVCA
3304  017140  000207                          RTS     PC
```

```
3305
3306
3307                                    ;TIMER ROUTINE
3308                                    ; ENTER VIA JSR PC,TIMER
3309
3310  017142  017737  161666  014530  TIMER:  MOV     @SWR,TIMSV
3311  017150  104007                   TSTTKS
3312  017152  032737  000400  014530  TIMERA: BIT     #BIT8,TIMSV
3313  017160  001006                   BNE     TIMER2          ;BIT 8 SET ?
3314  017162  005337  014532           DEC     TICKS           ;NO, DECREMENT TICKS
3315  017166  001002                   BNE     TIMER1
3316  017170  062716  000002           ADD     #2,(6)          ;ADD 2 TO STACK POINTER
3317  017174  000207           TIMER1: RTS     PC              ;RETURN
3318
3319                                    ; SWR 9=1 SELECT TEST TO LOCK ON
3320                                    ; SWR 2-0= TEST NUMBER
3321
3322  017176  042737  177770  014530  TIMER2: BIC     #177770,TIMSV
3323  017204  006337  014530           ASL     TIMSV
3324  017210  062737  017234  014530   ADD     #ROUTPT,TIMSV
3325  017216  017737  175306  014530   MOV     @TIMSV,TIMSV
3326  017224  013706  014444           MOV     STACK,SP
3327  017230  000177  175274   TIMER4: JMP     @TIMSV
3328
3329  017234  014624           ROUTPT: PIC0                    ;DISPLAY A HORIZONTAL LINE
3330  017236  014640                   PIC1                    ;DISPLAY A VERTICAL LINE
3331  017240  014744                   PIC3                    ;DISPLAY A SQUARE
3332  017242  015150                   PIC4                    ;DISPALY A "X"
3333  017244  015322                   PIC6                    ;DISPLAY CHARACTER SET
3334  017246  016070                   PIC7                    ;DISPLAY CHANNEL TEST
3335  017250  016334                   PIC100                  ;DISPLAY COLOR PATTERN
3336  017252  016712                   PIC12                   ;DISPLAY ERASE AND PHOSPHOR TEST
3337
3338  017254  013737  001014  014514  CHTIME: MOV     PDPDLY,BRLEV1
3339  017262  005337  014514           CHTMA:  DEC     BRLEV1
3340  017266  001403                   BEQ     CHTMB
3341  017270  006337  014532           ASL     TICKS
3342  017274  000772                   BR      CHTMA
3343  017276  000207           CHTMB:  RTS     PC
```

```
                                        ;SLOW RELAY SWITCH TEST
                                
017300  013706  014444          RELAY:  MOV     STACK,SP        ;LOAD THE STACK
017304  052777  000401  161542          BIS     #BIT8!BIT0,@GRSTAT      ;LOAD RELAYS
017312  004737  017332                  JSR     PC,DLY
017316  042777  000401  161530          BIC     #BIT8!BIT0,@GRSTAT      ;CLEAR RELAYS
017324  004737  017332                  JSR     PC,DLY
017330  000763                          BR      RELAY
                                
017332  013737  001014  014456  DLY:    MOV     PDPDLY,DELAY
017340  005037  017362                  CLR     DELAY1
017344  005237  017362          DLYA:   INC     DELAY1
017350  001375                          BNE     DLYA
017352  005337  014456                  DEC     DELAY
017356  001372                          BNE     DLYA
017360  000207                          RTS     PC
017362  000000                  DELAY1: 0
                                
                                        ;SCOPE OUTPUT OF CLOCK OVERFLOW
                                
017364  013706  014444          CKOVFL: MOV     STACK,SP
017370  012777  177766  161454          MOV     #-10.,@CSB      ;LOAD COUNTER PRESET
017376  012777  000403  161444          MOV     #403,@CSR       ;LOAD RATE AND MODE
017404  105777  161440          SOCOA:  TSTB    @CSR
017410  100375                          BPL     SOCOA
017412  000764                          BR      CKOVFL
                                
                                        ;TEST FOR SCHMITT TRIGGER #1 AND #2
                                
017414  005037  014510          ST1:    CLR     TEMP1
017420  042737  100000  017470          BIC     #BIT15,STST
017426  000406                          BR      STSA
                                
017430  012737  001000  014510  ST2:    MOV     #1000,TEMP1             ;LOAD MODE
017436  052737  100000  017470          BIS     #BIT15,STST
017444  013706  014444          STSA:   MOV     STACK,SP
017450  005037  014462                  CLR     KSTOR3
017454  013777  014510  161366  STSB:   MOV     TEMP1,@CSR              ;LOAD STATUS
017462  004537  013524                  JSR     5,LEDS
017466  014462                          KSTOR3
                                
017470  005777  161354          STST:   TST     @CSR                            ;TST OR TSTB
017474  100375                          BPL     STST
017476  005077  161346                  CLR     @CSR            ;CLEAR BIT 15
017502  005237  014462                  INC     KSTOR3
017506  004737  013476                  JSR     PC,BELLA
017512  000760                          BR      STSB
                                
                                
        001120                          .END    INIT
```

```
A       015576  2984    3024#   3131    3140
ADBRL   001004   549#
ADCS    001044   568#    608
ADCSR   001046   569#    632*    2695*
ADINT   001074   589#    617     653*
ADINT1  001076   589#    659     660*
AVCT12  011126  2167    2177    2188#
AVECTR  014446   668*    2387    2808#
B       015603  3026#
BEGIN   002066   752#    1513
BELL    013472  1511    1928    2322    2671#   3266
BELLA   013476  2673#    3389
BIT0  = 000001   475#    797     798     926     1185    1203    1216    1270    1282    1364    1389    1417    1654
                1655    1706    2074    2190    2199    2252    2267    3347    3349
BIT1  = 000002   474#    1149    1361    1964    1965    2198    2280    2848    2851
BIT10 = 002000   465#    937     949     961     973     990     1016    1024    1042    1050    1069    1077    1095
                1103    1121    1136    1141    1551    1556    2013    2014    2170    2291    3270    3290
BIT11 = 004000   464#    999     1021    1047    1074    1100    2021    2022    2291
BIT12 = 010000   463#    914     925     1126    1331    1381    2170    3271
BIT13 = 020000   462#    924     1167    1829    1864
BIT14 = 040000   461#    1167    1328    1379    1679    1690    1706    1894    1890    1905    1911
BIT15 = 100000   460#    886     1167    1670    1671    1706    3374    3378
BIT2  = 000004   473#    1149    1972    1973    2123    2280
BIT3  = 000010   472#    1149    1980    1981    2145    2280
BIT4  = 000020   471#    1989    1990    2280    2849
BIT5  = 000040   470#    678     1802    1864    2166
BIT6  = 000100   469#    756     792     1176    1192    1361    1428    1581    1602    1697    1698    1706    1713
                1716    1876    1884    1890    1905    1911    1944    1963    1997    1998    2234    2252    2267
                2291    2348    2852
BIT7  = 000200   468#    871     1000    1176    1688    1689    1706    1965    1973    1981    1990    1998    2006
                2014    2022    2283    2294
BIT8  = 000400   467#    1158    1662    1663    1706    2088    2089    2106    3312    3347    3349
BIT9  = 001000   466#    936     1158    1551    2005    2006    2291
BRLEV1  014514  1314*   1315*   1330    1363    1850*   1851*   1863    1883    2220*   2221*   2251    2827#   3338*
                3339*
BRLEV2  014516  1316*   1398    1852*   1904    2222*   2256    2828#
BRLEV3  014520  1317*   1318*   1416    1853*   1854*   2223*   2224*   2829#
C       015610  3028#   3129    3138
CHAR    015424  2985    2991#   3110    3120
CHAR1   015474  3000#   3014
CHAR2   015502  3002#   3010
CHAR3   015522  3003    3006#   3007
CHAR4   015452  2995#   2996
CHRCNT  014452  2349*   2366*   2367    2393    2395*   2810#
CHRCOL  015572  2982*   2986*   3021#
CHTIME  017254  2869    2893    2939    2974    3102    3156    3255    3338#
CHTMA   017262  3339#   3342
CHTMB   017276  3340    3343#
CH1     016270  3108    3129#
CH2     016312  3118    3138#
CK      013302  2566    2623#
CKBRL   001006   550#   1307*   1310    1314    1316    1317
CKDLY   006012  1532*   1550    1567#
CKOVFL  017364   533    3364#   3369
CKTEST  002054   527     681     748#
CKV     001100   591#    661*    1327*   1342*   1357*   1377*   1393*   1411*   1424*
```

CROSS REFERENCE TABLE -- USER SYMBOLS

```
CKVS    001102   592*   661    662*  1358*  1377   1378*  1394*  1412*  1424   1425*
CLRVC   016776  3256   3260   3270*
CLRVCA  017020  3275*  3279   3290
CLRVCB  017040  3276   3293*
CNTDEV  006006  1530*  1547   1565*
CNTLED  013632  2686*  2700*  2704*
CNTRLA  014357  2379   2795*
CNTRLC  014353   653   2783*
CNTRLG  014362  2415   2786*
COUNT   014454  1020*  1022*  1046*  1048*  1073*  1075*  1099*  1101*  2811*
CRLF    014411  2404   2585   2590   2792*
CSB     001052   573*   761*   766*   767    772*   773    778*   779    786*   788    935*   946*   949*
                 950    958*   960*   962    970*   972*   974    988*   991    1014*  1017   1025   1040*
                1043   1051   1067*  1070   1078   1093*  1096   1104   1119*  1122   1134*  1137   1142
                1293*  1360*  1396*  1414*  1528*  1557   1559*  2573   3365*
CSR     001050   572*   780*   760*   797*   798    805*   806    813*   814    821*   822    830*   831
                 838*   839    846*   847    854*   855    863*   864    871*   972    975    878*   979
                 886*   887    890    893*   894    901*   903    913*   914*   915    923*   924*   925*
                 926    934*   936*   937*   938    945*   947*   949*   957*   959*   961*   969*   971*
                 973*   987*   989*   990*   995    999*  1000*  1013*  1015*  1016*  1021*  1024*  1039*
                1041*  1042*  1047*  1050*  1066*  1068*  1069*  1074*  1077*  1092*  1094*  1095*  1100*
                1103*  1118*  1120*  1121*  1126*  1133*  1135*  1136*  1141*  1149*  1151   1158*  1160
                1167*  1169   1176*  1178   1185*  1187   1200   1203   1213   1216   1225   1235   1245
                1255   1266   1270   1279   1282   1292*  1294*  1296   1298   1326*  1328*  1331*  1359*
                1361*  1364*  1376*  1379*  1381*  1395*  1397*  1399*  1413*  1415*  1417*  1423*  1527*
                1552*  1553*  1556*  1558*  2572   3366*  3367   3381*  3385   3387*
CTEST1  002062   717    751*
D       015615  3030*
DELAY   014456  1295*  1299*  2812*  3353*  3357*
DELAY1  017362  3354*  3355*  3360*
DIOBRL  001010   551*  1844*  1847   1850   1852   1853
DISPLA  001036   562*   629*   752*  1578*  1941*  2845*
DLY     017332  3348   3350   3353*
DLYA    017344  3355*  3356   3358
DOT     014413   676   2794*
DRT0    006074  1577   1589*
DRT1    006116  1595*
DRT10   006442  1669*
DRT11   006464  1677*
DRT12   006514  1687*
DRT13   006536  1695*
DRT14   006566  1704*
DRT15   006630  1715*
DRT16   006666  1724*
DRT17   006710  1732*
DRT18   006732  1738*
DRT19   006754  1746*
DRT2    006146  1603*
DRT20   007006  1756*
DRT21   007044  1718   1767*
DRT21A  007132  1771   1783*
DRT21B  007136  1772   1786*
DRT22   007146  1781   1793*
DRT22A  007232  1797   1809*
DRT25   007260  1820*
DRT25A  007344  1826   1836*
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DRT28    007366      1843*
DRT29    007452      1857*
DRT29A   007532      1861    1862    1871*
DRT29B   007534      1874*
DRT29C   007652      1891    1892    1894*
DRT3     006170      1609*
DRT30    007654      1979    1993    1999*
DRT30A   007752      1902    1903    1913*
DRT4     006212      1615*
DRT5     006246      1623*
DRT6     006306      1632*
DRT6A    006310      1633*   1639
DRT7     006344      1637    1642*
DRT7A    006346      1643*   1649
DRT8     006376      1647    1653*
DRT9     006420      1661*
E        015622      3032*   3134    3143
EMTOK    012472      2480    2482*
EMTSRV   012452       514    2476*
EMTTAB   012512      2494    2498*
ENDPAS   013504      2672    2677*
ERROR =  104400       536*    769     775     781     790     800     808     816     824     833     841     849     857
                      866     874     877     881     889     892     896     905     917     929     940     952     964
                      976     993     997    1019    1027    1045    1053    1072    1080    1098    1106    1124    1139
                     1144    1153    1162    1171    1180    1189    1202    1205    1215    1218    1227    1237    1247
                     1257    1268    1272    1281    1284    1334    1349    1367    1404    1422    1438    1440    1450
                     1452    1462    1464    1474    1476    1487    1489    1499    1501    1593    1600    1607    1613
                     1621    1629    1636    1646    1657    1665    1673    1682    1691    1700    1710    1722    1728
                     1736    1742    1752    1763    1783    1785    1869    1892    1913    1959    1967    1975    1993
                     1998    2000    2008    2016    2024    2033    2039    2047    2053    2062    2066    2077    2083
                     2091    2094    2099    2108    2111    2116    2126    2131    2137    2149    2153    2159    2173
                     2182    2195    2204    2209    2241    2256    2272    2286    2297    2305    2315    3281
F        015627      3034*
FILCHR   001020       555*   2524
FILLS    001016       554*   2521
G        015634      3036*
GEN1     015410      2985*   2987
GRPHIO   001072       584*    615*    616*   1625*   1643*   1644
GRDAT    001056       576*   1586*   1720    1726    1734    1740    1760    1775    1896    1907    2576
GRDIO    001060       577*    615    1587*   1590*   1591    1596*   1598    1604*   1605    1610*   1611    1616*   1617*
                     1618    1624*   1626    1633*   1634    1719*   1725*   1733*   1739*   1749*   1759*   1774*   1895*
                     1906*   2575
GRIVA    001104       594*    663*   1771*   1797*   1809*   1824*   1861*   1881*   1902*   1917*
GRIVB    001110       597*    665*   1772*   1799*   1826*   1836*   1862*   1892*   1903*   1919*
GRIVSA   001106       595*    663     664*   1798*   1809    1810*   1824    1825*   1917    1919*
GRIVSB   001112       598*    665     666*   1799    1800*   1827*   1836    1837*   1919    1920*
GRSTAT   001054       575*    702*   1585*   1654*   1655    1662*   1663    1670*   1671    1679*   1690    1698*   1699
                     1697*   1698    1706*   1708    1747*   1750    1757*   1761    1770*   1790*   1792*   1795*   1802*
                     1819*   1822*   1829*   1860*   1864*   1880*   1894*   1900*   1901*   1905*   1911*   2574    3347*
                     2349*
H        015641      3038*   3130    3139
HERE     005570      1508    1511*
HIGH     014524      2831*   2889*   2936*   2943    2960
I        015646      3040*
ICOUNT   001042       564*   2640
INBUF    012334       678*    679     682     685     689    2347    2350*   2351*   2352*   2353*   2354*   2355*   2356*
```

```
                        2422    2439#
INCR    014526          2832#   2871    2897    2944
INIT    001120           526     605#   3393
INITA   001334           642#    669    2808
INITIA  001150           611#    614
INITIB  001212           620#    623
INITIC  001342           631     645#
INIT2   001400           637     644     655#    693
INIT3   001624           691#
INPUTA  012022          2357#   2359    2372    2394
INPUTB  012054          2365#   2400
KBTEST  006014           528     684    1573#
KBTESTA 006026          1577#   1930
KTEST1  006022           720    1576#
L       015553          3042#
M       015660          3044#
MSTOR1  014460          2813#
MSTOR3  014462          2568*   2569*   2571    2592    2814#   3380*   3393    3389*
MSTOR4  014464          2577*   2610    2615#
MSTOR5  014466          2578*   2613    2816#
MSTOR6  014470          2572*   2595    2817#
MSTOR7  014472          2573*   2598    2818#
MSTOR8  014474          2574*   2601    2819#
MSTOR9  014476          2575*   2604    2820#
MSTR10  014500          2576*   2607    2821#
MSTR11  014502          2580*   2619    2822#
MSTR12  014504          2579*   2616    2823#
MWT0    002130           755     765#   2650
MWT10   002356           829#
MWT11   002400           937#
MWT12   002422           845#
MWT14   002444           953#
MWT15   002466           862#
MWT16   002510           870#
MWT17   002354           885#
MWT18   002620           900#
MWT18A  002632           903#    907
MWT19   002650           912#
MWT2    002152           771#
MWT20   002674           922#
MWT22   002730           933#
MWT23   002766           944#
MWT24   003034           956#
MWT25   003102           968#
MWT26   003154           986#
MWT26A  003174           990#   1002
MWT3    002174           777#
MWT30   003252           994     998    1012#
MWT30A  003316          1021#   1023
MWT31   003352          1038#
MWT31A  003416          1047#   1049
MWT32   003452          1065#
MWT32A  003516          1074#   1076
MWT33   003552          1091#
MWT33A  003616          1100#   1102
MWT34   003656          1117#
```

```
KWT34A  003676          1121*   1128
KWT35   003734          1125    1132*
KWT36   004016          1148*
KWT37   004040          1157*
KWT38   004062          1166*
KWT39   004104          1175*
KWT4    002216           785*
KWT40   004126          1184*
KWT41   004156          1197*
KWT42   004214          1210*
KWT43   004252          1222*
KWT44   004276          1232*
KWT45   004322          1242*
KWT46   004346          1252*
KWT47   004372          1263*
KWT48   004430          1276*
KWT49   004542          1285    1335*
KWT5    002246           796*
KWT50   004630          1323*
KWT50A  004712          1327    1341*
KWT50B  004740          1342    1348*
KWT51   004744          1335    1347    1354*
KWT51A  005042          1357    1370*
KWT52   005044          1366    1374*
KWT53   005136          1391*
KWT53A  005230          1393    1404*
KWT54   005234          1409*
KWT54A  005326          1411    1422*
KWT55   005362          1432*
KWT56   005406          1444*
KWT57A  005432          1456*
KWT6    002270           804*
KWT60   005456          1468*
KWT61   005502          1481*
KWT62   005526          1493*
KWT7    002312           812*
KWT8    002334           820*
L       015665          3046*   3135    3144
LEDS    013524           669    2570    2686*   3382
LEDSA   013552          2690    2692*   2701
LEDSV1  013634          2688*   2692    2696*   2697*   2698*   2705*
LEDSV2  013636          2692*   2693*   2694*   2695    2706*
LEDSV3  013640          2687*   2694    2699*   2707*
LGERR1  013174          2583    2589*
LGERR2  013314          2567    2627*
LOADVC  017042          3257    3285*
LODVCA  017100          3292*   3303
LODVCB  017106          3294*   3300
LODVCC  017112          3293    3295*
LOGERR  013016           516    2564*
LOGICA  002012           519     728*
LOW     014522          2830*   2890*   2898    2899    2935*   2345    2961
LPSADD  001000           547*    609
LPSVCT  001002           548*    618
M       015672          3048*
MASK    013002          2539*   2545    2550*   2556*
```

```
MES1    013723          2587    2721#
MES2    014030           750    2741#
MES21   014421          2468    2797#
MES3    014055          1575    2745#
MES4    014165           643    2759#
MES5    014110          1937    2750#
MES6    014135          2754#   2842
MINCNT  006010          1531#   1542    1544    1566#
MODE    015564          2848#   2851#   2997    3018#
MONITR  001352           525     648#   2390    2469
N       015677          3050#   3132    3133    3141    3142
NEWIN   011750          2347#   2437
NEWSWR  014400          2419    2789#
NOCLK   002024           696#    706     715     734#    738#
NODIO   002026           697#    708     718     735#    740#
NOLEDS  013642           630#    645#   2689    2708#
NOSCOP  002030           698#    710     721     736#    742#
N0      016055          3094#
N1      016000          3076#   3137
N2      016005          3078#   3146
N3      016012          3080#
N4      016017          3082#
N5      016024          3084#
N6      016031          3086#
N7      016036          3088#
N8      016043          3090#
N9      016050          3092#
O       015704          3052#
OCTPRT  012662          2495    2534#
OPSS    011514          2270    2274#
OUTPTA  012072          2369#   2370    2398
P       015711          3054#
PASSCT  001040           563#    751#    752    1512#   1576#   1578    1929#   1938#   1941    2323#   2638    2659    2943#
                        2845    3267#
PB      014700          2870#
PBB     014656          2857    2863    2866#
PD      014704          2871#
PDPDLY  001014           553#   3338    3353
PE      014720          2874#   2879
PEEA    014710          2872#   2881
PICO    014624          2846    2855#   3329
PIC1    014640          2861#   3330
PIC10   016350          3157#   3243    3249
PIC10A  016370          3161#
PIC10B  016422          3169#   3173
PIC10C  016452          3180#   3184
PIC10D  016502          3191#   3195
PIC10E  016532          3202#   3206
PIC10D  016334          3126    3154#   3335
PIC11   016550          3211#
PIC11A  016576          3218#   3223
PIC11B  016632          3229#   3234
PIC11C  016674          3238    3244#
PIC12   016712          3254#   3336
PIC12A  016724          3256#   3259
PIC20   016746          3262#
```

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PIC3    014744          2864    2889#   3331
PIC4    015150          2935#   3332
PIC4B   015202          2940#
PIC6    015322          2973#   3333
PIC6A   015334          2975#   2980
PIC6B   015372          2978    2982#
PIC7    016070          2981    3101#   3334
PIC7A   016144          3109#   3113
PIC7AA  016106          3104#   3125
PIC7B   016226          3119#   3123
PRINT = 104000           537#    640     642     652     675     691     749    1574    1936    2378    2403    2414    2418
                        2435    2467    2584    2586    2589    2671    2673    2841
PRINT1  014442           639*   2582    2588*   2806#
PROC    014450          2451*   2458    2809#
PRTOCT= 104005           542#   2416    2591    2594    2597    2600    2603    2606    2609    2612    2615    2618
PSW     001022           556#    606*    650*    754*   1325*   1330*   1344*   1356*   1363*   1375*   1386*   1392*   1398*
                        1410*   1416*   1427*   1580*   1678*   1696*   1705*   1712*   1769*   1773*   1796*   1801*   1811*
                        1823*   1829*   1838*   1859*   1863*   1879*   1883*   1900*   1904*   1943*   2229*   2233*   2247*
                        2251*   2262*   2266*   2457*   2644*   2847*
PWRFAL  012352           508     656    2444#
PWR_P   012406          2452    2457#
P3      015016          2898#   2933
P3A     015042          2903#   2907
P3B     015064          2911#   2915
P3C     015106          2919#   2923
P3D     015130          2927#   2931
P4      015226          2945#   2970
P4A     015244          2951#   2956
P4B     015300          2963#   2968
P7CNT   016264          3107*   3112*   3117*   3122*   3127#
P7PNT   016266          3108*   3109    3111*   3118*   3119    3121*   3128#
Q       015716          3056#
QMARK   014416           692    2436    2795#
R       015723          3058#
RATE    006004          1198*   1211*   1223*   1233*   1243*   1253*   1264*   1277*   1294    1529*   1551*   1552    1564#
RELAY   017300           534    3346#   3351
REPEAT  005604          1433    1445    1457    1469    1482    1494    1527#
RETURN  013414           755*   1577*   1942*   2645    2647*   2650#   2846*
RING    013521          2674    2680#
ROUTPT  017234          3324    3329#
S       015730          3060#
SCOPE = 104002           539#    765     771     777     804     812     820     829     937     845     953     862     870
                         885     900     922     933     944     956     968     986    1148    1595    1609    1623    1632
                        1642    1661    1669    1677    1687    1695    1704    1724    1732    1739    1756    1767    1957
                        1954    1971    1979    1988    1996    2004    2012    2020    2029    2035    2043    2049    2057
                        2072
SCOPEB  013366          2635    2643#   2656    2668
SCOPEC  013322          2492    2633#
SCOPEF  013412           667*   2640    2642*   2646*   2649#   2661
SCOPEG  013400          2637    2639    2641    2646#   2658    2660    2669
SCOPEH  013416          2493    2654#
SCOPEI  013456          2491    2498    2666#
SCOPEJ  013360          2641#   2662
SCOPED= 104001           538#   2103    2121    2188
SCOPE1= 104003           540#    785     796     912    1012    1038    1065    1091    1117    1132    1157    1166    1175
                        1184    1197    1210    1222    1232    1242    1252    1263    1276    1305    1323    1354    1374
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                        1391    1409    1432    1444    1456    1468    1481    1493    1505    1589    1603    1615    1653
                        1715    1746    1793    1820    1843    1874    1898    1915    1962    2086    2143    2165    2228
                        2245    2260    2279    2290    2301    2310    2317
SOCOA   017404          3367*   3368
SOFTDI  000172           524*
SOFTSW  000170           523*   2417    2432*
SPACE = 104004           541*   2593    2596    2599    2602    2605    2608    2611    2614    2617    2620
SPACEA  016062          3096*   3136    3145
SPACEX  011732          2333*   2335*   2337*
SPCHR   012106          2362    2364    2376*
SPCHR1  012142          2377    2389*
SPCHR3  012204          2392    2399*
SPCHR4  012212          2401*
SPCHR5  012326          2368    2413    2435*
STACK   014444           605     649     753    1579    1940    2230    2248    2263    2807*   2844    3326    3346    3364
                        3379
STSA    017444          3375    3379*
STSB    017454          3381*   3390
STST    017470          3374*   3378*   3385*   3386
ST1     017414           531    3373*
ST2     017430           532    3377*
SWR     001034           561*    625     628*   1716    1876    2166    2565    2623    2634    2636    2655    2657    2667
                        2849    3310
SW00 = 000001            494*
SW01 = 000002            493*
SW02 = 000004            492*
SW03 = 000010            491*
SW04 = 000020            490*
SW05 = 000040            489*
SW06 = 000100            488*
SW07 = 000200            487*
SW08 = 000400            486*
SW09 = 001000            485*
SW10 = 002000            484*
SW11 = 004000            483*
SW12 = 010000            482*
SW13 = 020000            481*
SW14 = 040000            480*
SW15 = 100000            479*
T       015735          3062*
TEMP    014536           902*    906*    985*    991    1001*   1116*   1122    1127*   1544*   1618*   1619    1626*   1627
                        1631*   1633    1634    1638*   1641*   1643    1644    1648*   2169*   2178*   2580    2824*
TEMP1   014510          2825*   3296*   3291    3373*   3377*   3381
TEMP2   014512          2826*
TICKS   014532          2834*   2869*   2892*   2938*   2973*   3101*   3155*   3254*   3314*   3341*
TIMER   017142          2880    2932    2969    2979    3124    3248    3258    3310*
TIMERA  017152          3312*
TIMER1  017174          3315    3317*
TIMER2  017176          3313    3322*
TIMER4  017230          3327*
TIMSV   014530          2833*   3310*   3312    3322*   3323*   3324*   3325*   3327
TITLE   013644           641    2712*
TKB     001026           558*   2359
TKS     001024           557*    638*    651*    674*    756*    792*   1192*   1428*   1581*   1602*   1713*   1944*   1963*
                        2348*   2357    2558    2852*
TKSFLG  013004          2497    2558*
```

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TPB     001032          560*  2332*  2371*  2515*  2517*  2520*  2524*  2549*
TPS     001030          559*  2330   2369   2508   2518   2522   2547   2521
TSTEND  005552         1505*
TSTTAS= 104007          544*  2564   2633   2654   2666   3301   3311
TSTTIA  011104         2176*  2179   2191
TTYIN = 104006          543*   677   2420   2560
TYPECL  012602         2514   2517*
TYPERA  012550         2508*  2509   2516   2528
TYPERI  012566         2511   2513*
TYPER2  012574         2515*
TYPMES  012534         2490   2504*
U       015742         3064*
UPCNT   004470         1199   1212   1224   1234   1244   1254   1265   1278   1292*
UPCNTA  004514         1296*  1300
UPCNTB  004540         1297   1301*
V       015747         3066*
VCBRL   001012          552*  2213*  2216   2220   2222   2223
VCEXT   001070          582*
VCIV    001114          600*  2232*  2249*  2264*  2274*
VCIVS   001116          601*  2274
VCRET1  011434         2249   2260*
VCRET2  011506         2264   2271*
VCSTAT  001062          579*   704*  1948*  1356   1964*  1965   1972*  1973   1980*  1981   1989*  1990   1997*
                       1998   2005*  2006   2013*  2014   2021*  2022   2074*  2075   2078   2088*  2089   2092
                       2095   2105*  2106   2109   2112   2123*  2124   2129   2133   2145*  2146   2151   2155
                       2170*  2171   2176   2190*  2191   2198*  2193*  2200   2234*  2238*  2252*  2255*  2267*
                       2271*  2280*  2282   2291*  2293   2577   2966*  2867   2991*  2996   2937*  2942   2977*
                       2983   2995   3006   3103   3104*  3114*  3159   3270*  3271*  3275   3295*  3287
VCTEST  010034          529    687   1935*
VCTST0  010046         1940*  2324
VCTST2  010554         2078*  2091
VCTST3  010570         2079   2086*
VCTST4  010626         2095*  2098
VCTST5  010642         2096   2103*
VCTST6  010700         2112*  2115
VCTST7  010714         2113   2121*
VCTST8  010754         2133*  2136
VCTST9  010770         2134   2143*
VCTS10  011030         2155*  2158
VCTS11  011044         2156   2165*
VCTS12  011140         2191*  2194
VCTS13  011154         2192   2197*
VCTS14  011172         2200*  2203
VCTS15  011206         2201   2206*
VCTS20  011356         2239   2245*
VCT0    010114         1942   1954*
VCT1    010130         1962*
VCT11   010356         2029*
VCT12   010400         2035*
VCT15   010422         2043*
VCT16   010444         2049*
VCT17   010466         2057*
VCT2    010160         1971*
VCT3    010202         1979*
VCT4    010224         1988*
VCT5    010246         1996*
```

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VCT6    010270          2004#
VCT7    010312          2012#
VCT8    010334          2020#
VCXREG  001064           580#  1949*  2030*  2031   2036*  2037   2058*  2060   2128*  2302*  2304   2578   2855
                        2862   2894   2898*  2940   2993*  3004*  3157   3161*  3288
VCYREG  001066           581#  1950*  2044*  2045   2050*  2051   2059*  2064   2150*  2311*  2313   2579   2956
                        2861   2895   2899*  2941   2994*  3005*  3158   3162*  3289
VISUAL  014534           530    690   2840#
VSLOA   014616          2850   2852#
VSUALO  014546          2844#  3268
VTEST1  010042           723   1938#
VTEST2  014542           724   2843#
W       015754          3068#
WHAT    001632           673    696#   732
WHATA   001740           707    709    711    715#
WHATB   001752           716    718#  1509
WHATC   001764           719    721#  1927
WHATD   001776           724#  2321
WHATE   002002           722    725#  3265
WHAT1   002032           699    738#
WHAT2   002040           701    740#
WHAT3   002046           703    742#
X       015761          3070#
XPOS    015570          2975*  2993   3004   3012*  3015*  3020*  3105*  3115*
XSPACE  011702          2330#  2334   2494
XTTYIN  011734           511   2341#  2496
Y       015766          3072#
YPOS    015566          2976*  2991   2994   3005   3008*  3011*  3019*  3106*  3116*
YPT     015574          2991*  3011   3022#
Z       015773          3074#
$BDDAT  006002          1537*  1539   1542   1563#
$GDDAT  006000          1535*  1538   1562#
.     = 017514           507#   510#   513#   518#   520#   522#   546#   672    680    683    686    699    713
                         768    774    780    789    799    807    815    823    832    840    848    856    865
                         873    876    880    888    891    895    904    916    927    939    951    963    975
                         992   1018   1026   1044   1052   1071   1079   1097   1105   1123   1138   1143   1152
                        1161   1170   1179   1188   1201   1204   1214   1217   1226   1236   1246   1256   1267
                        1271   1280   1283   1308   1311   1333   1346   1366   1383   1398   1402   1403   1420
                        1421   1439   1451   1463   1475   1488   1500   1592   1599   1606   1612   1620   1628
                        1635   1645   1656   1664   1672   1681   1690   1699   1709   1717   1721   1727   1735
                        1741   1751   1762   1845   1848   1877   1912   1926   1957   1966   1974   1982   1991
                        1999   2007   2015   2023   2032   2038   2046   2052   2061   2065   2076   2090   2093
                        2107   2110   2125   2130   2147   2152   2172   2208   2214   2217   2237   2254   2269
                        2285   2296   2305   2314   2320   2331   2389   2441#  2519   2540   2548   2559   2622
                        2624   2801#  2877   2905   2913   2921   2929   2952   2958   2964   3099#  3164   3170
                        3175   3181   3186   3192   3197   3203   3208   3219   3225   3230   3236   3242   3247
                        3264   3298

. ABS.  017514     000

 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

 DZLPDC,DZLPDC.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DZLPDC.P11
```

RUN-TIME: 9 23 3 SECONDS
RUN-TIME RATIO: 256 37=6.8
CORE USED: 10K (19 PAGES)

K07

Spooler running 11 Seconds, 332 KCS, 0% disk reads, 3 disk writes, 87 pages