LPA/LPS

DIAGNOSTIC TEST 2
MD-11-DRLPI-A

EP-DRLPI-A-DL

FICHE 1 OF 1

MAR 1978
digital
MADE IN USA

IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DRLPI-A-D
PRODUCT NAME:	LPA/LPS DIAGNOSTIC TEST 2
DATE:	JANUARY 1978
MAINTAINER:	DIAGNOSTIC GROUP

SEQ 0002

1. ABSTRACT

THIS DIAGNOSTIC TESTS AND EXERCISES THE "LPS".
WHEN STARTED, IT WILL TYPE OUT THE PROGRAM TITLE.
A SENTANCE IS THEN TYPED GIVING THE LETTER DESIGNATORS
TO BE TYPED TO RUN ANY ONE OF THE FOUR (4) 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.

THIS PROGRAM IS A MODIFIED VERSION OF "MD-11-DZLPD-C". IT WAS
MODIFIED TO ENABLE THE OPERATOR TO CHECK OUT THE LPS11 OPTION WHEN
IT IS ON THE LPA11-KX I/O BUS. NO RECABLING IS NEEDED. SOME
TESTS DONE IN THE ORIGINAL DIAGNOSITC SUCH AS ARBITRATION TEST,
WERE DELETED AS THEY COULD NOT BE CHECKED. IF THIS DIAGNOSTIC
DOESN'T FIND A SUSPECTED PROBLEM, YOU MAY HAVE TO RUN "MD-11-DZLPD-C".
YOU SHOULD RUN "MD-11-DRLPA" BEFORE RUNNING THIS DIAGNOSTIC.
PLEASE READ SECTION 16.

2. REQUIREMENTS (EQUIPMENT)

A. PDP-11 COMPUTER WITH 16K OF MEMORY.
B. TELETYPE (OR EQUIVALENT)
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 SEPARATE DIAGNOSTIC (MD-11-DRLPJ).

3. LOADING PROCEDURE

A. USE STANDARD PROCEDURE FOR LOADING BINARY TAPES.

4. STARTING PROCEDURE

THE STARTING ADDRESS OF THIS DIAGNOSTIC IS 200.

5. CONSOLE SWITCH SETTINGS

SEQ 0003

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 ITERATIONS
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 200 SECONDS TO RUN THE CLOCK LOGIC TEST AND TYPE "END PASS".

7. DIGITAL INPUT-OUTPUT

SEQ 0004

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 ITERATIONS
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 ENCOUNTERING 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 5 SECONDS TO RUN THE DIGITAL I/O LOGIC TEST AND RING THE TELETYPE BELL.

8. POINT PLOT SCOPE LOGIC TEST

SEQ 0005

A. THIS TEST IS DESIGNED TO TEST THE LPSVC SCOPE CONTROL LOGIC. ALL USEABLE 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. TYPING ↑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 SWITCHES DOWN) THE ERROR ADDRESS AND THE CONTENTS OF THE VC STATUS, X AXIS 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 7 SECONDS TO RUN THE SCOPE LOGIC TEST.

9. POINT PLOT VISUAL DISPLAY TEST

SEQ 0006

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.

2.

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 & 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) THEN 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 1OWER RIGHT DIAGONAL). MODE 01 (INTENSIFY ON LOADING X) IS USED.

11. ADDITIONAL STARTING ADDRESSES

INCLUDED IN THIS PROGRAM ARE SEVERAL 'MINI' TESTS TO AID IN
THE CHECKING OF THE UNIQUE NON-PROGRAMABLE HARDWARE TO THE
LPS11 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

SEQ 0009

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 O.
UPON TERMINAING, THE PROGRAM WILL RESUME THE APPROPATE TEST.

16. LPA11 (SYSTEM) DIAGNOSTIC SUMMARY

DIAGNOSTICS FOR THE LPA11 ARE WRITTEN AT THREE LEVELS: (1) TOTAL PDP-11 SYSTEM, (2) LPA11 SYSTEM; AND, (3) LPA11 OPTIONS.

LEVEL 1, IS DESIGNED TO ISOLATE A FAILURE TO THE LPA11 SYSTEM. ALL OPTIONS ON THE PDP-11 ARE EXERCISED.

LEVEL 2 DIAGNOSTICS ISOLATE A FAILURE TO THE INDIVIDUAL OPTION WITHIN THE LPA11. THE LEVEL 2 DIAGNOSTIC IS MD-11-DRLPA. WHEN THE USER RUNS DRLPA HE CAN GENERALLY TELL WHICH OPTION DIAGNOSTIC (LEVEL 3) TO RUN NEXT. M8254 AND M8200-YC ERRORS MAY "LOOK" ALIKE AND DRLPA MAY NOT BE ABLE TO DISTINGUISH BETWEEN THEM. ARBITRATION ERRORS WILL NOT BE DETECTED BY THIS DIAGNOSTIC.

LEVEL THREE DIAGNOSTICS AID IN DETERMINING IF THE ERROR WAS IN FACT ON THE OPTION THE DRLPA SPECIFIED. THE USER MAY "LOOP" ON THE ERROR. WITHIN LEVEL THREE, THERE ARE TWO GROUPS OF DIAGNOSTICS. THE FIRST GROUP REQUIRES NO "EXTRA" WORK BY THE USER IN ORDER TO RUN. GROUP "A" DIAGNOSTICS DO NOT CHECK ARBITRATION, AND REQUIRE EXTRA TIME FOR EXECUTION. THE SECOND GROUP (GROUP "B") REQUIRES THAT THE USER RECONFIGURE THE PDP-11 SYSTEM. THIS RECONFIGURATION INVOLVES CABLING THE UNIBUS TO THE LPA'S I/O BUS.

THE DIAGNOSTIC FOR THE M8254 FALLS INTO THE GROUP "B" CATAGORY.

THE LPA11-KX DIAGNOSTIC KIT WILL INCLUDE:

OPTION	GROUP	DIAG. #	DIAG. TITLE
LPA11-KX	LEVEL 2	MD-11-DRLPA	LPA11-K SYSTEM DIAG.
M8254	"B"	MD-11-DRLPN	M8254 (IPBM) DIAG.
AA11-K	A	MD-11-DRLPB	AA11-K DIAG.
	B	MD-11-DZAAC	AA11-K DIAG.
AR11	A	MD-11-DRLPC	LPA/AR11 DIAG. #1
	A	MD-11-DRLPD	LPA/AR11 DIAG. #2
	A	MD-11-DRLPE	LPA/AR11 DIAG. #3
	B	MD-11-DZARA	AR11 DIAG. #1
	B	MD-11-DZARB	AR11 DIAG. #2
	B	MD-11-DZARC	AR11 DIAG. #3
DR11-K	A	MD-11-DRLPF	LPA/DR11-K DIAG.
	B	MD-11-DZDRG	DR11-K DIAG.
KW11-K	A	MD-11-DRLPG	LPA/KW11-K DIAG.
	B	MD-11-DZKWK	KW11-K DIAG.
LPS11	A	MD-11-DRLPH	LPA/LPS11 DIAG. #1
	A	MD-11-DRLPI	LPA/LPS11 DIAG. #2
	A	MD-11-DRLPJ	LPA/LPS11 DIAG. #3
	B	MD-11-DZLPC	LPS11 DIAG. #1
	B	MD-11-DZLPD	LPS11 DIAG. #2
	B	MD-11-DZLPI	LPS11 DIAG. #3
AD11-K	A	MD-11-DRLPK	LPA/AD11-K DIAG.
	B	MD-11-DZADL	AD11-K DIAG.
M8200-YC	B	MD-11-DZLPL	LPA/M8200-YC BASIC MICRO-CPU R/W TEST
	B	MD-11-DZLPM	LPA/M8200-YC JMP+ROM READ TEST

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                        .REM    [

                                LPA.MAC

WELCOME, THIS DIAGNOSTIC IS ONE IN A SERIES OF DIAGNOSTIC
DESIGNED IN ORDER TO AID YOU IN TESTING THE LPA-11XX OPTION.
I HOPE THAT YOU HAVE READ THE DOCUMENTATION SECTION OF THIS
DIAGNOSTIC.  IF YOU HAVE,YOU KNOW ABOUT ALL OF THE DIAGNOSTICS
THAT ARE AVAILIBLE FOR TESTING THE LPA SYSTEM.

                                GOOD LUCK !

[
.GLOBL  DRLPX2
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30
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                        .TITLE LPS DIAGNOSTIC TEST II MAINDEC-11-DRLPI-A
                        .ENABL  AMA
                        .LIST   ME
                        .NLIST  MC,MD,CND

                        .REM    !

                        THIS IS A LIST OF TESTS DELETED FROM THIS DIAGNOSTIC.
                        THESE TESTS COULD NOT BE DONE THROUGH THE LPA-11.

                        TEST THAT THE SCHMITT TRIGGER INTERRUPTS AT
                              LEVEL INDICATED -1
                        TEST THAT IF PRIORITY IS LOWERED AGAIN NO INTERRUPT
                              SHOULD OCCUR
                        TEST THAT CLOCK INTERRUPTS AT LEVEL INDICATED -1 (MODE 0)
                        TEST THAT THE CLOCK DOES NOT INTERRUPT AT LEVEL INDICATED
                        TEST THAT THE CLOCK DOES NOT INTERRUPT AT LEVEL INDICATED +1
                        TEST THAT THE DIGITAL I/O DOES NOT INTERRUPT
                        TEST THAT THE INPUT CAN INTERRUPT
                        TEST THAT THE OUTPUT DOES INTERRUPT
                        TEST FOR INTERRUPT FROM DIGITAL I/O ON LEVEL
                                    INDICATED -1
                        TEST FOR NO INTERRUPT FROM DIGITAL I/O ON LEVEL INDICATED
                        TEST THAT THE LPSVC DOES NOT INTERRUPT
                        TEST THAT THE DISPLAY DOES INTERRUPT AT LEVEL
                                    INDICATED -1
                        TEST THAT THE DISPLAY DOES NOT INTERRUPT AT LEVEL
                                    INDICATED
                        TEST IMHZ REPEATABILITY
                        TEST 100KHZ REPEATABILITY
                        TEST 10KHZ REPEATABILITY
                        TEST 1KHZ  REPEATABILITY
                        TEST 100HZ REPEATABILITY
                        TEST LINE REPEATABILITY
                        TEST THAT THERE IS A TIME DIFFERENCE BETWEEN FAST
                              INTENSIFY AND NOT INTENSIFY
                        PHOSPHOR AND ERASE TEST

                        !

000000  100000          BIT15=100000
000000  040000          BIT14=40000
000000  020000          BIT13=20000
000000  010000          BIT12=10000
000000  004000          BIT11=4000
000000  002000          BIT10=2000
000000  001000          BIT9=1000
000000  000400          BIT8=400
000000  000200          BIT7=200
000000  000100          BIT6=100
000000  000040          BIT5=40
000000  000020          BIT4=20
000000  000010          BIT3=10
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                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
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                                        ;LOAD TRAP CATCHER INTO LOC'S 0-1000
                    000024                      .=24
000024  014464                         PWRFAL                  ;POWER FAIL HANDLER
000026  000340                         340
                    000060                      .=60
000060  014046                         XTTYIN                  ;TELEPRINTER KEYBOARD ROUTINE
000062  000340                         340
                    000030                      .=30
000030  014566                         EMTSRV                  ;EMT TRAP, EMT DISPATCH SERVICE
000032  000340                         340
000034  015154                         LOGERR                  ;TRAP TRAP, LOGIC ERROR TRAP
000036  000340                         340
                    000046                      .=46
000046  002174                         LOGICAL
                    000052                      .=52
000052  000000                         0
                    000170                      .=170
000170  000000                 SOFTSW: 0                       ;SOFTWARE SWITCH REGISTER VALUE
000172  000000                 SOFTDI: 0
000174  000137  001512                 JMP     MONITR         ;PROGRAM 'RESTART' ADDRESS
000200  000137  001224                 JMP     INIT           ;INITIALIZATION ADDRESS
000204  000137  002236                 JMP     CKTEST         ;MANUAL SA OF CLOCK TEST
000210  000137  007642                 JMP     IOTEST         ;MANUAL SA OF DIGITAL I/O LOGIC TEST
000214  000137  011562                 JMP     VCTEST         ;MANUAL SA OF SCOPE LOGIC TEST
000220  000137  016722                 JMP     VISUAL         ;MANUAL SA OF SCOPE VISUAL TEST
000224  000137  021074                 JMP     ST1            ;MINI-TEST SCHMITT TRIGGER #1
000230  000137  021110                 JMP     ST2            ;MINI-TEST SCHMITT TRIGGER #2
000234  000137  021010                 JMP     CKOVFL         ;MINI-TEST CLOCK OVERFLOW
000240  000137  020660                 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  177776                 PS:     177776
001026  177560                 TKS:    177560
001030  177562                 TKB:    177562
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                                TPS:    177564
                                TPB:    177566
                                SWR:    177570  ;OR LOC. 170 IF RUNNING WITH NO SWITCH REGISTER
                                DISPLA: 177570
                                PASSCT: 0
                                ICOUNT: 2

                                ;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

001074  170415                  GRBHIO: 170415                  ;DIGITAL I/O OUTPUT REGISTER (HIGH BYTE)

                                        ;ADDRESS OF KMC-11 OF LPA-11    THE ADDR FOR KMADO MAY BE
                                        ;                               CHANGED BY THE USER TO REFLECT
                                        ;                               A DIFFERENT KMC-11 ADDR. THE
                                        ;                               REST OF THE ADDRESSES WILL
                                        ;                               BE CHANGED BY THE PROGRAM.
                                        ;

001076                          LPCI:
001076  170460                 KMADO:  .WORD   170460          ;BASE KMC ADDR. MAY BE PATCHED BY USER.

001100                          LPMR:
001100  170461                  KMAD1:  .WORD   170460+1                ;>DO NOT        <;KMC-CSR ADDR
001102                          LPCO:
001102  170462                 KMAD2:  .WORD   170460+2                ;>PATCH         <;
001104                          LPSO:
001104  170463                 KMAD3:  .WORD   170460+3                ;>THIS AREA     <
001106                          LPADL:
001106  170464                 KMAD4:  .WORD   170460+4                ;
001110                          LPADH:
001110  170465                 KMAD5:  .WORD   170460+5                ;>DO NOT        <
001112                          LPMS1:
001112  170466                 KMAD6:  .WORD   170460+6                ;>PATCH         <
001114                          LPMS2:
001114  170467                 KMAD7:  .WORD   170460+7                ;>THIS AREA     <

001116  000300                 VECTOR: .WORD   AVECT1&777      ;BASE VECTOR OF KMC
```

```
                                VECTPS: .WORD   4+AVECT1&777     ;VECOTR ADDR.+2
                                VERSN:  .WORD   4                ;CURRENT VERsION NUMBER OF MICROCODE.
                                .DVLS:  .WORD   0                ;/DEVICE LIST OF I/O ADDR. DEFINED
                                        .BLKW   16.              ;/BY INIT.
                                $BDDAT: 0
                                $GDDAT: 0
                                $ZERO:  0
                                $TMDAT: 0
                                ;LPS DEVICE INTERRUPT VECTORS
                                ADINT:  340                      ;A TO D INTERRUPT VECTOR
                                ADINT1: 342
                                AVECT1= 300
                                $VECT1: .WORD   AVECT1
                                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
```

```
                                        ;THIS ROUTINE IS EXECUTED ON LOADING THE PROGRAM


001224  013706  016632          INIT:   MOV     STACK,SP        ;INIT STACK POINTER=1000
001230  012777  000340  177564          MOV     #340,@PSW
                                        ;
                                        ;THIS SECTION OF CODE HANDLES INITIALIZING LPA-11 FUNCTIONS
                                        ;
001236  010046                          MOV     R0,-(SP)
001240  010146                          MOV     R1,-(SP)
001242  013700  001076                  MOV     KMADO,R0        ;GET KMC-11 ADDRESS.
001246  012701  001100                  MOV     #KMAD1,R1       ;GET ADDR. OF ADDR. LIST.

001252  005200                  64$:    INC     R0              ;UPDATE ADDR.
001254  010021                          MOV     R0,(1)+         ;WRITE ADDR.
001256  020127  001116                  CMP     R1,#KMAD7+2     ;DONE ALL ADDRESSES?
001262  001373                          BNE     64$             ;NO - DO NEXT ADDR.
001264  005037  001124                  CLR     .DVLS           ;CLR ADDR. LIST.
001270  012601                          MOV     (SP)+,R1
001272  012600                          MOV     (SP)+,R0

001274  004737  023054                  JSR     PC,$RESET                       ;CLEAR THE WORLD
001300  012700  001046                  MOV     #ADCS,R0
001304  013701  001000                  MOV     LPSADD,R1
001310  012702  000013                  MOV     #13,R2
001314  010120                  INIT1A: MOV     R1,(0)+
001316  062701  000002                  ADD     #2,R1
001322  005302                          DEC     R2
001324  001373                          BNE     INIT1A
001326  013737  001062  001074          MOV     GRDIO,GRBHIO
001334  052737  000001  001074          BIS     #1,GRBHIO
001342  012700  001176                  MOV     #ADINT,R0
001346  013701  001002                  MOV     LPSVCT,R1
001352  012702  000012                  MOV     #12,R2
001356  010120                  INIT1B: MOV     R1,(0)+
001360  062701  000002                  ADD     #2,R1
001364  005302                          DEC     R2
001366  001373                          BNE     INIT1B
001370  012737  001404  000004          MOV     #1$,@#4         ;LOAD TRAP RETURN
001376  005777  177434                  TST     @SWR            ;TEST IF SWITCH REGISTER
001402  000407                          BR      2$              ;BR IF YES
001404  022626                  1$:     CMP     (SP)+,(SP)+
001406  012737  000170  001036          MOV     #170,$WR        ;LOAD LOC. 170 INTO ADDRESS
001414  012737  000172  001040          MOV     #172,DISPLA
001422  005037  016030          2$:     CLR     NOLEDS

                                ;*      MOV     $ZERO,@ADDBR    ;/ PUT DATA FROM $ZERO TO DEVICE REG ADDBR
001436  000240                          NOP
001440  005737  022102                  TST     $AERR
001444  001403                          BEQ     4$
001446  012737  177777  016030          MOV     #-1,NOLEDS
001454  005737  000042          4$:     TST     @#42
```

```
 310  001460  001402                        BEQ     3$
 311  001462  000137  001542                JMP     INIT2
 312  001466  012777  000100  177332  3$:   MOV     #100,@TKS       ;ENABLE TTY INTERUPTS
 313  001474  005037  016630                CLR     PRINT1
 314  001500  104000                        PRINT                   ;CALL MESSAGE PRINTER VIA 'EMT'
 315  001502  016032                        TITLE                   ;TYPE PROGRAM HEADER.
 316  001504  104000              INITA:    PRINT
 317  001506  016353                        MES4                    ;PRINT THE TEST CALL LETTERS.
 318  001510  000414                        BR      INIT2           ;GO AND AWAIT COMMAND.
 319                               ;MONITOR SUBROUTINE. ENTER VIA '↑C' OR A RESTART AT LOCATION '200'.
 320  001512  004737  023054        MONITR: JSR     PC,$RESET                       ;INITIALIZE ON ENTRY
 321  001516  013706  016632                MOV     STACK,SP        ;RESET STACK POINTER
 322  001522  012777  000340  177272        MOV     #340,@PSW
 323  001530  012777  000100  177270    _   MOV     #100,@TKS       ;ENABLE TTY INTERRUPTS
 324  001536  104000                        PRINT                   ;CALL MESSAGE PRINTER
 325  001540  016541                        CNTRLC                  ;TYPE '↑C'
 326
```

```
001542  012737  014464  000024  INIT2:  MOV     #PWRFAL,@#24        ;SET UP POWER FAIL
001550  012737  000006  000004          MOV     #6,@#4              ;SET UP BUSS ERROR
001556  005037  000006                  CLR     @#6
001562  013777  001200  177406          MOV     ADINT1,@ADINT
001570  005077  177404                  CLR     @ADINT1
001574  013777  001206  177402          MOV     CKVS,@CKV
001602  005077  177400                  CLR     @CKVS
001606  013777  001212  177374          MOV     GRIVSA,@GRIVA
001614  005077  177372                  CLR     @GRIVSA
001620  013777  001216  177366          MOV     GRIVSB,@GRIVB
001626  005077  177364                  CLR     @GRIVSB
001632  005037  015570                  CLR     SCOPEF
001636  012737  001504  016634          MOV     #INITA,AVECTR       ;SET UP '↑A' VECTOR ADDRESS.
001644  004537  015702                  JSR     R5,LEDS
001650  000006                          6
001652  005737  000042                  TST     @#42
001656  001402                          BEQ     .+6
001660  000137  001774                  JMP     WHAT
001664  012777  000100  177134          MOV     #100,@TKS           ;ENABLE KEYBOARD INTERRUPT
001672  104000                          PRINT
001674  016601                          DOT                         ;PRINT '.' TO INDICATE MONITOR READY
001676  104006                          TTYIN                       ;WAIT FOR TTY ENTRY
001700  042737  000040  014446          BIC     #BITS,INBUF         ;ENABLE LOWER CASE
001706  122737  000101  014446          CMPB    #'A,INBUF           ;TEST FOR 'A'
001714  001002                          BNE     .+6
001716  000137  002236                  JMP     CKTEST              ;YES RUN 'CLOCK LOGIC TEST'
001722  122737  000102  014446          CMPB    #'B,INBUF           ;TEST FOR 'B'
001730  001002                          BNE     .+6                 ;NOT 'B'
001732  000137  007642                  JMP     IOTEST              ;YES RUN 'I/O LOGIC TEST'
001736  122737  000103  014446          CMPB    #'C,INBUF           ;TEST FOR 'C'
001744  001002                          BNE     .+6                 ;NOT 'C'
001746  000137  011562                  JMP     VCTEST              ;YES, RUN 'SCOPE LOGIC TEST'
001752  122737  000104  014446          CMPB    #'D,INBUF           ;TEST FOR 'D'
001760  001002                          BNE     .+6                 ;NOT 'D'
001762  000137  016722                  JMP     VISUAL              ;YES, RUN 'VISUAL DISPLAY TEST'
001766  104000                  INIT3:  PRINT                       ;ILLEGAL ENTRY
001770  016604                          QMARK                       ;TYPE '?'
001772  000663                          BR      INIT2               ;WAIT AGAIN
```

```
                                        ;EXECUTE ONLY IF LOCATION 42 IS NON ZERO
                                        
001774  005037  002206          WHAT:   CLR     NOCLK           ;CLEAR NO CLOCK
002000  005037  002210                  CLR     NODIO           ;CLEAR NO DIGITAL I/O
002004  005037  002212                  CLR     NOSCOP          ;CLEAR NO SCOPE
002010  012737  002214  000004          MOV     #WHAT1,@#4
                                        
                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
002026  012737  002222  000004          MOV     #WHAT2,@#4
                                        
                                ;*      MOV     $ZERO,@GRSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG GRSTAT
002044  012737  002230  000004          MOV     #WHAT3,@#4
                                        
                                ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
002062  012737  000006  000004          MOV     #6,@#4
002070  005737  002206                  TST     NOCLK           ;TEST FOR NO CLOCK
002074  001410                        BEQ     WHATA           ;BRANCH IF CLOCK
002076  005737  002210                  TST     NODIO           ;TEST FOR NO DIGITAL I/O
002102  001405                        BEQ     WHATA           ;BRANCH IF DIGITAL I/O
002104  005737  002212                  TST     NOSCOP          ;TEST FOR NO SCOPE
002110  001402                        BEQ     WHATA           ;BRANCH IF SCOPE
002112  000000                        HALT                    ;FATAL ERROR, NO SLAVE SYNC FROM ANY LPS-11 DEVICE
002114  000777                        BR      .               ;HANG HERE
                                        
002116  005737  002206          WHATA:  TST     NOCLK           ;TEST FOR CLOCK
002122  001002                        BNE     WHATB           ;BRANCH IF NO CLOCK
002124  000137  002246                  JMP     CTEST1          ;TEST CLOCK
002130  005737  002210          WHATB:  TST     NODIO           ;TEST FOR DIGITAL I/O
002134  000402                        BR      WHATC           ;DON't RUN LPS-11-DR IN CHAIN MODE <NEWER LPS-11-DRA>
002136  000137  007652                  JMP     ITEST1          ;RUN DIGITAL I/O TEST
002142  005737  002212          WHATC:  TST     NOSCOP          ;TEST FOR SCOPE
002146  001004                        BNE     WHATE           ;BRANCH IF NO SCOPE
002150  000137  011572                  JMP     VTEST1          ;TEST SCOPE LOGIC
002154  000137  016732          WHATD:  JMP     VTEST2          ;TEST VISUAL
002160  004737  023054          WHATE:  JSR     PC,$RESET
002164  004737  023054                  JSR     PC,$RESET
002170  013700  000042                  MOV     @#42,R0
002174  004710                LOGICAL:        JSR     PC,(0)
002176  000240                          NOP
002200  000240                          NOP
002202  000240                          NOP
002204  000673                          BR      WHAT
                                        
002206  000000                NOCLK:  0
002210  000000                NODIO:  0
002212  000000                NOSCOP: 0
                                        
002214  005137  002206          WHAT1:  COM     NOCLK
002220  000002                          RTI
002222  005137  002210          WHAT2:  COM     NODIO
002226  000002                          RTI
002230  005137  002212          WHAT3:  COM     NOSCOP
002234  000002                          RTI
```

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

002236  004737  023054          CKTEST: JSR     PC,$RESET
002242  104000                          PRINT
002244  016216                          MES2                            ;IDENTIFY TEST
002246  005037  001042          CTEST1: CLR     PASSCT
002252  013777  001042  176560  BEGIN:  MOV     PASSCT,@DISPLA
002260  013706  016632                  MOV     STACK,SP
002264  005077  176532                  CLR     @PSW
002270  012737  002326  015572          MOV     #KWT0+2,RETURN          ;SET UP RESTART OF PROGRAM
002276  052777  000100  176522          BIS     #BIT6,@TKS

                                ;TEST FOR NO BUSS ERRORS

                                ;*      MOV     $ZERO,@CSR              ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     $ZERO,@CSB              ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB

                                ;TEST THE COUNTER PRESET BUFFER

002324  104002                  KWT0:   SCOPE
002326  012737  177777  001174          MOV     #-1,$TMDAT              ;LOAD PRESET BUFFER

                                ;*      MOV     $TMDAT,@CSB             ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB

                                ;*      MOV     @CSB,$BDDAT             ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
002354  023737  001174  001166          CMP     $TMDAT,$BDDAT
002362  001401                          BEQ     .+4                     ;BRANCH IF EQUAL
002364  104400                          ERROR                           ;ERROR, COUNTER PRESET FAILED TO LOAD

002366  104002                  KWT2:   SCOPE
002370  012737  052525  001174          MOV     #52525,$TMDAT           ;LOAD PRESET BUFFER

                                ;*      MOV     $TMDAT,@CSB             ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB

                                ;*      MOV     @CSB,$BDDAT             ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
002416  023737  001174  001166          CMP     $TMDAT,$BDDAT
002424  001401                          BEQ     .+4                     ;BRANCH IF EQUAL
002426  104400                          ERROR                           ;ERROR, COUNTER PRESET FAILED TO LOAD

002430  104002                  KWT3:   SCOPE
002432  012737  025252  001174          MOV     #25252,$TMDAT           ;LOAD PRESET

                                ;*      MOV     $TMDAT,@CSB             ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB

                                ;*      MOV     @CSB,$BDDAT             ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
002460  023737  001174  001166          CMP     $TMDAT,$BDDAT
002466  001401                          BEQ     .+4                     ;BRANCH IF EQUAL
002470  104400                          ERROR                           ;ERROR, COUNTER PRESET FAILED TO LOAD

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

```
 473
 474  002472  104003                    KWT4:   SCOPE1
 475  002474  012737  177777  001174            MOV     #-1,$TMDAT
 476  002502  004737  023054                    JSR     PC,$RESET
 477
 478                                      ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
 479  002516  005737  001166                    TST     $BDDAT
 480  002522  001401                            BEQ     .+4
 481  002524  104400                            ERROR                   ;ERROR, INIT FAILED TO CLEAR CSB
 482
 483  002526  052777  000100  176272            BIS     #BIT6,@TKS
```

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

002534  104003                KWT5:   SCOPE1
002536  012737  000001  001174        MOV     #BIT0,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
002564  023737  001174  001166        CMP     $TMDAT,$BDDAT
002572  001401                        BEQ     .+4
002574  104400                        ERROR                           ;ERROR COUNTER ENABLE FAILED TO sET

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

002576  104002                KWT6:   SCOPE
002600  012737  000002  001174        MOV     #2,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
002626  023737  001174  001166        CMP     $TMDAT,$BDDAT
002634  001401                        BEQ     .+4
002636  104400                        ERROR                           ;ERROR, CSR NOT = 2

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

002640  104002                KWT7:   SCOPE
002642  012737  000004  001174        MOV     #4,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
002670  023737  001174  001166        CMP     $TMDAT,$BDDAT
002676  001401                        BEQ     .+4
002700  104400                        ERROR                           ;ERROR, CSR NOT = 4

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

002702  104002                KWT8:   SCOPE
002704  012737  000010  001174        MOV     #10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
002732  023737  001174  001166        CMP     $TMDAT,$BDDAT
002740  001401                        BEQ     .+4
002742  104400                        ERROR                           ;ERROR, CSR NOT = 10
```

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

002744  104002                KWT10:  SCOPE
002746  012737  000100  001174        MOV     #100,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEViCE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
002774  023737  001174  001166        CMP     $TMDAT,$BDDAT
003002  001401                       BEQ     .+4
003004  104400                       ERROR                           ;ERROR, CSR NOT = 100

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

003006  104002                KWT11:  SCOPE
003010  012737  000400  001174        MOV     #400,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003036  023737  001174  001166        CMP     $TMDAT,$BDDAT
003044  001401                       BEQ     .+4
003046  104400                       ERROR                           ;ERROR, CSR NOT = 400

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

003050  104002                KWT12:  SCOPE
003052  012737  001000  001174        MOV     #1000,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003100  023737  001174  001166        CMP     $TMDAT,$BDDAT
003106  001401                       BEQ     .+4
003110  104400                       ERROR                           ;ERROR, CSR NOT = 1000

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

003112  104002                KWT14:  SCOPE
003114  012737  020000  001174        MOV     #20000,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003142  023737  001174  001166        CMP     $TMDAT,$BDDAT
003150  001401                       BEQ     .+4
003152  104400                       ERROR                           ;ERROR, CSR NOT = 200000
```

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

003154  104002                 KWT15:  SCOPE
003156  012737  040000  001174         MOV     #40000,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003204  023737  001174  001166         CMP     $TMDAT,$BDDAT
003212  001401                        BEQ     .+4
003214  104400                        ERROR                           ;ERROR, CSR NOT = 40000

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

003216  104002                 KWT16:  SCOPE
003220  012737  000200  001174         MOV     #BIT7,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003246  105737  001166                 TSTB    $BDDAT
003252  100401                        BMI     .+4
003254  104400                        ERROR                           ;ERROR, CSR NOT = 200

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003276  005737  001166                 TST     $BDDAT
003302  001401                        BEQ     .+4
003304  104400                        ERROR                           ;ERROR CSR NOT = 0

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

003306  104002                 KWT17:  SCOPE
003310  012737  100000  001174         MOV     #BIT15,$TMDAT           ;SET BIT 15

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003336  005737  001166                 TST     $BDDAT
003342  100401                        BMI     .+4
003344  104400                        ERROR                           ;ERROR CSR NOT 100000

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003366  005737  001166                 TST     $BDDAT
003372  001401                        BEQ     .+4
003374  104400                        ERROR                           ;ERROR CSR NOT = 0

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

003376  104002                 KWT18:  SCOPE
```

```
636
637                                     ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
638  003410  005037  016674                     CLR     TEMP
639  003414                          KWT18A:
640
641                                     ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
642  003424  005737  001166                     TST     $BDDAT
643  003430  100001                             BPL     .+4
644  003432  104400                             ERROR                   ;ERROR ST1 SET IN ERROR
645  003434  105237  016674                     INCB    TEMP
646  003440  001365                             BNE     KWT18A
```

```
                                        ;TEST MAINT ST1 CAN SET ST1 FLAG
003442  104003                  KWT19:  SCOPE1
                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
003464  052737  010000  001174          BIS     #BIT12,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003512  005737  001166                  TST     $BDDAT
003516  100401                          BMI     .+4
003520  104400                          ERROR                   ;ERROR, ST1 FLAG FAILED TO SET

                                        ;TEST THAT WHEN ST1 FIRES AND ST1 START ENABLE =1
                                        ; THAT THE ENABLE COUNTER GETS SET
003522  104002                  KWT20:  SCOPE
                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
003534  012737  020000  001174          MOV     #BIT13,$TMDAT           ;SET ST1 START ENABLE
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
003562  052737  010000  001174          BIS     #BIT12,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003610  032737  000001  001166          BIT     #BIT0,$BDDAT
003616  001001                          BNE     .+4
003620  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

003622  104002                  KWT22:  SCOPE

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
003644  012737  001000  001174          MOV     #BIT9,$TMDAT            ;LOAD MODE

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
003672  052737  002000  001174          BIS     #BIT10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
003720  105737  001166                  TSTB    $BDDAT
003724  100401                          BMI     .+4
003726  104400                          ERROR                           ;ERROR, ST 2 FAILED TO SET BIT 7

                                        ;TEST THAT THE COUNTER CAN BE LOADED

003730  104002                  KWT23:  SCOPE

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
003742  012737  177777  001174          MOV     #-1,$TMDAT              ;LOAD PRESET AND COUNTER

                                ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
003760  012737  001401  001174          MOV     #1401,$TMDAT            ;LOAD MODE AND ENABLE COUNT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEVICE REG CSR

                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
004016  052737  002000  001174          BIS     #BIT10,$TMDAT           ;FIRE ST

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004044  022737  177777  001166          CMP     #-1,$BDDAT              ;TEST THE NUMBER
004052  001401                          BEQ     .+4
004054  104400                          ERROR                           ;ERROR, COUNTER FAILED TO LOAD PROPERLY

                                        ;TEST THAT THE COUNTER CAN BE LOADED

004056  104002                  KWT24:  SCOPE

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
004070  012737  125252  001174          MOV     #125252,$TMDAT          ;LOAD PRESET AND COUNTER

                                ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
004106  012737  001401  001174          MOV     #1401,$TMDAT            ;LOAD MODE AND ENABLE COUNT
```

```
                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                        ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
                                        ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMdAT.
004144  052737  002000  001174                BIS     #BIT10,$TMDAT
                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                        ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004172  022737  125252  001166                CMP     #125252,$BDDAT
004200  001401                              BEQ     .+4
004202  104400                              ERROR                           ;ERROR, COUNTER FAILED TO LOAD PROPERLY

                                        ;TEST THAT THE COUNTER CAN BE LOADED
004204  104002                      KWT25:  SCOPE
                                        ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
004216  012737  052525  001174                MOV     #52525,$TMDAT           ;LOAD PRESET AND COUNTER
                                                                                ;LOAD MODE AND ENABLE COUNT
                                                                                ;SHOULD ONLY CLEAR PRESET
                                        ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
004234  012737  001401  001174                MOV     #1401,$TMDAT
                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                        ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
                                        ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
004272  052737  002000  001174                BIS     #BIT10,$TMDAT
                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                        ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004320  022737  052525  001166                CMP     #52525,$BDDAT           ;TEST THE NUMBER
004326  001401                              BEQ     .+4
004330  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>
004332  005037  016674                  CLR     TEMP
004336  104002                KWT26:    SCOPE
                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
004360  012737  001002  001174          MOV     #1002,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
004376                          KWT26A:
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
004406  052737  002000  001174          BIS     #BIT10,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004434  023737  001166  016674          CMP     $BDDAT,TEMP
004442  001402                        BEQ     .+6
004444  104400                        ERROR                   ;MAINT COUNT FAILED
004446  000426                        BR      KWT30
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
004460  105737  001166                TSTB    $BDDAT          ;TEST DONE FLAG
004464  100402                        BMI     1$
004466  104400                        ERROR                   ;ERROR, CKBF TO BF FAILED TO SET DONE
004470  000415                        BR      KWT30
004472                          1$:           ;MAINT COUNT
004472  052737  004000  001166          BIS     #BIT11,$BDDAT
004500  042737  000200  001166          BIC     #BIT7,$BDDAT
                                ;*      MOV     $BDDAT,@CSR     ;/ PUT DATA FROM $BDDAT TO DEVICE REG CSR
004516  005237  016674                  INC     TEMP
004522  001325                        BNE     KWT26A          ;BRANCH IF NOT FULL COUNT
```

```
                                        ;TEST THAT THE COUNTER COUNTS UP
                                        ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
                                        ;USE MAINT COUNT <100KHZ>
                                        ;USE MAINT ST2
                                        ;USE MODE 2
                                        ;RATE #100KHZ

004524  104001                  KWT30:  SCOPE0

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
004546  012737  001004  001174          MOV     #1004,$TMDAT            ;LOAD STATUS

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
004574  052737  002000  001174          BIS     #BIT10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEVICE REG CSR

                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004622  005737  001166                  TST     $BDDAT
004626  001401                          BEQ     .+4
004630  104400                          ERROR                   ;ERROR PRESET INCREMENTED IN ERROR
004632  012737  000012  016642          MOV     #10.,COUNT      ;SET UP A COUNTER
004640                          KWT30A:

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMdAT.
004650  052737  004000  001174          BIS     #BIT11,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
004666  005337  016642                  DEC     COUNT
004672  001362                          BNE     KWT30A          ;BR

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
004704  052737  002000  001174          BIS     #BIT10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEViCE REG CSR

                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
004732  022737  000001  001166          CMP     #1,$BDDAT
004740  001401                          BEQ     .+4
004742  104400                          ERROR                   ;ERROR, CLOCK PRESET BUFFER
                                                                ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
                                                                ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC


                                        ;TEST THAT THE COUNTER COUNTS UP
                                        ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
                                        ;USE MAINT COUNT <10KHZ>
                                        ;USE MAINT ST2
                                        ;USE MODE 2
                                        ;RATE #10KHZ
```

```
                                KWT31:  SCOPEO
                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
004766  012737  001006  001174          MOV     #1006,$TMDAT            ;LOAD STATUS
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMdAT.
005014  052737  002000  001174          BIS     #BIT10,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005042  005737  001166                  TST     $BDDAT
005046  001401                          BEQ     .+4
005050  104400                          ERROR                   ;ERROR PRESET INCREMENTED IN ERROR
005052  012737  000144  016642          MOV     #100.,COUNT             ;SET UP A COUNTER
005060                          KWT31A:
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005070  052737  004000  001174          BIS     #BIT11,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
005106  005337  016642                  DEC     COUNT
005112  001362                          BNE     KWT31A                  ;BR
                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005124  052737  002000  001174          BIS     #BIT10,$TMDAT
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005152  022737  000001  001166          CMP     #1,$BDDAT
005160  001401                          BEQ     .+4
005162  104400                          ERROR                           ;ERROR, CLOCK PRESET BUFFER
                                                        ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
                                                        ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
```

```
                                        ;TEST THAT THE COUNTER COUNTS UP
                                        ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
                                        ;USE MAINT COUNT <1KHZ>
                                        ;USE MAINT ST2
                                        ;USE MODE 2
                                        ;RATE #1KHZ

005164  104001                  KWT32:  SCOPE0

                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
005206  012737  001010  001174          MOV     #1010,$TMDAT            ;LOAD STATUS

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005234  052737  002000  001174          BIS     #BIT10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMdAT TO DEVICE REG CSR

                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005262  005737  001166                  TST     $BDDAT
005266  001401                          BEQ     .+4
005270  104400                          ERROR                           ;ERROR PRESET INCREMENTED IN ERROR
005272  012737  001750  016642          MOV     #1000.,COUNT            ;SET UP A COUNTER
005300                          KWT32A:

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEViCE REG CSR,PUT DATA IN $TMDAT.
005310  052737  004000  001174          BIS     #BIT11,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
005326  005337  016642                  DEC     COUNT
005332  001362                          BNE     KWT32A                  ;BR

                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005344  052737  002000  001174          BIS     #BIT10,$TMDAT

                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005372  022737  000001  001166          CMP     #1,$BDDAT
005400  001401                          BEQ     .+4
005402  104400                          ERROR                           ;ERROR, CLOCK PRESET BUFFER
                                                        ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
                                                        ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC

                                        ;TEST THAT THE COUNTER COUNTS UP
                                        ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
                                        ;USE MAINT COUNT <100HZ>
                                        ;USE MAINT ST2
                                        ;USE MODE 2
                                        ;RATE #100HZ
```

```
                                                KWT33:  SCOPEO
                                                ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
                                                ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
005426  012737  001012  001174                          MOV     #1012,$TMDAT            ;LOAD STATUS
                                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005454  052737  002000  001174                          BIS     #BIT10,$TMDAT
                                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005502  005737  001166                                  TST     $BDDAT
005506  001401                                          BEQ     .+4
005510  104400                                          ERROR                   ;ERROR PRESET INCREMENTED IN ERROR
005512  012737  023420  016642                          MOV     #10000.,COUNT           ;SET UP A COUNTER
005520                                          KWT33A:
                                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005530  052737  004000  001174                          BIS     #BIT11,$TMDAT
                                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
005546  005337  016642                                  DEC     COUNT
005552  001362                                          BNE     KWT33A                  ;BR
                                                ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
005564  052737  002000  001174                          BIS     #BIT10,$TMDAT
                                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
                                                ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
005612  022737  000001  001166                          CMP     #1,$BDDAT
005620  001401                                          BEQ     .+4
005622  104400                                          ERROR                   ;ERROR, CLOCK PRESET BUFFER
                                                                        ;COUNTED IN ERROR, FAULT IS PROBILY IN THE
                                                                        ;CLOCK DOWN COUNT OR RATE SELECTION LOGIC
```

```
1012
1013                                    ;TEST THAT THE COUNTER COUNTS UP
1014                                    ;MAKE SURE THAT THE CLOCK SELECTION LOGIC WORKS
1015                                    ;USE MODE 2
1016                                    ;USE MAINT ST1
1017                                    ;RATE #EXTURNAL
1018
1019  005624  005037  016674                    CLR     TEMP
1020  005630  104001                    KWT34:  SCOPEO
1021
1022                                    ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
1023
1024                                    ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
1025  005652  012737  001014  001174            MOV     #1014,$TMDAT            ;MODE 2 EXTURNAL CLOCK RATE
1026
1027                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1028  005670                            KWT34A:
1029
1030                                    ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
1031  005700  052737  002000  001174            BIS     #BIT10,$TMDAT
1032
1033                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1034
1035                                    ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
1036  005726  023737  001166  016674            CMP     $BDDAT,TEMP
1037  005734  001402                            BEQ     .+6
1038  005736  104400                            ERROR                   ;EXTURNAL CLOCOIDAILED TO COUNT
1039  005740  000416                            BR      KWT35           ; THE COUNTER, CHECK THE RATE SELECTION
1040
1041                                    ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
1042  005752  052737  010000  001174            BIS     #BIT12,$TMDAT
1043
1044                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1045  005770  005237  016674                    INC     TEMP
1046  005774  001335                            BNE     KWT34A
1047
1048                                    ;TEST EXTURNAL INTERVAL FROM ZERO BASE (MODE 3)
1049
1050  005776  104001                    KWT35:  SCOPEO
1051
1052                                    ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
1053  006010  012737  025252  001174            MOV     #25252,$TMDAT
1054
1055                                    ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
1056  006026  012737  001402  001174            MOV     #1402,$TMDAT
1057
1058                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1059
1060                                    ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
1061  006054  052737  002000  001174            BIS     #BIT10,$TMDAT
1062
1063                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1064
1065                                    ;*      MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
```

```
1066  006102  022737  025252  001166          CMP     #25252,$BDDAT
1067  006110  001401                          BEQ     .+4
1068  006112  104400                          ERROR                           ;ERROR, MODE 3 FAILED TO LOAD CLOCK
1069                                                                          ; PRESET BUFFER
1070
1071                                  ;*        MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
1072  006124  052737  002000  001174          BIS     #BIT10,$TMDAT
1073
1074                                  ;*        MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1075
1076                                  ;*        MOV     @CSB,$BDDAT     ;/READ DEVICE REG CSB,PUT DATA IN $BDDAT.
1077  006152  022737  000000  001166          CMP     #0,$BDDAT
1078  006160  001401                          BEQ     .+4
1079  006162  104400                          ERROR                           ;ERROR, MODE 3 FAILED TO ZERO CLOCK COUNTER
```

```
1080
1081                                    ;TEST THAT RESET CLEARS RATE SELECT BITS
1082
1083  006164  104002                    KWT36:  SCOPE
1084  006166  012737  000016  001174            MOV     #BIT3!BIT2!BIT1,$TMDAT  ;SET MODE BITS
1085
1086                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1087  006204  004737  023054                    JSR     PC,$RESET
1088
1089                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1090  006220  005737  001166                    TST     $BDDAT
1091  006224  001401                            BEQ     .+4
1092  006226  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR RATE BITS
1093
1094                                    ;TEST THAT RESET CLEARS MODE SELECT BITS
1095
1096  006230  104003                    KWT37:  SCOPE1
1097  006232  012737  001400  001174            MOV     #BIT9!BIT8,$TMDAT               ;SET MODE BITS
1098
1099                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1100  006250  004737  023054                    JSR     PC,$RESET
1101
1102                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1103  006264  005737  001166                    TST     $BDDAT
1104  006270  001401                            BEQ     .+4
1105  006272  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR MODE BITS
1106
1107                                    ;TEST THAT RESET CLEARS ST1 FLAG,ST1 INTERRUPT ENABLE AND ST1 START ENABLE
1108
1109  006274  104003                    KWT38:  SCOPE1
1110  006276  012737  160000  001174            MOV     #BIT15!BIT14!BIT13,$TMDAT ;SET ST1 FLAG,INT ENABLE AND ST1 START ENABLE
1111
1112                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1113  006314  004737  023054                    JSR     PC,$RESET
1114
1115                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1116  006330  005737  001166                    TST     $BDDAT
1117  006334  001401                            BEQ     .+4
1118  006336  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR ST1 LOGIC
1119
1120                                    ;TEST THAT RESET CLEARS DONe FLAG AND DONE INTERRUPT ENABLE
1121
1122  006340  104003                    KWT39:  SCOPE1
1123  006342  012737  000300  001174            MOV     #BIT7!BIT6,$TMDAT       ;SET DONE FLAG AND INTERRUPT ENABLE
1124
1125                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1126  006360  004737  023054                    JSR     PC,$RESET
1127
1128                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1129  006374  005737  001166                    TST     $BDDAT
1130  006400  001401                            BEQ     .+4
1131  006402  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR DONE FLAG OR DONE
1132
1133                                    ;TEST THAT RESET CLEARS COUNTER ENABLE
```

```
1134
1135  006404  104003                    KWT40:  SCOPE1
1136  006406  012737  000001  001174            MOV     #BIT0,$TMDAT            ;LOAD COUNTER ENABLE
1137
1138                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1139  006424  004737  023054                    JSR     PC,$RESET
1140
1141                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1142  006440  005737  001166                    TST     $BDDAT
1143  006444  001401                            BEQ     .+4
1144  006446  104400                            ERROR                   ;ERROR, RESET FAILED TO CLEAR COUNTER ENABLE
1145
1146
1147  006450  052777  000100  172350            BIS     #BIT6,@TKS
```

```
                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES (MODE 0)
                                        ;TEST THAT CLOCK ENABLE DOES CLEAR ON DONE FLAG
                                        ;1MHZ
006456  104003                  KWT41:  SCOPE1
006460  012737  000003  007632          MOV     #3,RATE                 ;SELECT MODE 0, 1MHZ., GO
006466  004737  007130                  JSR     PC,UPCNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
006502  105737  001166                  TSTB    $BDDAT
006506  100401                          BMI     .+4
006510  104400                          ERROR                           ;ERROR, 1MHZ FAILED TO COUNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
006522  032737  000001  001166          BIT     #BIT0,$BDDAT
006530  001401                          BEQ     .+4
006532  104400                          ERROR                           ;ERROR, MODE 0 FAILED TO CLEAR COUNTER ENABLE

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;100 KHZ
006534  104003                  KWT42:  SCOPE1
006536  012737  000005  007632          MOV     #5,RATE                 ;SELECT MODE 0, 100KHZ., GO
006544  004737  007130                  JSR     PC,UPCNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
006560  105737  001166                  TSTB    $BDDAT
006564  100401                          BMI     .+4
006566  104400                          ERROR                           ;ERROR, 100KHZ. FAILED TO COUNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
006600  032737  000001  001166          BIT     #BIT0,$BDDAT
006606  001401                          BEQ     .+4
006610  104400                          ERROR                           ;ERROR MODE 0 FAILED TO cLEAR COUNT ENABLE

                                        ;10 KHZ
006612  104003                  KWT43:  SCOPE1
006614  012737  000007  007632          MOV     #7,RATE                 ;SELECT MODE 0, 10KHZ., GO
006622  004737  007130                  JSR     PC,UPCNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
006636  105737  001166                  TSTB    $BDDAT
006642  100401                          BMI     .+4
006644  104400                          ERROR                           ;ERROR, 10 KHZ. FAILED TO COUNT

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;1KHZ
006646  104003                  KWT44:  SCOPE1
006650  012737  000011  007632          MOV     #11,RATE                ;SELECT MODE 0, 1 KHZ, GO
006656  004737  007130                  JSR     PC,UPCNT
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
```

```
  1202  006672  105737  001166          TSTB    $BDDAT
  1203  006676  100401                  BMI     .+4
  1204  006700  104400                  ERROR                   ;ERROR, 1KHZ FAILED TO COUNT
  1205
```

```
1206                                    ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
1207                                    ;TEST 100 HZ
1208
1209  006702  104003                    KWT45:  SCOPE1
1210  006704  012737  000013  007632            MOV     #13,RATE                ;SELECT MODE 0, 100 HZ, GO
1211  006712  004737  007130                    JSR     PC,UPCNT
1212
1213                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1214  006726  105737  001166                    TSTB    $BDDAT
1215  006732  100401                            BMI     .+4
1216  006734  104400                            ERROR                           ;ERROR, 100HZ FAILED TO COUNT
1217
1218                                    ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
1219                                    ;LINE FREQ.
1220
1221  006736  104003                    KWT46:  SCOPE1
1222  006740  012737  000017  007632            MOV     #17,RATE                ;SELECT MODE 0, LINE FREQ, GO
1223  006746  004737  007130                    JSR     PC,UPCNT
1224
1225                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1226  006762  105737  001166                    TSTB    $BDDAT
1227  006766  100401                            BMI     .+4
1228  006770  104400                            ERROR                           ;ERROR, LINE FREQUENCY FAILED TO COUNT
1229
1230                                    ;REPEAT T12 WITH MODE 1
1231                                    ;TEST THAT CLOCK ENABLE DOES NOT CLEAR ON DONE
1232                                    ; 1 MHZ.
1233
1234  006772  104003                    KWT47:  SCOPE1
1235  006774  012737  000403  007632            MOV     #403,RATE               ;SELECT MODE 1, 1MHZ., GO
1236  007002  004737  007130                    JSR     PC,UPCNT
1237
1238                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1239  007016  105737  001166                    TSTB    $BDDAT
1240  007022  100401                            BMI     .+4
1241  007024  104400                            ERROR                           ;ERROR, 1 MHZ. FAILED TO COUNT
1242                                                                            ; MODE 1
1243
1244                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1245  007036  032737  000001  001166            BIT     #BIT0,$BDDAT
1246  007044  001001                            BNE     .+4
1247  007046  104400                            ERROR                           ;MODE 1 CLEARED COUNTER ENABLE IN ERROR
1248
1249                                    ;100KHZ.
1250
1251  007050  104003                    KWT48:  SCOPE1
1252  007052  012737  000405  007632            MOV     #405,RATE               ;MODE 1 100KHZ GO
1253  007060  004737  007130                    JSR     PC,UPCNT
1254
1255                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1256  007074  105737  001166                    TSTB    $BDDAT
1257  007100  100401                            BMI     .+4
1258  007102  104400                            ERROR                           ;ERROR, 100KHZ FAILED TO cOUNT MODE 1
1259
```

```
1260                                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
1261   007114  032737  000001  001166                           BIT     #BIT0,$BDDAT
1262   007122  001001                                         BNE     .+4
1263   007124  104400                                         ERROR                   ;MODE 1 CLEARED COUNTER ENABLE IN ERROR
1264   007126  000453                                         BR      KWT49
1265
```

```
                                        ;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

007130                                  UPCNT:

                                        ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
007140  012737  177776  001174            MOV     #-2,$TMDAT              ;MOVE -2 INT PRESET

                                        ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
007156  013737  007632  001174            MOV     RATE,$TMDAT             ;LOAD RATE AND ENABLE CLOCK

                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
007174  005037  016644                    CLR     DELAY                   ;DELAY
007200                                  UPCNTA:

                                        ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
007210  105737  001166                    TSTB    $BDDAT
007214  100417                            BMI     UPCNTB                  ;

                                        ;*      MOV     @CSR,$GDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $GDDAT.

                                        ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
007236  023737  001170  001166            CMP     $GDDAT,$BDDAT
007244  062737  000001  016644            ADD     #1,DELAY                ;
007252  001352                            BNE     UPCNTA                  ;
007254  000207                          UPCNTB: RTS     7                       ;EXIT

007256                                  KWT49:
007256                                  KWT52:
007256  104003                          KWT62:  SCOPE1
007260  004537  007336                        JSR     R5,REPEAT               ;
007264  000016                                16                              ;CLOCK RATE
007266  000001                                1                               ;CLOCK DEV
007270  000001                                1                               ;MIN. COUNT
007272  000000                                0                               ;DELAY
007274  104400                                ERROR                           ;ERROR, FAILED TO REACH MIN COUNT
007276  003401                                BLE     .+4
007300  104400                                ERROR                           ;ERROR, CLOCK REPEATABILITY >+1

                                        ;BELL ON PASS COMPLETE

007302  104003                          TSTEND: SCOPE1                  ;LOGICAL END OF THE TEST
007304  004737  023054                        JSR     PC,$RESET
007310  005737  000042                        TST     @#42
007314  001402                                BEQ     HERE
007316  000137  002130                        JMP     WHATB

007322  004737  015650                HERE:   JSR     PC,BELL                 ;REPORT END OF PASS
007326  005237  001042                        INC     PASSCT
007332  000137  002252                        JMP     BEGIN
```

```
                                        ;SUBROUTINE TO TEST THE CLOCK REPEATIBILITY
                                        ;FIRST CLEAR CLOCK STATUS AND PRESET BUFFER
                                        ; THEN ENABLE THE CLOCK TO COUNT AT A RATE.
                                        ; DECREMENT R0 FOR SOME PERIOD OF TIME, WHEN R0 = 0
                                        ; FIRE THE ST #2 AND CAUSE THE COUNTER TO LOAD THE PRESET REGISTER
                                        ; SAVE THE PRESET VALUE AND REPEAT THIS OPERATION AGAIN
                                        ;THEN COMPARE THE FIRST TIMED VALUE TO THE SECOND TIMED VALUE
                                        ; <MACHINE AND MEMORY TIMING NOT IMPORTANT>
                                        ; TO BE WITHIN THE VALUE SPECIFIED BY LOCATION CNTDEV
                                        ; IF GREATER THAN EXPECTED IT IS AN ERROR.
                                        ;ALSO TEST THAT THE COUNTER HAS REACHED A MIN. COUNT

007336                                  REPEAT:

                                        ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR

                                        ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
007356  012537  007632                          MOV     (R5)+,RATE              ;SET UP RATE
007362  012537  007634                          MOV     (R5)+,CNTDEV            ;SET UP CNT. DEV
007366  012537  007636                          MOV     (R5)+,MINCNT            ;SET UP MIN COUNT
007372  012537  007640                          MOV     (R5)+,CKDLY             ;SAVE DELAY
007376  004737  007466                          JSR     PC,10$                  ;DUMMY - TO CHARGE THE "CACHE"
007402  004737  007466                          JSR     PC,10$                  ;ENABLE THE CLOCK
007406  010037  001170                          MOV     R0,$GDDAT               ;SAVE 1ST RESULTS
007412  004737  007466                          JSR     PC,10$                  ;ENABLE THE CLOCK
007416  010037  001166                          MOV     R0,$BDDAT               ;SAVE THE 2ND RESULT
007422  013700  001170                          MOV     $GDDAT,R0               ;GET 1ST RESULT
007426  163700  001166                          SUB     $BDDAT,R0               ;SUBTRACT SECOND RESULT
007432  100001                                  BPL     3$
007434  005400                                  NEG     R0
007436  023737  001166  007636  3$:             CMP     $BDDAT,MINCNT           ;COMPARE TO MIN. COUNT
007444  002004                                  BGE     4$                      ;BRANCK IF GREATER
007446  013737  007636  016674                  MOV     MINCNT,TEMP             ;LOAD TEMP FOR TYPE-OUT
007454  000205                                  RTS     R5
007456  005725                          4$:     TST     (R5)+                   ;UPDATE THE STACK
007460  020037  007634                          CMP     R0,CNTDEV               ;COMPARE TO DEVEATION
007464  000205                                  RTS     R5

007466  013700  007640                  10$:    MOV     CKDLY,R0                ;LOAD DELAY COUNT
007472  052737  003000  007632                  BIS     #BIT10!BIT9,RATE        ;ENABLE ST MODE
007500  013737  007632  001174                  MOV     RATE,$TMDAT             ;LOAD RATE

                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR

                                        ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
007526  005237  001174                          INC     $TMDAT

                                        ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
007542  005300                          1$:     DEC     R0                      ;DELAY
007544  001376                                  BNE     1$

                                        ;*      MOV     @CSR,$TMDAT     ;/READ DEVICE REG CSR,PUT DATA IN $TMDAT.
007556  052737  002000  001174                  BIS     #BIT10,$TMDAT
```

```
1373
1374                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
1375
1376                                    ;*      MOV     @CSB,$TMDAT     ;/READ DEVICE REG CSB,PUT DATA IN $TMDAT.
1377  007604  013700  001174                       MOV     $TMDAT,R0
1378
1379                                    ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
1380
1381                                    ;*      MOV     $ZERO,@CSB      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSB
1382  007630  000207                       RTS     PC                      ;EXIT
1383
1384  007632  000000                RATE:   0                               ;CLOCK RATE
1385  007634  000000                CNTDEV: 0                               ;CLOCK DEV.
1386  007636  000000                MINCNT: 0                               ;MIN. COUNT
1387  007640  000000                CKDLY:  0
```

```
1388
1389                                    ;*************************************************************
1390                                    ;DIGITAL INPUT-OUTPUT LOGIC TEST
1391                                    ;*************************************************************
1392
1393  007642  004737  023054           IOTEST: JSR     PC,$RESET
1394  007646  104000                           PRINT
1395  007650  016243                           MES3                    ;IDENTIFY TEST
1396  007652  005037  001042           ITEST1: CLR     PASSCT
1397  007656  012737  007742  015572   IOTSTA: MOV     #DRTO+2,RETURN
1398  007664  013777  001042  171146           MOV     PASSCT,@DISPLA
1399  007672  013706  016632                   MOV     STACK,SP
1400  007676  005077  171120                   CLR     @PSW
1401  007702  052777  000100  171116           BIS     #BIT6,@TKS
1402
1403                                    ;TEST FOR NO BUSS ERRORS
1404
1405
1406                                    ;*      MOV     $ZERO,@GRSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG GRSTAT
1407
1408                                    ;*      MOV     $ZERO,@GRDAI    ;/ PUT DATA FROM $ZERO TO DEVICE REG GRDAI
1409
1410                                    ;*      MOV     $ZERO,@GRDIO    ;/ PUT DATA FROM $ZERO TO DEVICE REG GRDIO
1411
1412  007740  104003           DRTO:   SCOPE1
1413  007742  012737  177777  001174           MOV     #-1,$TMDAT      ;ALL ONES TO REGISTER
1414
1415                                    ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1416
1417                                    ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1418  007770  022737  177777  001166           CMP     #-1,$BDDAT
1419  007776  001401                           BEQ     .+4
1420  010000  104400                           ERROR                   ;REG WILL NOT HOLD ONES
1421
1422  010002  104002           DRT1:   SCOPE
1423  010004  012737  177777  001174           MOV     #-1,$TMDAT
1424
1425                                    ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1426  010022  004737  023054                   JSR     PC,$RESET               ;SET DATA TO ALL ONES
1427
1428                                    ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1429  010036  005737  001166                   TST     $BDDAT
1430  010042  001401                           BEQ     .+4
1431  010044  104400                           ERROR                   ;REG FAILED TO CLEAR
1432
1433  010046  052777  000100  170752           BIS     #BIT6,@TKS
1434  010054  104003           DRT2:   SCOPE1
1435  010056  012737  052525  001174           MOV     #52525,$TMDAT
1436
1437                                    ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1438
1439                                    ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1440  010104  022737  052525  001166           CMP     #52525,$BDDAT
1441  010112  001401                           BEQ     .+4
```

```
1442  010114  104400                          ERROR                   ;DATA NOT=52525
1443
1444  010116  104002                  DRT3:   SCOPE
1445  010120  012737  125252  001174          MOV     #125252,$TMDAT
1446
1447                                  ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1448
1449                                  ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1450  010146  022737  125252  001166          CMP     #125252,$BDDAT
1451  010154  001401                          BEQ     .+4
1452  010156  104400                          ERROR                   ;DATA NOT=125252
1453
```

```
1454  010160  104003                    DRT4:   SCOPE1
1455  010162  012737  177777  001174            MOV     #-1,$TMDAT
1456
1457                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1458  010200  105037  001174                    CLRB    $TMDAT          ;CLEAR LOW BYTE
1459
1460                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1461
1462                                      ;*      MOV     @GRDIO,TEMP     ;/READ DEVICE REG GRDIO,PUT DATA IN TEMP.
1463  010224  022737  177400  016674            CMP     #177400,TEMP
1464  010232  001401                            BEQ     .+4
1465  010234  104400                            ERROR                   ;BYTE LOW FAILED TO CLEAR
1466
1467  010236  104002                    DRT5:   SCOPE
1468  010240  012737  177777  001174            MOV     #-1,$TMDAT
1469
1470                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1471  010256  105037  001175                    CLRB    $TMDAT+1        ;CLEAR HIGH BYTE
1472
1473                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1474
1475                                      ;*      MOV     @GRDIO,TEMP     ;/READ DEVICE REG GRDIO,PUT DATA IN TEMP.
1476  010302  022737  000377  016674            CMP     #377,TEMp
1477  010310  001401                            BEQ     .+4
1478  010312  104400                            ERROR                   ;HIGH BYTE CLEAR FAILED
1479
1480  010314  005037  016674                    CLR     TEMP
1481  010320  104002                    DRT6:   SCOPE
1482  010322  113737  016674  001174    DRT6A:  MOVB    TEMP,$TMDAT     ;LOAD THE OUTPUT
1483
1484                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1485
1486                                      ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1487  010350  123737  016674  001166            CMPB    TEMP,$BDDAT
1488  010356  001402                            BEQ     .+6             ;BRANCH IF EQUAL
1489  010360  104400                            ERROR                   ;ERROR, LOW BYTE HAS BAD DATA
1490  010362  000405                            BR      DRT7
1491  010364  105237  016674                    INCB    TEMP
1492  010370  001354                            BNE     DRT6A
1493
1494  010372  005037  016674                    CLR     TEMP
1495  010376  104002                    DRT7:   SCOPE
1496  010400  113737  016674  001175    DRT7A:  MOVB    TEMP,$TMDAT+1   ;LOAD THE HIGH BYTE
1497
1498                                      ;*      MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1499
1500                                      ;*      MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1501  010426  123737  016674  001167            CMPB    TEMP,$BDDAT+1
1502  010434  001402                            BEQ     .+6             ;BRANCH IF EQUAL
1503  010436  104400                            ERROR                   ;ERROR, HIGH BYTE IN ERROR
1504  010440  000403                            BR      DRT8
1505  010442  105237  016674                    INCB    TEMP
1506  010446  001354                            BNE     DRT7A
```

```
1507
1508                                        ;RELAY #1 TEST
1509
1510  010450  104003                       DRT8:   SCOPE1
1511  010452  012737  000001  001174               MOV     #BIT0,$TMDAT    ;SET BIT 0
1512
1513                                        ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1514
1515                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1516  010500  022737  000001  001166               CMP     #BIT0,$BDDAT    ;TEST IT
1517  010506  001401                               BEQ     .+4
1518  010510  104400                               ERROR                   ;ERROR, RELAY 1 FAILED TO SET
1519
1520                                        ;RELAY #2 TEST
1521
1522  010512  104002                       DRT9:   SCOPE
1523  010514  012737  000400  001174               MOV     #BIT8,$TMDAT    ;SET RELAY 2
1524
1525                                        ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1526
1527                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1528  010542  022737  000400  001166               CMP     #BIT8,$BDDAT
1529  010550  001401                               BEQ     .+4
1530  010552  104400                               ERROR                   ;ERROR, RELAY 2 FAILED TO SET
1531
1532                                        ;TEST OUTPUT DATA ACCEPT FLAG
1533
1534  010554  104002                       DRT10:  SCOPE
1535  010556  012737  100000  001174               MOV     #BIT15,$TMDAT           ;SET BIT 15
1536
1537                                        ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1538
1539                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1540  010604  022737  100000  001166               CMP     #BIT15,$BDDAT
1541  010612  001401                               BEQ     .+4
1542  010614  104400                               ERROR                           ;ERROR, BIT 15 FAILED TO sET
1543
1544                                        ;TEST OUTPUT INTERRUPT ENABLE
1545
1546  010616  104002                       DRT11:  SCOPE
1547  010620  012777  000340  170174               MOV     #340,@PSW               ;RAISE PRIORITY
1548  010626  012737  040000  001174               MOV     #BIT14,$TMDAT           ;LOAD BIT 14
1549
1550                                        ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1551
1552                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1553  010654  022737  040000  001166               CMP     #BIT14,$BDDAT
1554  010662  001401                               BEQ     .+4
1555  010664  104400                               ERROR                           ;ERROR BIT 14 FAILED TO SET
1556
```

```
1557
1558                                        ;TEST INPUT DATA READY FLAG
1559
1560  010666  104002                DRT12:  SCOPE
1561  010670  012737  000200  001174        MOV     #BIT7,$TMDAT            ;SET BIT 7
1562
1563                                ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1564
1565                                ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1566  010716  022737  000200  001166        CMP     #BIT7,$BDDAT
1567  010724  001401                        BEQ     .+4
1568  010726  104400                        ERROR                           ;ERROR, BIT 7 FAILED TO SET
1569
1570                                        ;TEST INPUT INTERRUPT ENABLE
1571
1572  010730  104002                DRT13:  SCOPE
1573  010732  012777  000340  170062        MOV     #340,@PSW
1574  010740  012737  000100  001174        MOV     #BIT6,$TMDAT            ;SET BIT 6
1575
1576                                ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1577
1578                                ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1579  010766  022737  000100  001166        CMP     #BIT6,$BDDAT
1580  010774  001401                        BEQ     .+4
1581  010776  104400                        ERROR                           ;ERROR, BIT 6 FAILED TO SET
1582
1583                                        ;TEST THAT RESET CLEARS THE DIGITAL STATUS REGISTER
1584
1585  011000  104002                DRT14:  SCOPE
1586  011002  012777  000340  170012        MOV     #340,@PSW
1587  011010  012737  140701  001174        MOV     #BIT15!BIT14!BIT8!BIT7!BIT6!BIT0,$TMDAT
1588
1589                                ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
1590  011026  004737  023054                JSR     PC,$RESET
1591
1592                                ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1593  011042  042737  100000  001166        BIC     #BIT15,$BDDAT
1594  011050  005737  001166                TST     $BDDAT
1595  011054  001401                        BEQ     .+4
1596  011056  104400                        ERROR                           ;ERROR, RESET FAILED TO CLEAR DIGITAL STATUS REG
1597
1598  011060  005077  167736                CLR     @PSW
1599  011064  052777  000100  167734        BIS     #BIT6,@TKS
```

```
1600                                        ;TEST EXTERNAL TRANSFERS - CABLE MUST BE CONNECTED
1601  011072  104003                DRT15:  SCOPE1
1602  011074  032777  000100  167734        BIT     #BIT6,@SWR      ;TEST SWITCH BIT
1603  011102  001402                        BEQ     .+6             ;BRANCH IF DOWn
1604  011104  000137  011444                JMP     DRT28           ;BYPASS SOME TEST USING THE EXTERNAL CABLE
1605
1606                                  ;*    MOV     $ZERO,@GRDIO    ;/ PUT DATA FROM $ZERO TO DEVICE REG GRDIO
1607
1608                                  ;*    MOV     @GRDAI,$BDDAT   ;/READ DEVICE REG GRDAI,PUT DATA IN $BDDAT.
1609  011130  022737  000000  001166        CMP     #0,$BDDAT       ;READ THE INPUT
1610  011136  001401                        BEQ     .+4             ;BRANCH IF EQUAL
1611  011140  104400                        ERROR                   ;ERROR, INPUT DID NOT EQUAL THE OUTPUT REG.
1612
1613  011142  104002                DRT16:  SCOPE
1614  011144  012737  177777  001174        MOV     #-1,$TMDAT      ;LOAD THE OUTPUT
1615
1616                                  ;*    MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1617
1618                                  ;*    MOV     @GRDIO,$BDDAT   ;/READ DEVICE REG GRDIO,PUT DATA IN $BDDAT.
1619  011172  022737  177777  001166        CMP     #-1,$BDDAT      ;READ THE INPUT
1620  011200  001401                        BEQ     .+4             ;BRANCH IF EQUAL
1621  011202  104400                        ERROR                   ;ERROR, INPUT DID NOT EQUAL THE OUTPUT
1622                                                        ;IS THIS REALLY A LPS-11-DR ?? OR IS IT AN
1623                                                        ;LPS-11-DRA ?? IF DRA  USE MD-11-DZLPI TEST
1624
1625  011204  104002                DRT17:  SCOPE
1626  011206  012737  052525  001174        MOV     #52525,$TMDAT   ;LOAD THE OUTPUT
1627
1628                                  ;*    MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1629
1630                                  ;*    MOV     @GRDAI,$BDDAT   ;/READ DEVICE REG GRDAI,PUT DATA IN $BDDAT.
1631  011234  022737  052525  001166        CMP     #52525,$BDDAT   ;READ THE INPUT
1632  011242  001401                        BEQ     .+4             ;BRANCH IF EQUAL
1633  011244  104400                        ERROR                   ;ERROR, INPUT DID NOT EQUAL OUTPUT
1634
1635  011246  104002                DRT18:  SCOPE
1636  011250  012737  025252  001174        MOV     #25252,$TMDAT   ;LOAD THE OUTPUT
1637
1638                                  ;*    MOV     $TMDAT,@GRDIO   ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRDIO
1639
1640                                  ;*    MOV     @GRDAI,$BDDAT   ;/READ DEVICE REG GRDAI,PUT DATA IN $BDDAT.
1641  011276  022737  025252  001166        CMP     #25252,$BDDAT   ;READ THE INPUT
1642  011304  001401                        BEQ     .+4             ;BRANCH IF EQUAL
1643  011306  104400                        ERROR                   ;ERROR, INPUT DID NOT EQUAL OUTPUT
1644
1645                                  ;TEST THAT WHEN OUTPUTTING THE INPUT DATA READY FLAG SETS
1646
1647  011310  104003                DRT19:  SCOPE1
1648
1649                                  ;*    MOV     $ZERO,@GRSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG GRSTAT
1650
1651                                  ;*    MOV     $ZERO,@GRDIO    ;/ PUT DATA FROM $ZERO TO DEVICE REG GRDIO
1652                                                                ;OUTPUT 0
1653  011332  022727  000000  000000        CMP     #0,#0                   ;DELAY
```

```
1654
1655                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1656  011350  105737  001166                        TSTB    $BDDAT
1657  011354  100401                          BMI     .+4
1658  011356  104400                          ERROR                           ;INPUT DATA READY FLAG FAILED TO SET
1659
1660                                        ;TEST THAT WHEN THE INPUT BUFFER IS READ THE OUTPUT FLAG IS SET
1661
1662  011360  104002                        DRT20:  SCOPE
1663
1664                                        ;*      MOV     $ZERO,@GRSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG GRSTAT
1665
1666                                        ;*      MOV     $ZERO,@GRDIO    ;/ PUT DATA FROM $ZERO TO DEVICE REG GRDIO
1667  011402  022727  000000  000000              CMP     #0,#0
1668
1669                                        ;*      MOV     @GRDAI,$TMDAT   ;/READ DEVICE REG GRDAI,PUT DATA IN $TMDAT.
1670  011420  013700  001174                      MOV     $TMDAT,R0
1671
1672                                        ;*      MOV     @GRSTAT,$BDDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $BDDAT.
1673  011434  005737  001166                      TST     $BDDAT
1674  011440  100401                          BMI     .+4
1675  011442  104400                          ERROR                           ;INPUT DATA READY FLAG FAILED TO SET
```

```
1676
1677  011444  104003                  ;PRE INTERRUPT SETUP
1678  011446  042737  177437  001010  DRT28:  SCOPE1
1679  011454  001001                          BIC     #177437,DIOBRL
1680  011456  000000                          BNE     .+4
1681  011460  022737  000340  001010          HALT                    ;BR LEVEL INDICATED FOR DIGITAL I/O WAS 0
1682  011466  001001                          CMP     #340,DIOBRL
1683  011470  000000                          BNE     .+4
1684  011472  013737  001010  016702          HALT                    ;BR LEVEL INDICATED FOR DIGITAL I/O WAS 7
1685  011500  162737  000040  016702          MOV     DIOBRL,BRLEV1
1686  011506  013737  001010  016704          SUB     #40,BRLEV1
1687  011514  013737  001010  016706          MOV     DIOBRL,BRLEV2
1688  011522  062737  000040  016706          MOV     DIOBRL,BRLEV3
1689                                          ADD     #40,BRLEV3
1690
1691                                  ;LOGICAL END OF 'DIGITAL I/O LOGIC TEST'
1692
1693  011530  004737  023054                  JSR     PC,$RESET
1694  011534  005737  000042                  TST     @#42
1695  011540  001402                          BEQ     .+6
1696  011542  000137  002142                  JMP     WHATC
1697  011546  004737  015650                  JSR     7,BELL          ;REPORT END OF PASS
1698  011552  005237  001042                  INC     PASSCT
1699  011556  000137  007656                  JMP     IOTSTA
```

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

011562  004737  023054          VCTEST: JSR     PC,$RESET
011566  104000                          PRINT
011570  016276                          MESS                            ;IDENTIFY TEST
011572  005037  001042          VTEST1: CLR     PASSCT

011576  013706  016632          VCTST0: MOV     STACK,SP
011602  013777  001042  167230          MOV     PASSCT,@DISPLA
011610  012737  011662  015572          MOV     #VCT0+2,RETURN
011616  005077  167200                  CLR     @PSW
011622  052777  000100  167176          BIS     #BIT6,@TKS

                                ;TEST FOR NO BUSS ERRORS


                                ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT

                                ;*      MOV     $ZERO,@VCXREG   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCXREG

                                ;*      MOV     $ZERO,@VCYREG   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCYREG

                                ;TEST THAT RESET SETS READY BIT

011660  104002          VCT0:   SCOPE
011662  004737  023054          JSR     PC,$RESET

                                ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
011676  105737  001166          TSTB    $BDDAT
011702  100401                  BMI     .+4
011704  104400                  ERROR                                   ;ERROR, VCSTAT NOT = 200

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

011706  104003          VCT1:   SCOPE1
011710  052777  000100  167110          BIS     #BIT6,@TKS
011716  012737  000002  001174          MOV     #BIT1,$TMDAT            ;LOAD DISPLAY STATUS

                                ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT

                                ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
011744  022737  000202  001166          CMP     #BIT7!BIT1,$BDDAT
011752  001401                  BEQ     .+4
011754  104400                  ERROR                                   ;ERROR, VC STATUS NOT = 202

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

011756  104002          VCT2:   SCOPE
011760  012737  000004  001174          MOV     #BIT2,$TMDAT            ;LOAD DISPLAY STATUS

                                ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
```

```
1754                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1755  012006  022737  000204  001166                CMP     #BIT7!BIT2,$BDDAT
1756  012014  001401                              BEQ     .+4
1757  012016  104400                              ERROR                           ;ERROR, VC STATUS NOT = 204
1758
1759                                        ;TEST THAT MODE (BIT 3) CAN BE SET AND CLEARED
1760
1761  012020  104002                        VCT3:   SCOPE
1762  012022  012737  000010  001174                MOV     #BIT3,$TMDAT            ;LOAD DISPLAY STATUS
1763
1764                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
1765
1766                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1767  012050  022737  000210  001166                CMP     #BIT7!BIT3,$BDDAT
1768  012056  001401                              BEQ     .+4
1769  012060  104400                              ERROR                           ;ERROR, VC STATUS NOT = 210
1770
```

```
                                        ;TEST THAT EXT DEL (BIT 4) CAN BE SET AND CLEARED
                                        VCT4:   SCOPE
012062  104002
012064  012737  000020  001174                MOV     #BIT4,$TMDAT            ;LOAD DISPLAY STATUS
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
012112  022737  000220  001166                CMP     #BIT7!BIT4,$BDDAT
012120  001401                              BEQ     .+4
012122  104400                              ERROR                           ;ERROR, VC STATUS NOT = 220
                                        ;TEST THAT INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
                                        VCT5:   SCOPE
012124  104002
012126  012737  000100  001174                MOV     #BIT6,$TMDAT            ;LOAD DISPLAY STATUS
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
012154  022737  000300  001166                CMP     #BIT7!BIT6,$BDDAT
012162  001401                              BEQ     .+4
012164  104400                              ERROR                           ;ERROR, VC STATUS NOT = 300
                                        ;TEST THAT CHANNEL (BIT 9) CAN BE SET AND CLEARED
                                        VCT6:   SCOPE
012166  104002
012170  012737  001000  001174                MOV     #BIT9,$TMDAT            ;LOAD DISPLAY STATUS
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
012216  022737  001200  001166                CMP     #BIT9!BIT7,$BDDAT
012224  001401                              BEQ     .+4
012226  104400                              ERROR                           ;ERROR, VC STATUS NOT = 1200
                                        ;TEST THAT STORE (BIT 10) CAN BE SET AND CLEARED
                                        VCT7:   SCOPE
012230  104002
012232  012737  002000  001174                MOV     #BIT10,$TMDAT           ;LOAD DISPLAY STATUS
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEViCE REG VCSTAT,PUT DATA IN $BDDAT.
012260  022737  002200  001166                CMP     #BIT10!BIT7,$BDDAT
012266  001401                              BEQ     .+4
012270  104400                              ERROR                           ;ERROR, VC STATUS NOT = 2200
                                        ;TESt THAT WRITE THRU (BIT 11) CAN BE SET AND CLEARED
                                        VCT8:   SCOPE
012272  104002
012274  012737  004000  001174                MOV     #BIT11,$TMDAT           ;LOAD DISPLAY STATUS
```

```
1825                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
1826
1827                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1828  012322  022737  004200  001166            CMP     #BIT11!BIT7,$BDDAT
1829  012330  001401                            BEQ     .+4
1830  012332  104400                            ERROR                   ;ERROR, VC STATUS NOT = 4200
1831
```

```
1832
1833                                        ;TEST THAT THE X REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1834
1835  012334  104002                VCT11:  SCOPE
1836  012336  012737  002525  001174        MOV     #2525,$tMDAT            ;LOAD X REGISTER
1837
1838                                ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
1839
1840                                ;*      MOV     @VCXREG,$BDDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $BDDAT.
1841  012364  022737  002525  001166        CMP     #2525,$BDDAT
1842  012372  001401                       BEQ     .+4
1843  012374  104400                       ERROR                           ;ERROR, VC X REGISTER NOT = 2525
1844
1845  012376  104002                VCT12:  SCOPE
1846  012400  012737  005252  001174        MOV     #5252,$TMDAT            ;LOAD X REGISTER
1847
1848                                ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
1849
1850                                ;*      MOV     @VCXREG,$BDDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $BDDAT.
1851  012426  022737  005252  001166        CMP     #5252,$BDDAT
1852  012434  001401                       BEQ     .+4
1853  012436  104400                       ERROR                           ;ERROR, VC X REGISTER NOT = 5252
1854
1855                                        ;TEST THAT THE Y REGISTER (BITS 0-11) CAN BE SET AND CLEARED
1856
1857  012440  104002                VCT15:  SCOPE
1858  012442  012737  002525  001174        MOV     #2525,$TMDAT            ;LOAD Y REGISTER
1859
1860                                ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
1861
1862                                ;*      MOV     @VCYREG,$BDDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $BDDAT.
1863  012470  022737  002525  001166        CMP     #2525,$BDDAT
1864  012476  001401                       BEQ     .+4
1865  012500  104400                       ERROR                           ;ERROR, VC Y REGISTER NOT = 2525
1866
1867  012502  104002                VCT16:  SCOPE
1868  012504  012737  005252  001174        MOV     #5252,$TMDAT            ;LOAD Y REGISTER
1869
1870                                ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
1871
1872                                ;*      MOV     @VCYREG,$BDDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $BDDAT.
1873  012532  022737  005252  001166        CMP     #5252,$BDDAT
1874  012540  001401                       BEQ     .+4
1875  012542  104400                       ERROR                           ;ERROR, VC Y REGISTER NOT = 5252
1876
1877                                        ;TEST THAT THE X-Y REGISTER CAN HOLD DIFFERENT DATA
1878
1879  012544  104002                VCT17:  SCOPE
1880  012546  012737  001234  001174        MOV     #1234,$TMDAT            ;LOAD X REGISTER
1881
1882                                ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
1883  012564  012737  004321  001174        MOV     #4321,$TMDAT            ;LOAD X REGISTER
1884
1885                                ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
```

```
1886
1887                                            ;*      MOV     @VCXREG,$BDDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $BDDAT.
1888  012612  022737  001234  001166                    CMP     #1234,$BDDAT
1889  012620  001401                                    BEQ     .+4
1890  012622  104400                                    ERROR                   ;ERROR, SELECT X REGISTER INCORRECTLY
1891
1892
1893                                            ;*      MOV     @VCYREG,$BDDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $BDDAT.
1894  012634  022737  004321  001166                    CMP     #4321,$BDDAT
1895  012642  001401                                    BEQ     .+4
1896  012644  104400                                    ERROR                   ;ERROR, SELECTED Y REGISTER INCORRECTLY
1897
```

```
1898
1899                                    ;TEST THAT WHEN INTENSIFY BIT IS SET THAT THE READY BIT SETS
1900
1901  012646  104002                            SCOPE
1902  012650  012700  000100                    MOV     #100,R0
1903  012654  012737  000001  001174            MOV     #BIT0,$TMDAT            ;INTENSIFY
1904
1905                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
1906  012672                            VCTST2:
1907
1908                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1909  012702  105737  001166                    TSTB    $BDDAT
1910  012706  100403                            BMI     VCTST3                  ;SET EXIT
1911  012710  005300                            DEC     R0                      ;DELAY
1912  012712  001367                            BNE     VCTST2                  ;
1913  012714  104400                            ERROR                           ;READY FAILED TO SET AFTER A DELAY
1914
1915                                    ;TEST THAT WHEN COLOR IS CHANGED READY SETS AFTER A DELAY
1916
1917  012716  104003                    VCTST3: SCOPE1
1918  012720  012700  000400                    MOV     #400,R0                 ;SET UP A DELAY
1919  012724  012737  000400  001174            MOV     #BIT8,$TMDAT            ;CHANGE TO RED
1920
1921                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
1922
1923                                    ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
1924  012752  032737  000400  001174            BIT     #BIT8,$TMDAT
1925  012760  001001                            BNE     .+4                     ;IS IT SET ?
1926  012762  104400                            ERROR                           ;ERROR, COLOR BIT FAILED TO SET
1927  012764                            VCTST4:
1928
1929                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1930  012774  105737  001166                    TSTB    $BDDAT
1931  013000  100403                            BMI     VCTST5                  ;IS IT SET ?
1932  013002  005300                            DEC     R0                      ;NO, DELAY
1933  013004  001367                            BNE     VCTST4                  ;
1934  013006  104400                            ERROR                           ;ERROR, READY FAILED TO SET AFTER A COLOR CHANGE
1935
1936                                    ;TEST THAT WHEN COLOR IS CHANGED READY SETS AFTER A DELAY
1937
1938  013010  104001                    VCTST5: SCOPE0
1939  013012  012700  020000                    MOV     #20000,R0               ;SET UP A DELAY
1940
1941                                    ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
1942
1943                                    ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
1944  013036  032737  000400  001174            BIT     #BIT8,$TMDAT
1945
1946                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
1947
1948                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1949  013064  105737  001166                    TSTB    $BDDAT
1950  013070  100001                            BPL     .+4                     ;DID IT SET
1951  013072  104400                            ERROR                           ;ERROR, READY FAILED TO CLEAR
```

```
1952  013074                          VCTST6:
1953
1954                                  ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
1955  013104  105737  001166                  TSTB    $BDDAT
1956  013110  100403                          BMI     VCTST7
1957  013112  005300                          DEC     R0
1958  013114  001367                          BNE     VCTST6
1959  013116  104400                          ERROR                   ;ERROR, READY FAILED TO SET AFTER A COLOR CHANGE
```

```
                                        ;TEST THAT MODE 1 (INTENSIFY ON X)
                                        ;CLEARS THE READY FLAG AND THEN SETS IT
                                        VCTST7: SCOPE0
013120  104001                                  MOV     #100,R0                 ;SET UP DELAY
013122  012700  000100                          MOV     #BIT2,$TMDAT            ;LOAD MODE 1
013126  012737  000004  001174
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
013154  105737  001166                          TSTB    $BDDAT
013160  100401                                  BMI     .+4
013162  104400                                  ERROR                           ;ERROR, MODE 1 SHOULD NOT CLEAR READY UNTIL X IS
                                        ;*      MOV     $ZERO,@VCXREG   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCXREG
013174                                  VCTST8:
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
013204  105737  001166                          TSTB    $BDDAT
013210  100403                                  BMI     VCTST9                  ;SET, NEXT TEST
013212  005300                                  DEC     R0                      ;DELAY
013214  001367                                  BNE     VCTST8                  ;TEST READY AGAIN
013216  104400                                  ERROR                           ;ERROR, READY FAILED TO SET
                                                                                ; AFTER MODE 1 OPERATION
                                        ;TEST THAT MODE 2 (INTENSIFY ON Y)
                                        ;CLEARS THE READY FLAG AND THEN SETS IT
013220  104003                          VCTST9: SCOPE1
013222  012700  000100                          MOV     #100,R0                 ;SET UP DELAY
013226  012737  000010  001174                  MOV     #BIT3,$TMDAT            ;LOAD MODE 2
                                        ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
013254  005737  001166                          TST     $BDDAT
013260  100001                                  BPL     .+4
013262  104400                                  ERROR                           ;ERROR, MODE 2 SHOULD NOT CLEAR READY UNTIL Y IS
                                        ;*      MOV     $ZERO,@VCYREG   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCYREG
013274                                  VCTS10:
                                        ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
013304  105737  001166                          TSTB    $BDDAT
013310  100403                                  BMI     VCTS11                  ;SET, NEXT TEST
013312  005300                                  DEC     R0                      ;DELAY
013314  001367                                  BNE     VCTS10                  ;TEST READY AGAIN
013316  104400                                  ERROR                           ;ERROR, READY FAILED TO SET
                                                                                ; AFTER MODE 2 OPERATION
```

```
2014
```

```
                                        ;TEST THAT WHEN ERASE BIT IS SET THAT THE READY BIT
                                        ;CLEARS AND THEN SETS AFTER A DELAY
                                        ;
013320  104003                  VCTS11: SCOPE1
013322  032777  000040  165506          BIT     #BIT5,@SWR
013330  001444                          BEQ     AVCT12
013332  012700  000002                  MOV     #2,R0
013336  005037  016674                  CLR     TEMP            ;CLEAR DELAY
                                        ;
                                ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
013352  052737  012000  001174          BIS     #BIT12!BIT10,$TMDAT
                                        ;
                                ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
                                        ;
                                ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
013400  105737  001166                  TSTB    $BDDAT
                                        ;TEST THAT READY CLEARS
013404  100001                          BPL     .+4
013406  104400                          ERROR                   ;ERROR, READY FAILED TO RESET
                                        ;  UPON SETTING ERASE BIT
                                        ;
013410                          TST11A:
                                        ;
                                ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
013420  105737  001174                  TSTB    $TMDAT
013424  100406                          BMI     AVCT12          ;BRANCH IF SET
013426  005337  016674                  DEC     TEMP            ;DELAY
013432  001366                          BNE     TST11A          ;BRANCH IF NOT READY
013434  005300                          DEC     R0              ;DECREMENT COUNTER
013436  001364                          BNE     TST11A          ;BRANCH IF NOT COMPLETED
013440  104400                          ERROR                   ;ERROR, ERASE CLEARED READY AND FAILED
                                        ;TO SET READY AFTER A DELAY
                                        ;
013442                          AVCT12:                                 ;
013442                          VCTS13:
013442                          VCTS14:
013442                          VCTS15:
```

```
2052
2053                                    ;PRE-INTERRUPT SETUP
2054
2055  013442  042737  177437  001012          BIC     #177437,VCBRL   ;MASK TO  PSW
2056  013450  001001                          BNE     .+4
2057  013452  000000                          HALT                    ;LOACATION VCBRL CONTAILED A BR LEVEL 0
2058  013454  022737  000340  001012          CMP     #340,VCBRL      ;
2059  013462  001001                          BNE     .+4             ;TEST FOR BR 7
2060  013464  000000                          HALT                    ;LOCATION VCBRL CONTAINS BR LEVEL 7
2061
2062  013466  013737  001012  016702          MOV     VCBRL,BRLEV1            ;SET UP BR LEVELS
2063  013474  162737  000040  016702          SUB     #40,BRLEV1              ; -1
2064  013502  013737  001012  016704          MOV     VCBRL,BRLEV2            ; 0
2065  013510  013737  001012  016706          MOV     VCBRL,BRLEV3            ; +1
2066  013516  062737  000040  016706          ADD     #40,BRLEV3
```

```
2067
2068                                    ;TEST THAT RESET CLEARS MODE 0,2 ,FAST INTEN. AND EXT DELAY
2069
2070  013524  104003                            SCOPE1
2071  013526  012737  000036  001174            MOV     #BIT4!BIT3!BIT2!BIT1,$TMDAT
2072
2073                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2074  013544  004737  023054                    JSR     PC,$RESET
2075
2076                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
2077  013560  013700  001166                    MOV     $BDDAT,R0
2078  013564  042700  000200                    BIC     #BIT7,R0
2079  013570  005700                            TST     R0
2080  013572  001401                            BEQ     .+4
2081  013574  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR VC STATUS REG
2082
2083                                    ;TEST THAT RESET CLEARS INTERRUPT ENABLE, CHANNEL, STORE, WRITE THRU
2084
2085  013576  104003                            SCOPE1
2086  013600  012737  007100  001174            MOV     #BIT11!BIT10!BIT9!BIT6,$TMDAT
2087
2088                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2089  013616  004737  023054                    JSR     PC,$RESET
2090
2091                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
2092  013632  013700  001166                    MOV     $BDDAT,R0
2093  013636  042700  000200                    BIC     #BIT7,R0
2094  013642  005700                            TST     R0
2095  013644  001401                            BEQ     .+4
2096  013646  104400                            ERROR                           ;ERROR, RESET FAILED TO cLEAR VC STATUS
2097
2098                                    ;TEST THAT RESET CLEARS X REGISTER
2099
2100  013650  104003                            SCOPE1
2101  013652  012737  177777  001174            MOV     #-1,$TMDAT
2102
2103                                    ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
2104  013670  004737  023054                    JSR     PC,$RESET
2105
2106                                    ;*      MOV     @VCXREG,$BDDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $BDDAT.
2107  013704  005737  001166                    TST     $BDDAT
2108  013710  001401                            BEQ     .+4
2109  013712  104400                            ERROR                           ;ERROR, RESET FAILED TO CLEAR VC X REGISTER
2110
2111                                    ;TEST THAT RESET CLEARS Y REGISTER
2112
2113  013714  104003                            SCOPE1
2114  013716  012737  177777  001174            MOV     #-1,$TMDAT
2115
2116                                    ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
2117  013734  004737  023054                    JSR     PC,$RESET
2118
2119                                    ;*      MOV     @VCYREG,$BDDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $BDDAT.
2120  013750  005737  001166                    TST     $BDDAT
```

```
2121   013754   001401                BEQ     .+4
2122   013756   104400                ERROR                   ;ERROR, RESET FAILED TO CLEAR VC Y REGISTER
2123
2124   013760   104003                SCOPE1
2125   013762   004737   023054       JSR     PC,$RESET
2126   013766   005737   000042       TST     @#42
2127   013772   001402                BEQ     .+6
2128   013774   000137   002154       JMP     WHATD
2129   014000   004737   015650       JSR     7,BELL                  ;LOGICAL END OF THIS TEST
2130   014004   005237   001042       INC     PASSCT
2131   014010   000137   011576       JMP     VCTSTD
```

```
2132                                    ;SUBROUTINE TO ISSUE N SPACES
2133                                    ;N IS ONE PLUS VALUE CONTAINED IN SPACEX
2134                                    ;SPACEX IS CLEARED WITHIN THE SUBROUTINE, SO THAT A CALL ON
2135                                    ;SPACE WITHOUT LOADING SPACEX ISSUES ONLY ONE SPACE
2136
2137  014014  105777  165012          XSPACE: TSTB    @TPS            ;WAIT FOR TTY READY
2138  014020  100375                          BPL     .-4
2139  014022  012777  000240  165004         MOV     #240,@TPB       ;OUTPUT A SPACE
2140  014030  005337  014044                 DEC     SPACEX          ;DECREMENT COUNT
2141  014034  003367                         BGT     XSPACE          ;LOOP IF NOT DONE
2142  014036  005037  014044                 CLR     SPACEX          ;RESET COUNT TO ZERO
2143  014042  000002                         RTI                     ;RETURN
2144  014044  000000                  SPACEX: 0
2145
2146                                    ;KEYBOARD SERVICE ROUTINE
2147
2148  014046  010046                  XTTYIN: MOV     R0,-(SP)
2149  014050  010146                          MOV     R1,-(SP)
2150  014052  010246                          MOV     R2,-(SP)
2151  014054  010346                          MOV     R3,-(SP)
2152  014056  010446                          MOV     R4,-(SP)
2153  014060  010546                          MOV     R5,-(SP)
2154  014062  012704  014446          NEWIN:  MOV     #INBUF,R4       ;SETUP CHARACTER BUFFER
2155  014066  042777  000100  164732         BIC     #BIT6,@TKS
2156  014074  005037  016640                 CLR     CHRCNT          ;CLEAR CHARACTER COUNTER
2157  014100  005037  014446                 CLR     INBUF
2158  014104  005037  014450                 CLR     INBUF+2
2159  014110  005037  014452                 CLR     INBUF+4
2160  014114  005037  014454                 CLR     INBUF+6
2161  014120  005037  014456                 CLR     INBUF+10
2162  014124  005037  014460                 CLR     INBUF+12
2163  014130  005037  014462                 CLR     INBUF+14
2164  014134  105777  164666          INPUTA: TSTB    @TKS            ;CHARACTER READY?
2165  014140  100375                          BPL     INPUTA          ;NO, WAIT IT OUT
2166  014142  017701  164662                 MOV     @TKB,R1         ;SAVE CHARACTER
2167  014146  042701  177600                 BIC     #177600,R1      ;STRIP PARITY BIT
2168  014152  120127  000060                 CMPB    R1,#60          ;IS IT A SPECIAL CHARACTER
2169  014156  100420                         BMI     SPCHR           ;YES, TEST IT
2170  014160  122701  000173                 CMPB    #173,R1
2171  014164  100415                         BMI     SPCHR
2172  014166  010124                  INPUTB: MOV     R1,(R4)+        ;SAVE CHARACTER
2173  014170  005237  016640                 INC     CHRCNT          ;INCREMENT THE CHARACTER COUNT.
2174  014174  022737  000006  016640         CMP     #6,CHRCNT
2175  014202  100516                         BMI     SPCHR5
2176  014204  105777  164622          OUTPTA: TSTB    @TPS            ;ECHO CHARACTER
2177  014210  100375                          BPL     OUTPTA
2178  014212  110177  164616                 MOVB    R1,@TPB
2179  014216  000746                         BR      INPUTA          ;WAIT FOR NEXT CHARACTER
2180
2181                                    ;SUBROUTINE TO TEST FOR SPECIAL CHARACTERS :'↑A','↑C','G','CR',',' OR 'RUBOUT'
2182
2183  014220  122701  000001          SPCHR:  CMPB    #1,R1           ;CHAR.='↑A'
2184  014224  001013                          BNE     SPCHR1          ;NO, NOT '↑A'
2185  014226  104000                          PRINT                   ;ECHO '↑A'
```

```
2186  014230  016545                        CNTRLA                  ;RESTORE 'SP'
2187  014232  012605                        MOV     (SP)+,R5
2188  014234  012604                        MOV     (SP)+,R4
2189  014236  012603                        MOV     (SP)+,R3
2190  014240  012602                        MOV     (SP)+,R2
2191  014242  012601                        MOV     (SP)+,R1
2192  014244  012600                        MOV     (SP)+,R0
2193  014246  022626                        CMP     (SP)+,(SP)+
2194  014250  000177  002360                JMP     @AVECTR         ;YES, EXIT VIA '↑A' VECTOR ADDRESS.
2195  014254  122701  000003      SPCHR1:   CMPB    #3,R1           ;CHAR.='↑C'
2196  014260  001002                        BNE     .+6             ;NO,NOT '↑C'
2197  014262  000137  001512                JMP     MONITR          ;YES, EXIT TO MONITOR
2198  014266  122701  000177                CMPB    #177,R1         ;CHAR. = 'RUBOUT'
2199  014272  001011                        BNE     SPCHR3          ;IGNORE CHAR. & EXIT
2200  014274  005737  016640                TST     CHRCNT          ;IS RUBOUT LEGAL?
2201  014300  001715                        BEQ     INPUTA          ;NO, IGNORE IT
2202  014302  005337  016640                DEC     CHRCNT
2203  014306  012701  000134                MOV     #134,R1         ;TYPE '\' TO INDICATE RUBOUUT
2204  014312  005744                        TST     -(R4)           ;POP OFF LAST CHARACTER
2205  014314  000733                        BR      OUTPTA          ;WAIT FOR NEXT CHARACTER
2206  014316  122701  000054      SPCHR3:   CMPB    #54,R1          ;TEST FOR ','
2207  014322  001721                        BEQ     INPUTB          ;LEGAL CHAR., SAVE IT
2208  014324  122701  000015      SPCHR4:   CMPB    #15,R1          ;=TO 'CARRIAGE RETURN' TO TERMINATE?
2209  014330  001011                        BNE     1$              ;NO, CONTINUE
2210  014332  104000                        PRINT                   ;YES, TYPE 'CR-LF'
2211  014334  016577                        CRLF
2212  014336  012605                4$:     MOV     (SP)+,R5
2213  014340  012604                        MOV     (SP)+,R4
2214  014342  012603                        MOV     (SP)+,R3
2215  014344  012602                        MOV     (SP)+,R2
2216  014346  012601                        MOV     (SP)+,R1
2217  014350  012600                        MOV     (SP)+,R0
2218  014352  000002                        RTI                     ;EXIT
2219  014354  122701  000007        1$:     CMPB    #7,R1           ;TEST IF CTRL G
2220  014360  001027                        BNE     SPCHR5  ;BR IF NOT
2221  014362  104000                        PRINT
2222  014364  016550                        CNTRLG
2223  014366  104005                        PRTOCT                  ;REPORT OLD
2224  014370  000170                        SOFTSW
2225  014372  104000                        PRINT
2226  014374  016566                        NEWSWR                  ;ASK FOR NEW
2227  014376  104006                        TTYIN
2228  014400  005001                        CLR     R1              ;CLEAR NEW
2229  014402  012700  014446                MOV     #INBUF,R0       ;LOAD NEW POINTER
2230  014406  005710                2$:     TST     (R0)            ;TEST FOR TERM
2231  014410  001410                        BEQ     3$              ;BR IF TERM
2232  014412  012002                        MOV     (R0)+,R2        ;GET A VALUE
2233  014414  042702  177770                BIC     #177770,R2      ;MASK
2234  014420  006301                        ASL     R1
2235  014422  006301                        ASL     R1
2236  014424  006301                        ASL     R1
2237  014426  060201                        ADD     R2,R1
2238  014430  000766                        BR      2$
2239  014432  010137  000170        3$:     MOV     R1,SOFTSW       ;SAVE SWITCH VALUE
```

```
2240  014436  000737                        BR      4$
2241
2242  014440  104000                SPCHRS: PRINT                   ;OTHERWISE TYPE '?'
2243  014442  016604                        QMARK
2244  014444  000606                        BR NEWIN                ; WAIT FOR NEW ENTRY
2245  014446  000000                INBUF:  0                       ;CHARACTER STORAGE BUFFER
2246
2247
2248          014464                        .=.+14
2249                                ;POWER FAIL HANDLER
2250
2251  014464  010046                PWRFAL: MOV     R0,-(SP)
2252  014466  010146                        MOV     R1,-(SP)
2253  014470  010246                        MOV     R2,-(SP)
2254  014472  010346                        MOV     R3,-(SP)
2255  014474  010446                        MOV     R4,-(SP)
2256  014476  010546                        MOV     R5,-(SP)
2257  014500  013746  000024                MOV     24,-(SP)
2258  014504  010637  016636                MOV     SP,PROC
2259  014510  012737  014520  000024        MOV     #PWRUP,24
2260  014516  000000                        HALT
2261
2262                                ;POWER UP HANDLER
2263
2264  014520  012777  000340  164274 PWRUP:  MOV     #340,@PSW
2265  014526  013706  016636                MOV     PROC,SP
2266  014532  012637  000024                MOV     (SP)+,24
2267  014536  012605                        MOV     (SP)+,R5
2268  014540  012604                        MOV     (SP)+,R4
2269  014542  012603                        MOV     (SP)+,R3
2270  014544  012602                        MOV     (SP)+,R2
2271  014546  012601                        MOV     (SP)+,R1
2272  014550  012600                        MOV     (SP)+,R0
2273  014552  004737  023054                JSR     PC,$RESET
2274  014556  104000                        PRINT
2275  014560  016607                        MES21
2276  014562  000137  001512                JMP     MONITR
```

```
2277
2278
2279                                    ;EMT DISPATCH SERVICE ROUTINE
2280                                    ;ARGUMENT OF EMT IS EXTRACTED AND USED AS OFFSET TO OBTAIN POINTER
2281                                    ;TO THE SELECTED SUBROUTINE.
2282
2283  014566  011646                    EMTSRV: MOV     (SP),-(SP)      ;GET PC FOR TO rETURN
2284  014570  162716  000002                    SUB     #2,(SP)         ;PC OF EMT
2285  014574  017616  000000                    MOV     @(SP),(SP)      ;GET EMT
2286  014600  005716                            TST     (SP)            ;IS EMT VALID?
2287  014602  001001                            BNE     EMTOK
2288  014604  000000                            HALT                    ;INVALID EMT
2289  014606  006316                    EMTOK:  ASL     (SP)            ;MULTIPLY EMT ARG BY '2'
2290  014610  042716  177001                    BIC     #177001,(SP)    ;CLEAR UNWANTED BITS
2291  014614  062716  014626                    ADD     #EMTTAB,(SP)    ;POINTER TO SUBROUTINE ADDRESS
2292  014620  017616  000000                    MOV     @(SP),(SP)      ;SUBROUTINE ADDRESS
2293  014624  000136                            JMP     @(SP)+          ;GO TO SUBROUTINE
2294
2295                                    ;EMT DISPATCH TABLE
2296
2297  014626  014650                    EMTTAB: TYPMES                  ;MESSAGE PRINT ROUTINE
2298  014630  015634                            SCOPEI                  ;SCOPE ROUTINE
2299  014632  015500                            SCOPEC                  ;LOGIC TEST SCOPE ROUTINE
2300  014634  015574                            SCOPEH                  ;LOGIC TEST SCOPE LOOP (10)
2301  014636  014014                            XSPACE                  ;SUBROUTINE TO TYPE SPACES
2302  014640  015006                            OCTPRT                  ;OCTAL PRINT ROUTINE
2303  014642  014046                            XTTYIN                  ;TELEPRINTER SERVICE ROUTINE
2304  014644  015142                            TKSFLG                  ;SUBROUTINE TO TEST FOR KEYBOARD FLAG
2305  014646  015634                            SCOPEI                  ;SCOPE ROUTINE
2306
```

```
2307                                    ;MESSAGE PRINT ROUTINE, ENTERED VIA EMT DISPATCH HANDLER.
2308                                    ;ROUTINE PICKS UP CONTENTS OF THE 'PC' AND USES THIS AS
2309                                    ;THE ADDRESS OF MESSAGE TO BE TYPED.
2310
2311  014650  000240                    TYPMES: NOP
2312  014652  000240                            NOP
2313  014654  010537  015140                    MOV     R5,SAV5
2314  014660  017605  000000                    MOV     @(SP),R5        ;GET THE MESSAGE ADDRESS FROM START
2315  014664  062716  000002                    ADD     #2,(SP)         ;SET UP STACK TO EXIT
2316  014670  105777  164136            TYPERA: TSTB    @TPS
2317  014674  100375                            BPL     TYPERA          ;WAIT FOR TTY DONE
2318  014676  122715  000100                    CMPB    #100,(R5)       ;TEST FOR '@'
2319  014702  001003                            BNE     TYPER1          ;BRANCH IF NO EQUAL
2320  014704  013705  015140                    MOV     SAV5,R5
2321  014710  000002                            RTI                     ;OTHERWISE EXIT
2322  014712  122715  000045            TYPER1: CMPB    #45,(R5)        ;TEST FOR '%'
2323  014716  001403                            BEQ     TYPECL          ;IF = TYPE 'CR-LF'
2324  014720  112577  164110            TYPER2: MOVB    (R5)+,@TPB      ;OUTPUT CHAR.
2325  014724  000761                            BR      TYPERA
2326  014726  012777  000015  164100    TYPECL: MOV     #15,@TPB        ;TYPE 'CR'
2327  014734  105777  164072                    TSTB    @TPS
2328  014740  100375                            BPL     .-4
2329  014742  012777  000012  164064            MOV     #12,@TPB
2330  014750  013737  001016  015004            MOV     FILLS,2$        ;LOAD COUNTER
2331  014756  105777  164050            1$:     TSTB    @TPS            ;TEST FLAG
2332  014762  100375                            BPL     1$
2333  014764  113777  001020  164042            MOVB    FILCHR,@TPB     ;LOAD FILLER CHARACTER
2334  014772  005337  015004                    DEC     2$              ;DONE
2335  014776  100367                            BPL     1$
2336  015000  105725                            TSTB    (R5)+           ;INCREMENT BUFFER
2337  015002  000732                            BR      TYPERA
2338  015004  000000                    2$:     0
2339
2340                                    ;SUBROUTINE TO TYPEOUT A '6' DIGIT OCTAL NO. THE 'PC' CONTAINS
2341                                    ;THE ADDRESS OF 'WORD' TO BE TYPED
2342
2343  015006  000240                    OCTPRT: NOP
2344  015010  000240                            NOP
2345  015012  010537  015140                    MOV     R5,SAV5
2346  015016  017605  000000                    MOV     @(SP),R5        ;THE ADDRESS OF WORD TO BE TYPED
2347  015022  062716  000002                    ADD     #2,(SP)         ;SET UP STACK TO EXIT
2348  015026  012737  000006  015132            MOV     #6,10$
2349  015034  012737  000376  015136            MOV     #376,MASK       ;MASK FOR FIRST BIT
2350  015042  000401                            BR      .+4
2351  015044  006115                    1$:     ROL     (R5)
2352  015046  006115                            ROL     (R5)
2353  015050  006115                            ROL     (R5)
2354  015052  111537  015134                    MOVB    (R5),11$
2355  015056  143737  015136  015134            BICB    MASK,11$
2356  015064  052737  000260  015134            BIS     #260,11$
2357  015072  132777  000200  163732            BITB    #200,@TPS
2358  015100  100374                            BPL     .-6             ;WAIT FOR PRINTER READY
2359  015102  113777  015134  163724            MOVB    11$,@TPB        ;PRINT CHAR.
2360  015110  012737  000370  015136            MOV     #370,MASK       ;MASK FOR NEXT '5' DIGITS
```

```
2361  015116  005337  015132          DEC     10$
2362  015122  001350                  BNE     1$
2363  015124  013705  015140          MOV SAV5,R5
2364  015130  000002                  RTI
2365  015132  000000          10$:    0
2366  015134  000000          11$:    0
2367  015136  000376          MASK:   376
2368  015140  000000          SAV5:   0
2369                          ;SUBROUTINE TO TEST FOR THE KEYBOARD FLAG BEING SET
2370  015142  105777  163660  TKSFLG: TSTB    @TKS            ;FLAG SET?
2371  015146  100001                  BPL     .+4             ;NO, EXIT
2372  015150  104006                  TTYIN                   ;YES,INQUIRE
2373  015152  000002                  RTI
2374
2375                          ;ENTERED WITH SYSTEM TRAP CALL (ERROR)
2376  015154  104007          LOGERR: TSTTKS                  ;TEST FOR KEYBOARD INTERRUPT
2377  015156  037727  163654  020000  BIT     @SWR,#20000     ;TEST FOR INHIBIT PRINT OUT
2378  015164  001135                  BNE     CK              ;INHIBIT,CHECK FOR HALT
2379  015166  012737  015472  000004  MOV     #LGERR2,@#4     ;SET UP FOR BUSS ERROR
2380  015174  011637  016650          MOV     (SP),KSTOR3     ;PC OF FAILING ROUTINE
2381  015200  162737  000002  016650  SUB     #2,KSTOR3
2382  015206  004537  015702          JSR     5,LEDS
2383  015212  016650                  KSTOR3
2384
2385                          ;*      MOV     @CSR,KSTOR6     ;/READ DEVICE REG CSR,PUT DATA IN KSTOR6.
2386
2387                          ;*      MOV     @CSB,KSTOR7     ;/READ DEVICE REG CSB,PUT DATA IN KSTOR7.
2388
2389                          ;*      MOV     @GRSTAT,KSTOR8  ;/READ DEVICE REG GRSTAT,PUT DATA IN KSTOR8.
2390
2391                          ;*      MOV     @GRDIO,KSTOR9   ;/READ DEVICE REG GRDIO,PUT DATA IN KSTOR9.
2392
2393                          ;*      MOV     @GRDAI,KSTR10   ;/READ DEVICE REG GRDAI,PUT DATA IN KSTR10.
2394
2395                          ;*      MOV     @VCSTAT,KSTOR4  ;/READ DEVICE REG VCSTAT,PUT DATA IN KSTOR4.
2396
2397                          ;*      MOV     @VCXREG,KSTOR5  ;/READ DEVICE REG VCXREG,PUT DATA IN KSTOR5.
2398
2399                          ;*      MOV     @VCYREG,KSTR12  ;/READ DEVICE REG VCYREG,PUT DATA IN KSTR12.
2400  015314  013737  016674  016670  MOV     TEMP,KSTR11     ;SAVE TEMP
2401  015322  012737  000006  000004  MOV     #6,@#4          ;RESET BUSS ERROR
2402  015330  005737  016630          TST     PRINT1
2403  015334  001006                  BNE     LGERR1
2404  015336  104000                  PRINT
2405  015340  016577                  CRLF
2406  015342  104000                  PRINT
2407  015344  016111                  MES1
2408  015346  005237  016630          INC     PRINT1
2409  015352  104000          LGERR1: PRINT                   ;OUTPUT CARRIAGE RETURN AND LINE FEED
2410  015354  016577                  CRLF
2411  015356  104005                  PRTOCT                  ;PRINT FAILING PC+2
2412  015360  016650                  KSTOR3
2413  015362  104004                  SPACE
2414  015364  104005                  PRTOCT
```

```
2415  015366  016656                        KSTOR6
2416  015370  104004                        SPACE
2417  015372  104005                        PRTOCT
2418  015374  016660                        KSTOR7
2419  015376  104004                        SPACE
2420  015400  104005                        PRTOCT
2421  015402  016662                        KSTOR8
2422  015404  104004                        SPACE
2423  015406  104005                        PRTOCT
2424  015410  016664                        KSTOR9
2425  015412  104004                        SPACE
2426  015414  104005                        PRTOCT
2427  015416  016666                        KSTR10
2428  015420  104004                        SPACE
2429  015422  104005                        PRTOCT
2430  015424  016652                        KSTOR4
2431  015426  104004                        SPACE
2432  015430  104005                        PRTOCT
2433  015432  016654                        KSTOR5
2434  015434  104004                        SPACE
2435  015436  104005                        PRTOCT
2436  015440  016672                        KSTR12
2437  015442  104004                        SPACE
2438  015444  104005                        PRTOCT
2439  015446  016670                        KSTR11
2440  015450  104004                        SPACE
2441  015452  105777  163354                TSTB    @TPS
2442  015456  100375                        BPL     .-4
2443  015460  005777  163352        CK:     TST     @SWR            ;CHECK SR FOR HALT SWITCH
2444  015464  100001                        BPL     .+4             ;BRANCH IF NOT SET
2445  015466  000000                        HALT                    ;HALT ON ERROR UP
2446  015470  000002                        RTI                     ;RETURN TO mAIN LINE
2447  015472  062716  000002        LGERR2: ADD     #2,(SP)
2448  015476  000002                        RTI
2449
2450
2451                                ;SCOPE AND/OR ITERATION LOOP FOR SOME TEST 2 TIMES
2452
2453  015500  104007                SCOPEC: TSTTKS                  ;TEST FOR KEYBOARD INIT
2454  015502  032777  040000  163326        BIT     #40000,@SWR     ;TEST SR FOR SCOPE
2455  015510  001015                        BNE     SCOPEB          ;YES, SCOPE
2456  015512  032777  004000  163316        BIT     #4000,@SWR      ;NO-TEST FOR ITERATION
2457  015520  001016                        BNE     SCOPEG          ;INHIBIT ITERATION
2458  015522  005737  001042                TST     PASSCT          ;TEST IF FIRST PASS
2459  015526  001413                        BEQ     SCOPEG          ;BR IF FIRST PASS -- QUICKK PASS
2460  015530  023737  015570  001044        CMP     SCOPEF,ICOUNT   ;COMPARE CURRENT COUNT TO MAX NUMBER
2461  015536  001407                SCOPEJ: BEQ     SCOPEG          ;EXIT-DONE
2462  015540  005237  015570                INC     SCOPEF          ;INCREMENT COUNT
2463  015544  022606                SCOPEB: CMP     (6)+,SP         ;REPOSITION STACK
2464  015546  012677  163250                MOV     (6)+,@PSW       ;RESTORE PREVIOUS PROCESSOR STATUS
2465  015552  000177  000014                JMP     @RETURN         ;REPEAT TEST
2466  015556  005037  015570        SCOPEG: CLR     SCOPEF          ;CLEAR COUNT
2467  015562  011637  015572                MOV     @SP,RETURN      ;SAVE SCOPE RETURN POINTER
2468  015566  000002                        RTI                     ;RETURN INLINE-NEXT TEST
```

```
                                SCOPEF: 0                       ;COUNT LOCATION FOR ITERATION LOOP
                                RETURN: KWTO                    ;ADDRESS OF LAST TEST

                                ;SCOPE AND/OR INTERATION LOOP FOR SOME TESTS 2 TIMES

                                SCOPEH: TSTTKS
                                        BIT     #40000,@SWR
                                        BNE     SCOPEB
                                        BIT     #4000,@SWR
                                        BNE     SCOPEG
                                        TST     PASSCT          ;TEST IF FIRST PASS
                                        BEQ     SCOPEG          ;BR IF YES
                                        CMP     SCOPEF,#2
                                        BR      SCOPEJ

                                ;SCOPE LOOP FOR SOME TEST 1 TIME

                                SCOPEI: TSTTKS                          ;TEST KEYBOARD
                                        BIT     #40000,@SWR
                                        BNE     SCOPEB
                                        BR      SCOPEG

                                BELL:   PRINT
                                        ENDPAS
                                BELLA:  PRINT
                                        RING
                                        RTS     PC              ;EXIT

                                ENDPAS: .ASCII  '%END PASS   @'

                                RING:   .BYTE   7,7,100
                                        .EVEN

                                ;LOAD THE LPS DISPLAY LIGHTS

                                LEDS:   MOV     #6,CNTLED
                                        CLR     LEDSV3
                                        MOV     @(5)+,LEDSV1
                                        TST     NOLEDS
                                        BEQ     LEDSA
                                        RTS     R5
                                LEDSA:  MOV     LEDSV1,LEDSV2
                                        BIC     #177770,LEDSV2
                                        MOVB    LEDSV3,LEDSV2+1
                                        MOV     LEDSV2,$TMDAT

                                ;*      MOV     $TMDAT,@ADDBR   ;/ PUT DATA FROM $TMDAT TO DEVICE REG ADDBR
                                        ASR     LEDSV1
                                        ASR     LEDSV1
                                        ASR     LEDSV1
                                        INC     LEDSV3
                                        DEC     CNTLED
```

```
2523  016014  001345                        BNE     LEDSA
2524  016016  000205                        RTS     5
2525
2526  016020  000006            CNTLED: 6
2527  016022  000000            LEDSV1: 0
2528  016024  000000            LEDSV2: 0
2529  016026  000000            LEDSV3: 0
2530  016030  000000            NOLEDS: 0
2531
```

```
2532
2533                                            ;MESSAGES
2534  016032  022445  046045  051520  TITLE:  .ASCII  '%%%LPS DIAGNOSTIC TEST II (MAINDEC-11-DRLPI-A)@'
2535  016040  042040  040511  047107
2536  016046  051517  044524  020103
2537  016054  042524  052123  044440
2538  016062  020111  046450  044501
2539  016070  042116  041505  030455
2540  016076  026461  051104  050114
2541  016104  026511  024501     100
2542
2543  016111     040  050040  020103  MES1:   .ASCII  "  PC   "
2544  016116  020040
2545  016120  045503  052123  052101          .ASCII  "CKSTAT "
2546  016126     040
2547  016127     103  041113  043125          .ASCII  "CKBUFF "
2548  016134  020106
2549  016136  047511  052123  052101          .ASCII  "IOSTAT "
2550  016144     040
2551  016145     111  026517  052517          .ASCII  "IO-OUT "
2552  016152  020124
2553  016154  044440  026517  047111          .ASCII  " IO-IN "
2554  016162     040
2555  016163     126  051503  040524          .ASCII  "VCSTAT "
2556  016170  020124
2557  016172  041526  040530  051530          .ASCII  "VCXAXS "
2558  016200     040
2559  016201     126  054503  054101          .ASCII  "VCYAXS "
2560  016206  020123
2561  016210  052040  046505  040120          .ASCII  " TEMP@"
2562
2563  016216  021045  046103  041517  MES2:   .ASCII  '%"CLOCK LOGIC TEST"%@'
2564  016224  020113  047514  044507
2565  016232  020103  042524  052123
2566  016240  022442     100
2567  016243     045  042042  043511  MES3:   .ASCII  '%"DIGITAL I/O LOGIC TEST"%@'
2568  016250  052111  046101  044440
2569  016256  047457  046040  043517
2570  016264  041511  052040  051505
2571  016272  021124  040045
2572  016276  021045  041523  050117  MES5:   .ASCII  '%"SCOPE LOGIC TEST"%@'
2573  016304  020105  047514  044507
2574  016312  020103  042524  052123
2575  016320  022442     100
2576  016323     045  053042  051511  MES6:   .ASCII  '%"VISUAL DISPLAY TEST"%@'
2577  016330  040525  020114  044504
2578  016336  050123  040514  020131
2579  016344  042524  052123  022442
2580  016352     100
2581  016353     045  054524  042520  MES4:   .ASCII  "%TYPE LETTER ' ' TO RUN DESIRED TEST:%"
2582  016360  046040  052105  042524
2583  016366  020122  020047  020047
2584  016374  047524  051040  047125
2585  016402  042040  051505  051111
```

```
2586   016410  042105  052040  051505
2587   016416  035124     045
2588   016421     047  023501  041475          .ASCII  "'A'=CLOCK LOGIC%"
2589   016426  047514  045503  046040
2590   016434  043517  041511     045
2591   016441     047  023502  044475          .ASCII  "'B'=I/O LOGIC%"
2592   016446  047457  046040  043517
2593   016454  041511     045
2594   016457     047  023503  051475          .ASCII  "'C'=SCOPE CONTROL LOGIC%"
2595   016464  047503  042520  041440
2596   016472  047117  051124  046117
2597   016500  046040  043517  041511
2598   016506     045
2599   016507     047  023504  053075          .ASCII  "'D'=VISUAL SCOPE DISPLAY%@"
2600   016514  051511  040525  020114
2601   016522  041523  050117  020105
2602   016530  044504  050123  040514
2603   016536  022531     100
2604
2605   016541     136  022503     100  CNTRLC: .ASCII  '↑C%@'
2606
2607   016545     136  040101          CNTRLA: .ASCII  '↑A@'
2608   016550  043536  047445  042114  CNTRLG: .ASCII  '↑G%OLD SWR = @'
2609   016556  051440  051127  036440
2610   016564  040040
2611   016566  020040  042516  020127  NEWSWR: .ASCII  '  NEW = @'
2612   016574  020075     100
2613
2614   016577     045     100          CRLF:   .ASCII  '%@'
2615
2616   016601     045  040056          DOT:    .ASCII  '%.@'
2617
2618   016604  020077     100          QMARK:  .ASCII  '? @'
2619   016607     045  047520  042527  MES21:  .ASCII  '%POWER FAILURE @'
2620   016614  020122  040506  046111
2621   016622  051125  020105     100
2622
2623           016630                          .EVEN
2624
2625
```

```
2626                                    ;ADDRESS AND CONSTANTS TABLE
2627
2628   016630  000000   PRINT1: 0
2629   016632  001000   STACK:  1000          ;INITIAL SP. ADDRESS
2630   016634  001504   AVECTR: INITA         ;'↑A' VECTOR ADDRESS
2631   016636  000000   PROC:   0             ;TEMP STORAGE FOR 'PSW'
2632   016640  000000   CHRCNT: 0             ;TEMP STORAGE
2633   016642  000000   COUNT:  0             ;TEMP STORAGE
2634   016644  000000   DELAY:  0
2635   016646  000000   KSTOR1: 0             ;PERMANENT STORAGE
2636   016650  000000   KSTOR3: 0             ;PERMANENT STORAGE
2637   016652  000000   KSTOR4: 0             ;PERMANENT STORAGE
2638   016654  000000   KSTOR5: 0
2639   016656  000000   KSTOR6: 0
2640   016660  000000   KSTOR7: 0
2641   016662  000000   KSTOR8: 0
2642   016664  000000   KSTOR9: 0
2643   016666  000000   KSTR10: 0
2644   016670  000000   KSTR11: 0
2645   016672  000000   KSTR12: 0
2646   016674  000000   TEMP:   0
2647   016676  000000   TEMP1:  0             ;TEMPORARY STORAGE
2648   016700  000000   TEMP2:  0             ;TEMPORARY STORAGE
2649   016702  000000   BRLEV1: 0
2650   016704  000000   BRLEV2: 0
2651   016706  000000   BRLEV3: 0
2652   016710  000000   LOW:    0
2653   016712  000000   HIGH:   0
2654   016714  000020   INCR:   20
2655   016716  000000   TIMSV:  0
2656   016720  000000   TICKS:  0
```

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

016722  004737  023054          VISUAL: JSR     PC,$RESET
016726  104000                          PRINT
016730  016323                          MES6
016732  005037  001042          VTEST2: CLR     PASSCT
016736  013706  016632          VSUALO: MOV     STACK,SP        ;LOAD THE STACK POINTER
016742  013777  001042  162070          MOV     PASSCT,@DISPLA  ;LOAD PASS COUNT
016750  012737  017016  015572          MOV     #PIC0+2,RETURN  ;LOAD RETURN ADDRESS
016756  005077  162040                  CLR     @PSW
016762  042737  000002  020156          BIC     #BIT1,MODE
016770  032777  000020  162040          BIT     #BIT4,@SWR
016776  001003                          BNE     VSLOA
017000  052737  000002  020156          BIS     #BIT1,MODE
017006  052777  000100  162012  VSLOA:  BIS     #BIT6,@TKS      ;ENABLE KEYBOARD

                                        ;DISPLAY HORIZONTAL LINE USING INTERRUPT, NON STORE DISPLAY.
017014  013737  001066  017056  PIC0:   MOV     VCXREG,R0X
017022  013737  001070  017060          MOV     VCYREG,R1Y
017030  004737  017062                  JSR     PC,PBB

                                        ;DISPLAY A VERTICAL LINE

017034  013737  001070  017056  PIC1:   MOV     VCYREG,R0X
017042  013737  001066  017060          MOV     VCXREG,R1Y
017050  004737  017062                  JSR     PC,PBB
017054  000467                          BR      PIC3

017056  000000          R0X:    .WORD   0
017060  000000          R1Y:    .WORD   0


017062          PBB:

                        ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
017072  013704  001064          MOV     VCSTAT,R4
017076  012737  000050  016720  MOV     #50,TICKS
017104  004737  020634          JSR     PC,CHTIME       ;CHECK TIMER
017110  012703  007760  PB:     MOV     #7760,R3        ;SET HIGH LIMIT
017114  013702  016714  PD:     MOV     INCR,R2         ;INITIALIZE INCREMENTS BETWEEN POINTS
017120  012737  004000  001174  PEEA:   MOV     #4000,$TMDAT

                        ;*      MOV     $TMDAT,@R1Y     ;/ PUT DATA FROM $TMDAT TO DEVICE REG R1Y
017136  012737  000000  001174          MOV     #0,$TMDAT

                        ;*      MOV     $TMDAT,@R0X     ;/ PUT DATA FROM $TMDAT TO DEVICE REG R0X
017154          PE:
017154  060237  001174          ADD     R2,$TMDAT

                        ;*      MOV     $TMDAT,@R0X     ;/ PUT DATA FROM $TMDAT TO DEVICE REG R0X
017170  012737  000001  001166  MOV     #1,$BDDAT
```

```
2711
2712                                    ;*      MOV     $BDDAT,@VCSTAT  ;/ PUT DATA FROM $BDDAT TO DEVICE REG VCSTAT
2713
2714                                    ;*      MOV     @ROX,$BDDAT     ;/READ DEVICE REG ROX,PUT DATA IN $BDDAT.
2715  017216  023703  001174                      CMP     $TMDAT,R3               ;DONE ALL POINTS?
2716  017222  001354                      BNE     PE              ;NO
2717  017224  004737  020532                      JSR     PC,TIMER
2718  017230  000733                      BR      PEEA
2719  017232  000207                      RTS     PC
2720
```

```
2721
2722                                    ;PINCUSHION
2723                                    ;PLOT A SQUARE FROM LOWER LEFT TO LOWER RIGHT TO
2724                                    ;UPPER RIGHT TO UPPER LEFT TO 10WER LEFT.
2725                                    ;NON STORE DISPLAY
2726  017234  012737  007770  016712  PIC3:   MOV     #7770,HIGH
2727  017242  012737  000000  016710          MOV     #0,LOW
2728
2729                                    ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
2730  017260  012737  000050  016720          MOV     #50,TICKS
2731  017266  004737  020634                  JSR     PC,CHTIME
2732  017272  013701  001066                  MOV     VCXREG,R1
2733  017276  013702  001070                  MOV     VCYREG,R2
2734  017302  013703  001064                  MOV     VCSTAT,R3
2735  017306  013704  016714                  MOV     INCR,R4
2736  017312                          P3:
2737
2738                                    ;*      MOV     LOW,@VCXREG     ;/ PUT DATA FROM LOW TO DEVICE REG VCXREG
2739
2740                                    ;*      MOV     LOW,@VCYREG     ;/ PUT DATA FROM LOW TO DEVICE REG VCYREG
2741                                    ;DRAW BOTTOM LINE
2742  017332  012700  000377                  MOV     #377,R0
2743  017336  012737  000004  001174          MOV     #4,$TMDAT               ;ENABLE INTENSIFY ON LOADING X
2744
2745                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2746  017354                          P3A:
2747
2748                                    ;*      MOV     @VCXREG,$TMDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $TMDAT.
2749  017364  060437  001174                  ADD     R4,$TMDAT
2750
2751                                    ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
2752  017400  005300                          DEC     R0
2753  017402  001364                          BNE     P3A             ;NO
2754                                    ;DRAW RIGHT LINE
2755  017404  012737  000010  001174          MOV     #10,$TMDAT              ;ENABLE INTENSIFY ON LOADING Y
2756
2757                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2758  017422  012700  000377                  MOV     #377,R0
2759  017426                          P3B:
2760
2761                                    ;*      MOV     @VCYREG,$TMDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $TMDAT.
2762  017436  060437  001174                  ADD     R4,$TMDAT
2763
2764                                    ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
2765  017452  005300                          DEC     R0
2766  017454  001364                          BNE     P3B             ;NO
2767                                    ;DRAW TOP LINE
2768  017456  012737  000004  001174          MOV     #4,$TMDAT               ;ENABLE INTENSIFY ON LOADING X
2769
2770                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2771  017474  012700  000377                  MOV     #377,R0
2772  017500                          P3C:
2773
2774                                    ;*      MOV     @VCXREG,$TMDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $TMDAT.
```

```
2775  017510  160437  001174                  SUB     R4,$TMDAT
2776
2777                                  ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
2778  017524  005300                          DEC     R0
2779  017526  001364                          BNE     P3C             ;NO
2780                                  ;DRAW LEFT LINE
2781  017530  012737  000010  001174          MOV     #10,$TMDAT              ;ENABLE INTENSIFY LOADING Y
2782
2783                                  ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMdAT TO DEViCE REG VCSTAT
2784  017546  012700  000377                  MOV     #377,R0
2785  017552                          P3D:
2786
2787                                  ;*      MOV     @VCYREG,$TMDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $TMDAT.
2788  017562  160437  001174                  SUB     R4,$TMDAT
2789
2790                                  ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
2791  017576  005300                          DEC     R0
2792  017600  001364                          BNE     P3D             ;NO
2793  017602  004737  020532                  JSR     PC,TIMER
2794  017606  000401                          BR      3$
2795  017610  000402                          BR      PIC4
2796  017612  000137  017312          3$:     JMP     P3
2797                                  ;PLOT AN X WITH NON STORE DISPLAY
2798  017616  012737  000000  016710  PIC4:   MOV     #0,LOW
2799  017624  012737  007770  016712          MOV     #7770,HIGH
2800
2801                                  ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
2802  017642  012737  000050  016720          MOV     #50,TICKS
2803  017650  004737  020634                  JSR     PC,CHTIME       ;CHECK TIME
2804  017654  013701  001066          PIC4B:  MOV     VCXREG,R1
2805  017660  013702  001070                  MOV     VCYREG,R2
2806  017664  013703  001064                  MOV     VCSTAT,R3
2807  017670  013700  016712                  MOV     HIGH,R0
2808  017674  013704  016714                  MOV     INCR,R4
2809  017700                          P4:
2810
2811                                  ;*      MOV     LOW,@VCYREG     ;/ PUT DATA FROM LOW TO DEVICE REG VCYREG
2812
2813                                  ;*      MOV     LOW,@VCXREG     ;/ PUT DATA FROM LOW TO DEVICE REG VCXREG
2814
2815                                  ;PLOT LINE BEGINNING IN LOWER LEFT CORNER
2816  017720  012737  000004  001174          MOV     #4,$TMDAT               ;ENABLE INTENSIFY ON LOADING X
2817
2818                                  ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2819  017736  012700  000377                  MOV     #377,R0
2820  017742                          P4A:
2821
2822                                  ;*      MOV     @VCYREG,$GDDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $GDDAT.
2823  017752  060437  001170                  ADD     R4,$GDDAT
2824
2825                                  ;*      MOV     $GDDAT,@VCYREG  ;/ PUT DATA FROM $GDDAT TO DEVICE REG VCYREG
2826
2827                                  ;*      MOV     @VCXREG,$BDDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $BDDAT.
2828  017776  060437  001166                  ADD     R4,$BDDAT
```

```
2829
2830                                    ;*      MOV     $BDDAT,@VCXREG  ;/ PUT DATA FROM $BDDAT TO DEVICE REG VCXREG
2831  020012  005300                            DEC     R0
2832  020014  001352                            BNE     P4A             ;NO
2833                                    ;PLOT LINE BEGINNING IN UPPER LEFT CORNER
2834
2835                                    ;*      MOV     HIGH,@VCYREG    ;/ PUT DATA FROM HIGH TO dEVICE REG VCYREG
2836
2837                                    ;*      MOV     LOW,@VCXREG     ;/ PUT DATA FROM LOW TO DEVICE REG VCXREG
2838  020036  012700  000377                    MOV     #377,R0
2839  020042                            P4B:
2840
2841                                    ;*      MOV     @VCYREG,$TMDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $TMDAT.
2842  020052  160437  001174                    SUB     R4,$TMDAT
2843
2844                                    ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
2845
2846                                    ;*      MOV     @VCXREG,$TMDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $TMDAT.
2847  020076  060437  001174                    ADD     R4,$TMDAT
2848
2849                                    ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
2850  020112  005300                            DEC     R0
2851  020114  001352                            BNE     P4B             ;NO
2852  020116  004737  020532                    JSR     PC,TIMER
2853  020122  000666                            BR      P4
2854
2855                                            .EVEN
2856
2857
2858
2859
2860  020124  004737  023054            PIC20:  JSR     PC,$RESET
2861  020130  005737  000042                    TST     @#42
2862  020134  001402                            BEQ     .+6
2863  020136  000137  002160                    JMP     WHATE
2864  020142  004737  015650                    JSR     PC,BELL         ;REPORT END OF PASS
2865  020146  005237  001042                    INC     PASSCT
2866  020152  000137  016736                    JMP     VSUALO
2867
2868  020156  000010                    MODE:   10
2869
2870  020160  012737  002000  001174    CLRVC:  MOV     #BIT10,$TMDAT   ;ENABLE STORE
2871
2872                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2873
2874                                    ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
2875  020206  052737  010000  001174            BIS     #BIT12,$TMDAT   ;ERASE THE SCREEN
2876
2877                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO dEVICE REG VCSTAT
2878  020224  012700  000020                    MOV     #20,R0          ;SET UP DELAY
2879  020230  005001                            CLR     R1
2880
2881  020232                            CLRVCA:
2882
```

```
2883                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
2884  020242  105737  001166                    TSTB    $BDDAT
2885  020246  100405                          BMI     CLRVCB          ;BRANCH IF SET
2886  020250  005301                          DEC     R1              ;DELAY
2887  020252  001367                          BNE     CLRVCA
2888  020254  005300                          DEC     R0              ;DELAY
2889  020256  001365                          BNE     CLRVCA
2890  020260  104400                          ERROR                   ;ERROR, ERASE FAILED TO SET READY AFTER A DELAY
2891
2892  020262  000207                  CLRVCB: RTS     PC
2893
2894  020264                          LOADVC:
2895
2896                                    ;*      MOV     $ZERO,@VCSTAT   ;/ PUT DATA FROM $ZERO TO DEVICE REG VCSTAT
2897  020274  012737  007777  016676            MOV     #7777,TEMP1
2898  020302  013700  001064                    MOV     VCSTAT,R0
2899  020306  013701  001066                    MOV     VCXREG,R1
2900  020312  013702  001070                    MOV     VCYREG,R2
2901  020316  012737  002000  001174            MOV     #BIT10,$TMDAT   ;SET STORE MODE
2902
2903                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2904
2905                                    ;*      MOV     TEMP1,@VCYREG   ;/ PUT DATA FROM TEMp1 TO DEVICE REG VCYREG
2906  020344  012737  007777  001174  LODVCA: MOV     #7777,$TMDAT
2907
2908                                    ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCXREG
2909  020362  000413                          BR      LODVCC
2910  020364                          LODVCB:
2911
2912                                    ;*      MOV     @VCXREG,$TMDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $TMdAT.
2913  020374  162737  000010  001174            SUB     #10,$TMDAT
2914
2915                                    ;*      MOV     $TMDAT,@VCXREG  ;/ PUT DATA FROM $TMDaT TO DEVICE REG VCXREG
2916  020412                          LODVCC:
2917
2918                                    ;*      MOV     @VCSTAT,$TMDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $TMDAT.
2919  020422  005237  001174                    INC     $TMDAT
2920
2921                                    ;*      MOV     $TMDAT,@VCSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCSTAT
2922  020436  000240                          NOP
2923  020440                          1$:
2924
2925                                    ;*      MOV     @VCSTAT,$BDDAT  ;/READ DEVICE REG VCSTAT,PUT DATA IN $BDDAT.
2926  020450  105737  001166                    TSTB    $BDDAT
2927  020454  100371                          BPL     1$
2928
2929                                    ;*      MOV     @VCXREG,$TMDAT  ;/READ DEVICE REG VCXREG,PUT DATA IN $TMDAT.
2930  020466  022737  000007  001174            CMP     #7,$TMDAT
2931  020474  001333                          BNE     LODVCB
2932  020476  104007                          TSTTKS                  ;TEST FOR INPUT FLAG
2933
2934                                    ;*      MOV     @VCYREG,$TMDAT  ;/READ DEVICE REG VCYREG,PUT DATA IN $TMdAT.
2935  020510  162737  000003  001174            SUB     #3,$TMDAT
2936
```

```
 2937                                   ;*      MOV     $TMDAT,@VCYREG  ;/ PUT DATA FROM $TMDAT TO DEVICE REG VCYREG
 2938  020526  001306                           BNE     LODVCA
 2939  020530  000207                           RTS     PC
```

```
2940
2941
2942                                    ;TIMER ROUTINE
2943                                    ; ENTER VIA JSR PC,TIMER
2944
2945  020532  017737  160300  016716  TIMER:  MOV     @SWR,TIMSV
2946  020540  104007                          TSTTKS
2947  020542  032737  000400  016716  TIMERA: BIT     #BIT8,TIMSV
2948  020550  001006                          BNE     TIMER2          ;BIT 8 SET ?
2949  020552  005337  016720                  DEC     TICKS           ;NO, DECREMENT TICKS
2950  020556  001002                          BNE     TIMER1
2951  020560  062716  000002                  ADD     #2,(6)          ;ADD 2 TO STACK POINTER
2952  020564  000207                  TIMER1: RTS     PC              ;RETURN
2953
2954                                    ; SWR 8=1 SELECT TEST TO LOCK ON
2955                                    ; SWR 2-0= TEST NUMBER
2956
2957  020566  042737  177770  016716  TIMER2: BIC     #177770,TIMSV
2958  020574  006337  016716                  ASL     TIMSV
2959  020600  062737  020624  016716          ADD     #ROUTPT,TIMSV
2960  020606  017737  176104  016716          MOV     @TIMSV,TIMSV
2961  020614  013706  016632                  MOV     STACK,SP
2962  020620  000177  176072          TIMER4: JMP     @TIMSV
2963
2964  020624  017014                  ROUTPT: PIC0                    ;DISPLAY A HORIZONTAL LINE
2965  020626  017034                          PIC1                    ;DISPLAY A VERTICAL LINE
2966  020630  017234                          PIC3                    ;DISPLAY A SQUARE
2967  020632  017616                          PIC4                    ;DISPALY A "X"
2968
2969  020634  013737  001014  016702  CHTIME: MOV     PDPDLY,BRLEV1
2970  020642  005337  016702          CHTMA:  DEC     BRLEV1
2971  020646  001403                          BEQ     CHTMB
2972  020650  006337  016720                  ASL     TICKS
2973  020654  000772                          BR      CHTMA
2974  020656  000207                  CHTMB:  RTS     PC
```

```
                                        ;SLOW RELAY SWITCH TEST
                                        
020660  013706  016632          RELAY:  MOV     STACK,SP        ;LOAD THE STACK
020664  005037  001124                  CLR     .DVLS
                                        
                                ;*      MOV     @GRSTAT,$TMDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $TMDAT.
020700  052737  000401  001174          BIS     #BIT8!BIT0,$TMDAT
                                        
                                ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMDAT TO DEVICE REG GRSTAT
020716  004737  020756                  JSR     PC,DLY
                                        
                                ;*      MOV     @GRSTAT,$TMDAT  ;/READ DEVICE REG GRSTAT,PUT DATA IN $TMDAT.
020732  042737  000401  001174          BIC     #BIT8!BIT0,$TMDAT
                                        
                                ;*      MOV     $TMDAT,@GRSTAT  ;/ PUT DATA FROM $TMdAT TO DEVICE REG GRSTAT
020750  004737  020756                  JSR     PC,DLY
020754  000741                          BR      RELAY
                                        
020756  013737  001014  016644  DLY:    MOV     PDPDLY,DELAY
020764  005037  021006          DLYA:   CLR     DELAY1
020770  005237  021006                  INC     DELAY1
020774  001375                          BNE     DLYA
020776  005337  016644                  DEC     DELAY
021002  001372                          BNE     DLYA
021004  000207                          RTS     PC
021006  000000          DELAY1: 0
                                        
                                        ;SCOPE OUTPUT OF CLOCK OVERFLOW
                                        
021010  013706  016632          CKOVFL: MOV     STACK,SP
021014  012737  177766  001174          MOV     #-10.,$TMDAT    ;LOAD COUNTER PRESET
021022  005037  001124                  CLR     .DVLS
                                        
                                ;*      MOV     $TMDAT,@CSB     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSB
021036  012737  000403  001174          MOV     #403,$TMDAT     ;LOAD RATE AND MODE
                                        
                                ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
021054                          SOCOA:
                                        
                                ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
021064  105737  001166                  TSTB    $BDDAT
021070  100371                          BPL     SOCOA
021072  000746                          BR      CKOVFL
                                        
                                        ;TEST FOR SCHMITT TRIGGER #1 AND #2
                                        
021074  005037  016676          ST1:    CLR     TEMP1
021100  042737  100000  021174          BIC     #BIT15,STSC
021106  000406                          BR      STSA
                                        
021110  012737  001000  016676  ST2:    MOV     #1000,TEMP1             ;LOAD MODE
021116  052737  100000  021174          BIS     #BIT15,STSC
021124  013706  016632          STSA:   MOV     STACK,SP
021130  005037  016650                  CLR     KSTOR3
```

```
3029  021134  005037  001124                  CLR     .DVLS
3030  021140  013737  016676  001174  STSB:   MOV     TEMP1,$TMDAT            ;LOAD STATUS
3031
3032                                    ;*      MOV     $TMDAT,@CSR     ;/ PUT DATA FROM $TMDAT TO DEVICE REG CSR
3033  021156  004537  015702                  JSR     5,LEDS
3034  021162  016650                          KSTOR3
3035
3036  021164                          STST:
3037
3038                                    ;*      MOV     @CSR,$BDDAT     ;/READ DEVICE REG CSR,PUT DATA IN $BDDAT.
3039  021174  005737  001166          STSC:   TST     $BDDAT
3040  021200  100371                          BPL     STST
3041
3042                                    ;*      MOV     $ZERO,@CSR      ;/ PUT DATA FROM $ZERO TO DEVICE REG CSR
3043  021212  005237  016650                  INC     KSTOR3
3044  021216  004737  015654                  JSR     PC,BELLA
3045  021222  000746                          BR      STSB
3046
3047                                    ;*
3048                                    ;*THIS SUB CODE IS USED TO INITIALIZE THE LPA-11
3049                                    ;*FIRST WE WILL LOAD MICROCODE INTO KMC-11
3050                                    ;*NEXT WE WILL INIT BOTH UPROCESSORS
3051                                    ;*THEN WE WILL LOAD DEVICE TABLE IN SLAVE UP.
3052                                    ;*THE ORDER OF LOAD IS DETERMINED BY THE USER.
3053                                    ;*
3054                                    ;*      CALL=   JSR     R5,$LPAI
3055                                    ;*              .WORD   0               ;ADDR. OF DEVICE ADDRESS.
3056                                    ;* ROUTINES REQUIRED:    .LOADLP
3057                                    ;* PROGRAMS REQUIRED:    DRLPX2
3058                                    ;*
3059
3060                                    ;*              ;RETURNS WITH $AERR=1 IF SLAVE
3061                                    ;*              ;MICRO SAYS AN ADDR. DOES NOT EXSIST. IN THE LIST.
3062                                    ;*
3063  021224                          $LPAI:
3064  021224  013746  000004                  MOV     4,-(SP)
3065
3066  021230  000413                          BR      31$             ;FIELD DOES NOT HAVE A BUS SWITCH TO
3067                                                                  ;WORRY ABOUT,SO WE WILL UNCONDITIONALLY
3068                                                                  ;BRANCH ARROUD THE NEXT CODE THAT
3069                                                                  ;WORKS BASED ON A BUS SWITCH.
3070                                                                  ;CODE LEFT IN HERE FOR IN HOUSE
3071                                                                  ;PERSONAL WHO MAY PATCH THIS BRANCH
3072                                                                  ;INSTRUCTION TO A <NOP> OCTAL <240>
3073                                                                  ;IN ORDER TO rUN PROGRAM WITH A SWITCH.
3074
3075                                                                  ;NOTE THIS "SWITCH" IS A PIECE OF INHOUSE
3076                                                                  ;TEST EQUIPMENT ONLY IT CONNECTS
3077                                                                  ;THE UNIBUS TO THE I/O BUS FOR
3078                                                                  ;CERTAIN TESTING.
3079  021232  012737  021256  000004          MOV     #30$,4
3080  021240  005237  170000                  INC     170000
3081  021244  104000                          PRINT
3082  021246  021252                          64$
```

```
3083  021250  000401                          BR      65$
3084  021252                          64$:    ;ASCIZ  <7>##
3085  021254                          65$:
3086  021254  000401                          BR      31$
3087  021256  022626                  30$:    CMP     (SP)+,(SP)+
3088  021260  012637  000004          31$:    MOV     (SP)+,4         ;ALL THIS JUNK MUST BE REMOVED!!
3089  021264  005037  022102                  CLR     $AERR
3090  021270  004537  022104                  JSR     R5,$LOAD        ;LOAD MICRO-CODE.
3091  021274  000000G                         .WORD   DRLPX2          ;FILE "DRLPX2.OBJ"
3092
3093  021276  052777  040000  157572          BIS     #BIT14,@KMADO   ;ISSUE KMC+DMC INIT.
3094
3095  021304                          1$:
3096                                                                  ;"HANGS" HERE THEN KMC-11 ERROR.
3097  021304  010146                          MOV     R1,-(SP)
3098  021306  005001                          CLR     R1
3099  021310  005201                  2$:     INC     R1              ;STALL FOR DMC-UP
3100  021312  001376                          BNE     2$
3101  021314  012777  104000  157554          MOV     #BIT15!BIT11,@KMADO     ;SET RUN, AND ENABLE ARBITRATION.
3102  021322  105201                  25$:    INCB    R1
3103  021324  001376                          BNE     25$
3104
3105  021326  032777  000040  157542          BIT     #BIT5,@KMADO    ;SLAVE READY? (READING IPBM SR)
3106  021334  001401                          BEQ     3$
3107                                                                  ;FATAL LPA-11 ERROR SLAVE NOT READY.
3108  021336  104400                          ERROR
3109
3110  021340  012777  000004  157534  3$:     MOV     #4,@KMAD2       ;READ FAST PATH
3111  021346                          4$:
3112  021346  004537  022720                  JSR     R5, $TOUT       ;-TOUT-CHECK FOR TIMEOUT
3113
3114  021352  104400                          ERROR                   ;/TIME-OUT ERROR
3115                                                                  ;/WE FAILED TO COMPLETE
3116                                                                  ;/CURRENT OPERATION.
3117                                                                  ;/CONTINUES IN THIS LOOP
3118                                                                  ;/WOULD MAKE US "HANG" HERE
3119
3120  021354  000774                          BR              4$
3121
3122                                                                  ;/RETURNS HERE-FROM-TIMED OUT.
3123  021356  122777  000377  157516          CMPB    #377,@KMAD2     ;WAIT TILL KMC DONE COMMAND.
3124  021364  001370                          BNE     4$
3125  021366  122777  000377  157512          CMPB    #377,@KMAD4     ;IF FAST PATH=377 THEN ERROR.
3126  021374  001001                          BNE     35$
3127  021376  104400                          ERROR                   ;IPBM ERROR (SLAVE SIDE)
3128                                                                  ;YOU MUST RUN IPBM DIAGNOSTIC.
3129
3130  021400  122777  000004  157500  35$:    CMPB    #4,@KMAD4       ;IS THIS THE CORRECT VERSION OF MICRO-CODE?
3131  021406  001543                          BEQ     5$              ;YES-CONTINUE.
3132  021410  005227  177777                  INC     #-1
3133  021414  001140                          BNE     5$
3134  021416  005227  177777                  INC     #-1
3135  021422  001135                          BNE     5$
3136  021424  104000                          PRINT
```

```
3137  021426  021432                          66$
3138  021430  000440                          BR      67$
3139  021432                          66$:    ;ASCIZ  <200>"W A R N I N G  THIS PROGRAM WAS DESiGNED TO RUN WITH VERSION 4"
3140  021532                          67$:
3141  021532  104000                          PRINT
3142  021534  021540                          68$
3143  021536  000430                          BR      69$
3144  021540                          68$:    ;ASCIZ  <200>"MICRO-CODE. ANOTHER VERSION CODE WAS DETECTED."
3145  021620                          69$:
3146  021620  104000                          PRINT
3147  021622  021626                          70$
3148  021624  000434                          BR      71$
3149  021626                          70$:    ;ASCIZ  <200>"THIS MAY OR MAYNOT CAUSE FALSE ERROR TO BE REPORTED."<200><200>
3150  021716                          71$:
3151
3152  021716  112737  177777  022050  5$:     MOVB    #0-1,11$        ;DAC CODE FOR SLAVE.
3153  021724  012501                          MOV     (5)+,R1         ;GET NEXT DEVICE ADDR.
3154  021726  021127  000000          6$:     CMP     (R1),#0         ;TERM REACHED?
3155  021732  001444                          BEQ     10$
3156  021734  105237  022050                  INCB    11$
3157  021740  113777  022050  157140          MOVB    11$,@KMAD4      ;FIFO DATA
3158  021746  004737  022052                  JSR     PC,20$          ;ISSUE SEND
3159  021752  112177  157130                  MOVB    (R1)+,@KMAD4    ;SEND LOW BYTE OF DEVICE ADDR TO SLAVE.
3160  021756  004737  022052                  JSR     PC,20$          ;ISSUE SEND
3161  021762  112177  157120                  MOVB    (R1)+,@KMAD4    ;SEND HIGH BYTE OF DEVICE ADDR. TO SLAVE.
3162  021766  004737  022052                  JSR     PC,20$
3163
3164  021772  032777  000002  157076  7$:     BIT     #BIT1,@KMAD0    ;WAIT FOR FIFO DATA
3165  022000  001374                          BNE     7$              ;=1 NO DATA. =0 DATA.
3166  022002  112777  000002  157072          MOVB    #2,@KMAD2       ;READ FIFO.
3167
3168  022010                          8$:
3169  022010  004537  022720                  JSR     R5, $TOUT       ;-TOUT-CHECK FOR TIMEOUT
3170
3171  022014  104400                          ERROR                   ;/TIME-OUT ERROR
3172                                                                  ;/WE FAILED TO COMPLETE
3173                                                                  ;/CURRENT OPERATION.
3174                                                                  ;/CONTINUES IN THIS LOOP
3175                                                                  ;/WOULD MAKE US "HANG" HERE
3176
3177  022016  000774                          BR              8$
3178
3179                                                                  ;/RETURNS HERE-FROM-TIMED OUT.
3180  022020  122777  000377  157054          CMPB    #377,@KMAD2     ;WAIT FOR READ.
3181  022026  001370                          BNE     8$
3182  022030  105777  157052                  TSTB    @KMAD4          ;WAS A ZERO RETURNED?
3183  022034  001734                          BEQ     6$              ;YES GET NEXT ADDR.
3184                                                                  ;SLAVE WILL RETURN CODE 0 IF
3185  022036  005237  022102                  INC     $AERR           ;DEV PRESENT.   ELSE
3186                                                                  ;EXIT $AERR=1 IF SLAVE GIVES ERROR.
3187  022042  005041                          CLR     -(1)            ;GET RID OF REFERENCE TO BAD ADDR.
3188  022044  012601                  10$:    MOV     (SP)+,R1
3189  022046  000205                          RTS     R5              ;RETURN ALL ADDR. CHECKED.
3190
```

```
3191  022050  000000                    11$:    .WORD   0               ;HOLDS DAC CODE PLUS OFFSET
3192                                                                      ;TO SLAVES ADDR. TABLE.
3193
3194  022052  112777  000003  157022    20$:    MOVB    #3,@KMAD2       ;ISSUE FIFO WRITE
3195  022060                            21$:
3196  022060  004537  022720                    JSR     R5, $TOuT       ;-TOUT-CHECK FOR TIMEOUT
3197
3198  022064  104400                            ERROR                   ;/TIME-OUT ERROR
3199                                                                      ;/WE FAILED TO COMPLETE
3200                                                                      ;/CURRENT OPERATION.
3201                                                                      ;/CONTINUES IN THIS LOOP
3202                                                                      ;/WOULD MAKE US "HANG" HERE
3203
3204  022066  000774                            BR              21$
3205
3206                                                                      ;/RETURNS HERE-FROM-TIMED OUT.
3207  022070  122777  000377  157004            CMPB    #377,@KMAD2     ;KMC CODE WILL RETURN A "377"
3208  022076  001370                            BNE     21$             ;WHEN DONE COMMAND.
3209  022100  000207                            RTS     PC
3210
3211  022102  000000                    $AERR:  .WORD   0               ;=0 IF ADDR. LIST OK,=1 IF BAD.
3212
3213                                            ;*
3214                                            ;*THIS SUB CODE USED TO LOAD MICRO-CODE INTO LPA-11.
3215                                            ;*      CALL =  JSR     R5,$LOAD
3216                                            ;*              .WORD   XX              ;ADDR. OF MICRO CODE.
3217                                            ;*              ;RETURNS HERE
3218                                            ;*      NOTE:   MICRO CODE FILE MUST END IN -1 DATA.
3219                                            ;*
3220
3221  022104  010446                    $LOAD:  MOV     R4,-(SP)        ;SAVE R4.
3222  022106  010046                            MOV     R0,-(SP)        ;SAVE R0.
3223  022110  012500                    1$:     MOV     (5)+,R0         ;GET PROG. ADDR.
3224  022112  005077  156760                    CLR     @KMAD0          ;CLEAR CSR
3225  022116  005077  156764                    CLR     @KMAD4          ;CLEAR CRAM ADDR.
3226  022122  052777  002000  156746  2$:      BIS     #2000,@KMAD0    ;SELECT CRAM.
3227  022130  012077  156756                    MOV     (0)+,@KMAD6     ;WRITE DATA.
3228  022134  052777  020000  156734            BIS     #20000,@KMAD0   ;SET CRAM WRITE
3229  022142  005077  156730                    CLR     @KMAD0          ;DISABLE CRAM.
3230  022146  005277  156734                    INC     @KMAD4          ;UPDATE CRAM ADDR.
3231  022152  021027  177777                    CMP     (0),#-1         ;ALL DONE?
3232  022156  001361                            BNE     2$              ;NO LOOP.
3233  022160  005077  156722                    CLR     @KMAD4          ;CLEAR CRAM ADDR.
3234  022164  016500  177776                    MOV     -2(5),R0        ;GET MICRO CODE ADDR.
3235
3236  022170  052777  002000  156700  3$:      BIS     #2000,@KMAD0    ;SELECT CRAM
3237  022176  022077  156710                    CMP     (R0)+,@KMAD6    ;DATA OK?
3238  022202  001013                            BNE     5$              ;NO - REPORT AN ERROR.
3239  022204  021027  177777                    CMP     (0),#-1         ;ALL DONE?
3240  022210  001405                            BEQ     4$              ;YES - EXIT
3241  022212  005077  156660                    CLR     @KMAD0          ;NO - DESELECT CRAM.
3242  022216  005277  156664                    INC     @KMAD4          ;UPDATE CRAM ADDR.
3243  022222  000762                            BR      3$
3244
```

```
3245  022224  012600                  4$:   MOV     (SP)+,R0        ;RESTORE R0
3246  022226  012604                        MOV     (SP)+,R4        ;RESTORE R4
3247  022230  000205                        RTS     R5              ;EXIT
3248
3249  022232                          5$:                           ;COME HERE ON LOAD ERROR
3250  022232  005745                        TST     -(5)
3251  022234  105204                        INCB    R4              ;UPDATE ERROR COUNTER.
3252  022236  100324                        BPL     1$              ;IF NOT TOO MANY, TRY AGAIN.
3253  022240  000000                        HALT                    ;MICRO CODE LOAD ERROR.
3254                                                                ;KMC-11 FAULT. YOU COULD TRY
3255  022242  000722                        BR      1$              ;TO PRESS CONTINUE TO GIVE IT
3256                                                                ;ANOTHER CHANCE, BUT I DOUBT
3257                                                                ;THAT THAT WOULD WORK. SINCE I'VE
3258                                                                ;ALREADY GIVEN IT '77 (OCTAL) CHANCES.
3259                                                                ;TRY RUNNING THE KMC-11 DIAGNOSTIC.
3260
3261
3262                                    ;
3263                                    ;*THIS ROUTINE ISSUES A WRITE COMMAND TO THE LPA-11
3264                                    ;*
3265                                    ;*      CALL =  JSR     R5,$TLKW
3266                                    ;*              .WORD   0               ;OFFSET OF DEVICE ADDR.
3267                                    ;*              .WORD   0               ;DATA TO BE WRITTEN
3268                                    ;*
3269  022244  010046                  $TLKW: MOV     R0,-(SP)        ;SAVE R0
3270  022246  012500                        MOV     (5)+,R0         ;GET DEVICE OFFSET
3271  022250  052700  000340                BIS     #340,R0         ;ADD WRITE CODE.
3272  022254  004737  022526                JSR     PC,$LPW         ;WAIT FOR FAST PATH READY
3273  022260  010037  022352                MOV     R0,W1
3274  022264  010077  156616                MOV     R0,@KMAD4
3275  022270  112777  000005  156604        MOVB    #5,@KMAD2       ;ISSUE FAST PATH WRITE
3276  022276  004737  022526                JSR     PC,$LPW         ;WAIT FOR RDY
3277  022302  011537  022354                MOV     (5),W2
3278  022306  112577  156574                MOVB    (5)+,@KMAD4     ;WRITE LOW BYTE DATA.
3279
3280  022312  112777  000005  156562        MOVB    #5,@KMAD2       ;FP WRITE
3281  022320  004737  022526                JSR     PC,$LPW
3282  022324  111537  022356                MOVB    (5),W3
3283  022330  112577  156552                MOVB    (5)+,@KMAD4     ;WRITE HIGH BYTE
3284  022334  112777  000005  156540        MOVB    #5,@KMAD2
3285  022342  004737  022526                JSR     PC,$LPW
3286  022346  012600                        MOV     (SP)+,R0
3287  022350  000205                        RTS     R5              ;EXIT DONE.
3288  022352  000000                  W1:   0
3289  022354  000000                  W2:   0
3290  022356  000000                  W3:   0
3291
3292                                    ;*
3293                                    ;*THIS ROUTINE ISSUES A READ COMMAND TO THE LPA-11
3294                                    ;*
3295                                    ;*      CALL =  JSR     R5,$TLKr
3296                                    ;*              .WORD   0               ;OFFSET OF DEVICE
3297                                    ;*              ;RETURNS HERE
3298                                    ;*DATA IN WORD $DATR
```

```
3299                                                    ;*
3300
3301  022360  010046                          $TLKR:   MOV     R0,-(SP)       ;SAVE R0
3302  022362  012500                                   MOV     (5)+,R0        ;GET OFFSET
3303  022364  052700  000300                          BIS     #300,R0        ;ADD READ CODE
3304  022370  004737  022526                          JSR     PC,$LPW        ;WAIT TILL READY
3305  022374  110077  156506                          MOVB    R0,@KMAD4
3306  022400  112777  000005  156474                  MOVB    #5,@KMAD2      ;ISSUE WRITE FP
3307  022406  004737  022526                          JSR     PC,$LPW
3308  022412  010037  022522                          MOV     R0,RD1
3309  022416                                  1$:
3310  022416  004537  022720                          JSR     R5, $TOUT      ;-TOUT-CHECK FOR TIMEOUT
3311
3312  022422  104400                                   ERROR                  ;/TIME-OUT ERROR
3313                                                                          ;/WE FAILED TO COMPLETE
3314                                                                          ;/CURRENT OPERATION.
3315                                                                          ;/CONTINUES IN THIS LOOP
3316                                                                          ;/WOULD MAKE US "HANG" HERE
3317
3318  022424  000774                                   BR              1$
3319
3320                                                                          ;/RETURNS HERE-FROM-TIMED OUT.
3321  022426  032777  000040  156442                  BIT     #BIT5,@KMAD0   ;FAST PATH GOT DATA?
3322  022434  001370                                   BNE     1$
3323  022436  112777  000004  156436                  MOVB    #4,@KMAD2      ;ISSUE FAST PATH READ
3324  022444  004737  022526                          JSR     PC,$LPW
3325  022450  117737  156432  022524                  MOVB    @KMAD4,$DATR   ;GET LOW BYTE
3326  022456                                  2$:
3327  022456  004537  022720                          JSR     R5, $TOUT      ;-TOUT-CHECK FOR TIMEOUT
3328
3329  022462  104400                                   ERROR                  ;/TIME-OUT ERROR
3330                                                                          ;/WE FAILED TO COMPLETE
3331                                                                          ;/CURRENT OPERATION.
3332                                                                          ;/CONTINUES IN THIS LOOP
3333                                                                          ;/WOULD MAKE US "HANG" HERE
3334
3335  022464  000774                                   BR              2$
3336
3337                                                                          ;/RETURNS HERE-FROM-TIMED OUT.
3338  022466  032777  000040  156402                  BIT     #BIT5,@KMAD0   ;FAST PATH READY?
3339  022474  001370                                   BNE     2$
3340  022476  112777  000004  156376                  MOVB    #4,@KMAD2      ;ISSUE FAST PATH READ
3341  022504  004737  022526                          JSR     PC,$LPW
3342  022510  117737  156372  022525                  MOVB    @KMAD4,$DATR+1 ;SAVE HIGH BYTE
3343  022516  012600                                   MOV     (SP)+,R0
3344  022520  000205                                   RTS     R5
3345  022522  000000                          RD1:     0
3346  022524  000000                          $DATR:   .WORD   0
3347                                                    ;
3348                                                    ;THIS ROUTINE WAITS FOR KMC-CODE TO BECOME READY AS WELL
3349                                                    ;AS FAST PATH TO BE READ.
3350                                                    ;
3351                                                    ;       CALL =  JSR     PC,$LPw
3352                                                    ;
```

```
3353                                            ;IT WILL TIME OUT IF TOO MUCH TIME IS TAKEN BY
3354                                            ;THE MICRO-PROCESSORS AND REPORT AN ERROR, THEN HALT.
3355                                            ;
3356
3357  022526  010146                  $LPW:    MOV     R1,-(SP)        ;SAVE R1
3358  022530  005001                           CLR     R1
3359  022532  122777  000377  156342  1$:      CMPB    #377,@KMAD2     ;FINISHED INSTRUCTION?
3360  022540  001403                           BEQ     2$
3361  022542  005201                           INC     R1              ;TIME OUT?
3362  022544  001372                           BNE     1$
3363  022546  000411                           BR      10$
3364
3365  022550  032777  000020  156320  2$:      BIT     #BIT4,@KMAD0    ;FAST PATH READ?
3366  022556  001403                           BEQ     3$
3367  022560  005201                           INC     R1              ;NO - TIME OUT?
3368  022562  001372                           BNE     2$
3369  022564  000402                           BR      10$             ;YES - REPORT AN ERROR
3370
3371  022566  012601                  3$:      MOV     (SP)+,R1        ;RESTORE R1
3372  022570  000207                           RTS     PC              ;EXIT
3373
3374  022572                           10$:
3375  022572  104000                           PRINT
3376  022574  022600                           64$
3377  022576  000407                           BR      65$
3378  022600                           64$:    ;ASCIZ  <200>#LPA-11 FAULT#
3379  022616                           65$:
3380
3381  022616  000000                  11$:     HALT                    ;LPA-11 FAULT RUN LPA-11
3382  022620  000776                           BR      11$             ;DIAGNOSTICS.
3383
3384
3385
3386                                            ;*
3387                                            ;*THIS ROUTINE PROVIDES THE LINKAGE FROM USER CODE TO
3388                                            ;*A DEVICE ADDRESS ON THE I/O BUSS FOR WRITE ONLY.
3389                                            ;*
3390                                            ;* FIRST WE WILL DETERMINE IF THE ADDRESS HAS BEEN USED
3391                                            ;* BEFORE. IF NOT WE HAVE TO INITIALIZE THE LPA WITH
3392                                            ;* THAT ADDRESS.
3393                                            ;* WHEN THE ADDR. IS KNOWN BY THE LPA, DO THE OUTPUT BY
3394                                            ;* $TLKW
3395                                            ;*
3396
3397  022622  010046                  $OUtLP:  MOV     R0,-(SP)        ;SAVE R0
3398  022624  010146                           MOV     R1,-(SP)        ;SAVE R1
3399
3400  022626  012700  001124                   MOV     #.DVLS,R0       ;PROGRAM DEFINED LIST.
3401  022632  005001                           CLR     R1
3402  022634  005710                  1$:      TST     (0)             ;TERMINATOR REACHED?
3403  022636  001421                           BEQ     10$             ;YES NEXT STEP.
3404  022640  027520  000000                   CMP     @(5),(0)+       ;MATCH WITH ADDR IN LIST?
3405  022644  001402                           BEQ     2$
3406  022646  005201                           INC     R1
```

```
3407  022650  000771                          BR      1$
3408
3409  022652  010137  022670          2$:     MOV     R1,3$           ;SAVE OFFSET, DEVICE KNOWN.
3410  022656  005725                          TST     (5)+
3411  022660  013537  022672                  MOV     @(5)+,4$        ;GET DATA TO BE WRITTEN
3412  022664  004537  022244                  JSR     R5,$TLKW        ;DO WRITE
3413  022670  000000          3$:     .WORD   0                       ;DEVICE OFFSET
3414  022672  000000          4$:     .WORD   0                       ;DATA TO BE WRITTEN.
3415  022674  012601                  MOV     (SP)+,R1
3416  022676  012600                  MOV     (SP)+,R0
3417  022700  000205                  RTS     R5
3418  022702  017520  000000  10$:     MOV     @(5),(0)+       ;SAVE ADDR.
3419  022706  005010                  CLR     (0)
3420  022710  004537  021224                  JSR     R5,$LPAI
3421  022714  001124                  .WORD   .DVLS
3422  022716  000755                  BR      2$
3423
3424                                  ;*
3425                                  ;*$TOUT ROUTINE USED TO WATCH IF
3426                                  ;*      WE'RE IN A LOOP TOO-LONG
3427                                  ;*      CALL=   JSR R5, $TOUT
3428                                  ;*              ERROR X     ;RETURNS HERE ON TIMEOUT
3429                                  ;*              BR
3430                                  ;*              ;RETURNS HERE NO ERROR
3431                                  ;*
3432
3433  022720  020537  022754  $TOUT:  CMP     R5,$SAD         ;SAME ADDR?
3434  022724  001405                  BEQ     1$
3435  022726  010537  022754                  MOV     R5,$SAD         ;NO-SAVE THIS ADDR.
3436  022732  005037  022756                  CLR     $CNT            ;CLR CNT AT ADDR.
3437  022736  000403                  BR      2$
3438  022740  005237  022756  1$:     INC     $CNT            ;OVERFLOW?
3439  022744  100402                  BMI     3$              ;YES-ERROR RETURN
3440  022746  062705  000004  2$:     ADD     #4,R5           ;NO-NON ERROR RETURN
3441  022752  000205          3$:     RTS     R5              ;RETURN.
3442
3443  022754  000000  $SAD:   .WORD   0               ;CONTAINS LOOP ADDR.
3444  022756  000000  $CNT:   .WORD   0               ;# OF TIMES AT ADDR.
3445                                  ;*
3446                                  ;*THIS ROUTINE PROVIDES THE LINKAGE FROM USER CODE
3447                                  ;*TO A DEVICE ADDR. ON THE I/O BUSS FOR READ ONLY.
3448                                  ;*
3449                                  ;*FIRST WE WILL DETERMINE IF THE ADDRESS HAS BEEN
3450                                  ;*USED BEFORE. IF NOT, WE HAVE TO INITIALIZE THE LPA
3451                                  ;*WITH THE NEW ADDR.
3452                                  ;*WHEN THE ADDR IS KNOWN WE CAN DO OUTPUT THROUGH
3453                                  ;*$TLKR
3454                                  ;*      CALL THROUGH    MOVEI   DATA,ADDR.
3455                                  ;*              WHICH EQUALS:
3456                                  ;*                      JSR     R5,$INLP
3457                                  ;*                      .WORD   XX      ADDR OF DEVICE
3458                                  ;*                      .WORD   YY      ADDR TO STORE READ DATA.
3459
3460  022760  010046  $INLP:  MOV     R0,-(SP)        ;SAVE R0
```

```
3461  022762  010146                        MOV     R1,-(SP)        ;SAVE R1
3462
3463  022764  012700  001124                MOV     #.DVLS,P0       ;PROG DEFINED ADDR. LIST.
3464  022770  005001                        CLR     R1
3465  022772  005710                1$:     TST     (0)             ;EOL REACHED?
3466  022774  001420                        BEQ     10$             ;YES - DEFINE NEW ADDR.
3467
3468  022776  027520  000000              CMP     @(5),(0)+       ;ADDR. MATCH?
3469  023002  001402                        BEQ     2$
3470  023004  005201                        INC     R1
3471  023006  000771                        BR      1$
3472
3473  023010  010137  023022        2$:     MOV     R1,3$           ;SAVE LIST OFFSET
3474  023014  005725                        TST     (5)+
3475  023016  004537  022360                JSR     R5,$TLKr        ;GO READ DEVICE
3476          023022          $OFS=.
3477  023022  000000                3$:     .WORD   0               ;OFFSET OF DEVICE
3478
3479  023024  013735  022524                MOV     $DATR,@(5)+     ;STORE DATA.
3480  023030  012601                        MOV     (SP)+,R1        ;RESTORE R1
3481  023032  012600                        MOV     (SP)+,R0        ;RESTORE R2
3482  023034  000205                        RTS     R5              ;EXIT
3483
3484  023036  017520  000000        10$:    MOV     @(5),(0)+
3485  023042  005010                        CLR     (0)
3486  023044  004537  021224                JSR     R5,$LPAI
3487  023050  001124                        .WORD   .DVLS
3488  023052  000756                        BR      2$
3489
3490                                        ;*
3491                                        ;* THIS ROUTINE REPLACES WHAT THE USER WOULD ORDINARILY
3492                                        ;*USE FOR A RESET.  FIRST,WE DO A RESET INSTRUCTION.
3493                                        ;*THEN WE CLR ".DVLST" WHICH FORCES US TO RESET BOTH THE
3494                                        ;*KMC AND DMC AS SOON AS A DEVICE IS REFERENCED.
3495                                        ;*
3496                                        ;*      CALL=JSR        PC,$RESET       ;REPLACES "RESET INSTRUCTION
3497                                        ;*              ;RETURNS HERE.
3498                                        ;*
3499  023054  000005                $RESET: RESET                   ;RESET THE WORLD.
3500
3501                                ;*      MOV     @2$,1$  ;/READ DEVICE REG 2$,PUT DATA IN 1$.
3502  023066  005737  022102                TST     $AERR           ;IF NO ERROR,LOOP
3503  023072  001004                        BNE     10$             ;THERE WAS AN ERROR.
3504  023074  062737  000002  023110        ADD     #2,2$           ;UPDATE DEVICE ADDR.
3505                                                                ;YOU SEE ,WE HAVE TO PROTECT OUR SELF!
3506                                                                ;IF 2$ CONTAINED A VALID ADDR,WE
3507                                                                ;MUST KEEP TRYING UNTIL WE GENERATE
3508                                                                ;AN INVALID ADDR.
3509  023102  000764                        BR      $RESET
3510  023104                        10$:
3511  023104  000207                        RTS     PC
3512  023106  000000                1$:     .WORD   0               ;JUNK LOC.
3513  023110  160000                2$:     .WORD   160000          ;DUMB ADDR. FORCES INIT OF DMC/KMC.
3514
```

```
                                                ;
                                                ;SDELAY- ROUTINE TO GIVE A MINOR DELAY.
                                                ;        IS NOT TIME DEPENDENT CODE SENCE
                                                ;        NOT USED TO GET SPECIFIC TIME BUT
                                                ;        JUST A LITTLE DELAY.
                                                ;
                                                ;        THAT IS UNLESS A REAL TIME CLOCK IS PRESENT!
                                                ;        THEN WE'LL GENERATE A TIME BETWEEN 16MS TO 32 MS
                                                ;
                                                ;
                                                ;        CALL=   JSR PC,  SDELAY
                                                ;
023112                          SDELAY:
023112  005737  023174                        TST     RTCCSR          ;CLOCK PRESENT?
023116  100016                               BPL     10$
023120  012737  000002  023164                MOV     #2,TIME
023126  052777  000115  000040                BIS     #115,@RTCCSR    ;START CLOCK
023134  005037  001024                        CLR     PS
023140  005737  023164          1$:           TST     TIME
023144  001375                               BNE     1$
023146  005077  000022                        CLR     @RTCCSR         ;STOP CLOCK
                                
023152  000207                               RTS PC
023154  105237  023164          10$:          INCB    TIME
023160  001375                               BNE     10$
023162  000207                               RTS     PC
                                
023164  000000                 TIME:         .WORD   0
                                
023166  005337  023164          CLKINT:       DEC     TIME
023172  000002                               RTI
023174  000000                 RTCCSR:       .WORD   0               ;CLOCK CSR IF USED.
                                                ;
                                                ;
                                                ;THIS ROUTINE LOOKS THROUGH CURENT .DVLS FOR A/D ADDR.
                                                ;IF UNFOUND,GENERATES IT. THIS ROUTINE'S WHOLE PURPOSE IS
                                                ;TO SET UP THE USER PROGRAM TO LINK TO FILE "DRLPX2" FOR
                                                ;SAMPLE TAKEING PURPOSES.
                                                ;       TO TAKE SAMPLES, THE USER PROGRAM MUST SET UP
                                                ;       A/D CSR IN BSEL 4,AND 5.
                                                ;       (2) HE MUST CALL THIS ROUTINE:
                                                ;               JSR     R5,$PUTS        ;CALL SET UP ROUTINE.
                                                ;               .WORD   ADCSR           ;ADDR. OF A/D CSR.
                                                ;               ;RETURNS HERE ;KMC BSEL 3,6,7 PERMINENTLY SET UP
                                                ;                               ;(UNTILL ONE DOES A RESET)
                                                ;
                                                ;       (3)THE USER MUST PUT CODE 006 INTO KMC REG 2 TO
                                                ;          START CONVERSION  CAUTION*DO WITH MOVB INSTR.!
                                                ;       (4)MONITOR KMC REG 2 FOR CODE 377 (DRLPX2 IS DONE)
                                                ;       (5)READ KMC REG 4,5 FOR A/D RESULT.
                                                ;       (6) TO TAKE MORE SAMPLES,SIMPLY PUT A/D CSR INTO
                                                ;          BSEL 4,5 AND CODE 6 INTO BSEL 2.
                                                ;
```

```
3569   023176   012537   023206          $PUTS:  MOV     (5)+,1$                 ;GET ADDR OF ADDR. OF A/D
3570   023202   004537   022760                  JSR     R5,$INLP
3571   023206   000000                    1$:     .WORD   0
3572   023210   023304                            .WORD   10$
3573   023212   113777   023022   155672         MOVB    $OFS,@KMAD6
3574   023220   113777   023022   155666         MOVB    $OFS,@KMAD7
3575   023226   013737   023206   023246         MOV     1$,2$
3576   023234   062737   000002   023246         ADD     #2,2$
3577   023242   004537   022760                  JSR     R5,$INLP
3578   023246   000000                    2$:     .WORD   0
3579   023250   023304                            .WORD   10$
3580   023252   113777   023022   155624         MOVB    $OFS,@KMAD3
3581   023260   152777   000340   155624         BISB    #340,@KMAD6
3582   023266   152777   000300   155620         BISB    #300,@KMAD7
3583   023274   152777   000300   155602         BISB    #300,@KMAD3
3584   023302   000205                          RTS     R5
3585   023304   000000                    10$:    .WORD   0
3586
3587            000001                          .END
```

```
ADBRL    001004          161#
ADCS     001046          181#    280
ADDBR    001050          182#    305    2518
ADINT    001176          239#    289     331*
ADINT1   001200          240#    331     332*
AVCT12   013442         2020    2040    2048#
AVECTR   016634          340*    2194    2630#
AVECT1=  000300          225     226     241#    242
BEGIN    002252          427#    1318
BELL     015650         1316    1697    2129    2491#   2864
BELLA    015654         2493#   3044
BIT0   = 000001           87#     488     681    1136    1162    1179    1245    1261    1511    1516    1587    1903    2981
                         2987
BIT1   = 000002           86#    1084    1738    1743    2071    2670    2673    3164
BIT10  = 002000           77#     698     722     746     772     800     841     860     888     907     936     955     983
                         1002    1031    1061    1072    1359    1372    1811    1816    2025    2086    2870    2901
BIT11  = 004000           76#     816     853     900     948     995    1823    1828    2086    3101
BIT12  = 010000           75#     656     676    1042    2025    2875
BIT13  = 020000           74#     671    1110
BIT14  = 040000           73#    1110    1548    1553    1587    3093
BIT15  = 100000           72#     617    1110    1535    1540    1587    1593    3022    3026    3101
BIT2   = 000004           85#    1084    1750    1755    1966    2071
BIT3   = 000010           84#    1084    1762    1767    1993    2071
BIT4   = 000020           83#    1775    1780    2071    2671    3365
BIT5   = 000040           82#     350    2019    3105    3321    3338
BIT6   = 000100           81#     431     483    1123    1147    1401    1433    1574    1579    1587    1599    1602    1713
                         1737    1787    1792    2086    2155    2674
BIT7   = 000200           80#     598     817    1123    1561    1566    1587    1743    1755    1767    1780    1792    1804
                         1816    1828    2078    2093
BIT8   = 000400           79#    1097    1523    1528    1587    1919    1924    1944    2947    2981    2987
BIT9   = 001000           78#     693    1097    1359    1799    1804    2086
BRLEV1   016702         1684*   1685*   2062*   2063*   2649#   2969*   2970*
BRLEV2   016704         1686*   2064*   2650#
BRLEV3   016706         1687*   1688*   2065*   2066*   2651#
CHRCNT   016640         2156*   2173*   2174    2200    2202*   2632#
CHTIME   020634         2697    2731    2803    2969#
CHTMA    020642         2970#   2973
CHTMB    020656         2971    2974#
CK       015460         2378    2443#
CKBRL    001006          162#
CKDLY    007640         1340*   1358    1387#
CKOVFL   021010          145    3004#   3017
CKTEST   002236          139     353     423#
CKV      001204          244#    333*
CKVS     001206          245#    333     334*
CLKINT   023166         3545#
CLRVC    020160         2870#
CLRVCA   020232         2881#   2887    2889
CLRVCB   020262         2885    2892#
CNTDEV   007634         1338*   1355    1385#
CNTLED   016020         2506*   2522*   2526#
CNTRLA   016545         2186    2607#
CNTRLC   016541          325    2605#
CNTRLG   016550         2222    2608#
```

```
COUNT   016642          849*   856*   896*   903*   944*   951*   991*   998*  2633#
CRLF    016577         2211   2405   2410  2614#
CSB     001054          186#   439    446    448    456    458    466    468    479    693    715    720    727
                        739    744    751    765    770    777    794    805    836    846    865    883    893
                        912    931    941    960    978    988   1007   1025   1036   1056   1066   1077   1277
                       1337   1377   1382   2388   3009
CSR     001052          185#   374    437    491    493    503    505    515    517    527    529    540    542
                        552    554    564    566    576    578    589    591    601    603    608    610    620
                        622    627    629    638    642    654    656    659    661    671    674    676    679
                        681    691    696    698    701    703    712    718    722    725    736    742    746
                        749    760    768    772    775    792    797    800    803    811    820    834    839
                        841    844    853    856    860    863    881    886    888    891    900    903    907
                        910    929    934    936    939    948    951    955    958    976    981    983    986
                        995    998   1002   1005   1023   1028   1031   1034   1042   1045   1053   1059   1061
                       1064   1072   1075   1087   1090   1100   1103   1113   1116   1126   1129   1139   1142
                       1157   1162   1174   1179   1190   1202   1214   1226   1239   1245   1256   1261   1274
                       1280   1284   1288   1290   1335   1363   1365   1368   1372   1375   1380   2386   3012
                       3015   3033   3039   3043
CTEST1  002246          392    426#
DELAY   016644         1280*  1291*  2634#  2993*  2997*
DELAY1  021006         2994*  2995*  3000#
DIOBRL  001010          163#  1678*  1681   1684   1686   1687
DISPLA  001040          175#   301*   427*  1398*  1710*  2667*
DLY     020756         2984   2990   2993#
DLYA    020770         2995#  2996   2998
DOT     016601          348   2616#
DRLPX2= ******  G        14#  3091
DRT0    007740         1397   1412#
DRT1    010002         1422#
DRT10   010554         1534#
DRT11   010616         1546#
DRT12   010666         1560#
DRT13   010730         1572#
DRT14   011000         1585#
DRT15   011072         1601#
DRT16   011142         1613#
DRT17   011204         1625#
DRT18   011246         1635#
DRT19   011310         1647#
DRT2    010054         1434#
DRT20   011360         1662#
DRT28   011444         1604   1677#
DRT3    010116         1444#
DRT4    010160         1454#
DRT5    010236         1467#
DRT6    010320         1481#
DRT6A   010322         1482#  1492
DRT7    010376         1490   1495#
DRT7A   010400         1496#  1506
DRT8    010450         1504   1510#
DRT9    010512         1522#
EMTOK   014606         2287   2289#
EMTSRV  014566          126   2283#
EMTTAB  014626         2291   2297#
```

```
ENDPAS  015662          2492    2497#
ERROR = 104400           148#     450     460     470     481     495     507     519     531     544     556     568     580
                         593      605     612     624     631     644     663     683     705     729     753     779     807
                         813      848     867     895     914     943     962     990    1009    1038    1068    1079    1092
                        1105     1118    1131    1144    1159    1164    1176    1181    1192    1204    1216    1228    1241
                        1247     1258    1263    1304    1306    1420    1431    1442    1452    1465    1478    1489    1503
                        1518     1530    1542    1555    1568    1581    1596    1611    1621    1633    1643    1658    1675
                        1732     1745    1757    1769    1782    1794    1806    1818    1830    1843    1853    1865    1875
                        1890     1896    1913    1926    1934    1951    1959    1973    1985    2000    2012    2033    2045
                        2081     2096    2109    2122    2890    3108    3114    3127    3171    3198    3312    3329
FILCHR  001020           167#    2333
FILLS   001016           166#    2330
GRBHIO  001074           197#     287*    288*
GRDAI   001060           189#    1409    1609    1631    1641    1670    2394
GRDIO   001062           190#     287    1411    1416    1418    1426    1429    1438    1440    1448    1450    1458    1461
                        1463     1471    1474    1476    1485    1487    1499    1501    1607    1617    1619    1629    1639
                        1652     1667    2392
GRIVA   001210           247#     335*
GRIVB   001214           250#     337*
GRIVSA  001212           248#     335     336*
GRIVSB  001216           251#     337     338*
GRSTAT  001056           188#     377    1407    1514    1516    1526    1528    1538    1540    1551    1553    1564    1566
                        1577     1579    1590    1593    1650    1656    1665    1673    2390    2981    2984    2987    2990
HERE    007322          1313    1316#
HIGH    016712          2653#    2726*   2799*   2807    2836
ICOUNT  001044           177#    2460
INBUF   014446           350*     351     354     357     360    2154   2157*   2158*   2159*   2160*   2161*   2162*   2163*
                        2229    2245#
INCR    016714          2654#    2699    2735    2808
INIT    001224           138     260#
INITA   001504           316#     340    2630
INIT1A  001314           283#     286
INIT1B  001356           292#     295
INIT2   001542           311      318     328#    365
INIT3   001766           363#
INPUTA  014134          2164#    2165    2179    2201
INPUTB  014166          2172#    2207
IOTEST  007642           140      356    1393#
IOTSTA  007656          1397#    1699
ITEST1  007652           395    1396#
KMAD0   001076           208#     268    3093*   3101*   3105    3164   3224*   3226*   3228*   3229*   3236*   3241*   3321
                        3338    3365
KMAD1   001100           211#     269
KMAD2   001102           213#    3110*   3123    3166*   3180    3194*   3207   3275*   3280*   3284*   3306*   3323*   3340*
                        3359
KMAD3   001104           215#    3580*   3583*
KMAD4   001106           217#    3125    3130    3157*   3159*   3161*   3182   3225*   3230*   3233*   3242*   3274*   3278*
                        3283*   3305*   3325    3342
KMAD5   001110           219#
KMAD6   001112           221#    3227*   3237    3573*   3581*
KMAD7   001114           223#     273    3574*   3582*
KSTOR1  016646          2635#
KSTOR3  016650          2380*   2381*   2383    2412    2636#   3028*   3034   3043*
KSTOR4  016652          2396    2430    2637#
```

```
KSTOR5   016654            2398    2433    2638#
KSTOR6   016656            2386    2415    2639#
KSTOR7   016660            2388    2418    2640#
KSTOR8   016662            2390    2421    2641#
KSTOR9   016664            2392    2424    2642#
KSTR10   016666            2394    2427    2643#
KSTR11   016670            2400*   2439    2644#
KSTR12   016672            2400    2436    2645#
KWT0     002324             430     442#   2470
KWT10    002744             536#
KWT11    003006             548#
KWT12    003050             560#
KWT14    003112             572#
KWT15    003154             585#
KWT16    003216             597#
KWT17    003306             616#
KWT18    003376             635#
KWT18A   003414             639#    646
KWT19    003442             651#
KWT2     002366             452#
KWT20    003522             668#
KWT22    003622             688#
KWT23    003730             709#
KWT24    004056             733#
KWT25    004204             757#
KWT26    004336             789#
KWT26A   004376             797#    821
KWT3     002430             462#
KWT30    004524             808     814     831#
KWT30A   004640             850#    857
KWT31    004744             878#
KWT31A   005060             897#    904
KWT32    005164             926#
KWT32A   005300             945#    952
KWT33    005404             973#
KWT33A   005520             992#    999
KWT34    005630            1020#
KWT34A   005670            1028#   1046
KWT35    005776            1039    1050#
KWT36    006164            1083#
KWT37    006230            1096#
KWT38    006274            1109#
KWT39    006340            1122#
KWT4     002472             474#
KWT40    006404            1135#
KWT41    006456            1152#
KWT42    006534            1169#
KWT43    006612            1185#
KWT44    006646            1197#
KWT45    006702            1209#
KWT46    006736            1221#
KWT47    006772            1234#
KWT48    007050            1251#
KWT49    007256            1264    1296#
```

```
KWTS    002534            487#
KWTS2   007256           1297#
KWT6    002576            499#
KWT62   007256           1298#
KWT7    002640            511#
KWT8    002702            523#
LEDS    015702            341    2382    2506#   3033
LEDSA   015730           2510    2512#   2523
LEDSV1  016022           2508#   2512    2518#   2519*   2520*   2527#
LEDSV2  016024           2512*   2513*   2514*   2515    2528#
LEDSV3  016026           2507*   2514    2521*   2529#
LGERR1  015352           2403    2409#
LGERR2  015472           2379    2447#
LOADVC  020264           2894#
LODVCA  020344           2906#   2938
LODVCB  020364           2910#   2931
LODVCC  020412           2909    2916#
LOGERR  015154            128    2376#
LOGICA  002174            131     403#
LOW     016710           2652#   2727*   2739    2741    2798*   2812    2814    2838
LPADH   001110            218#
LPADL   001106            216#
LPCI    001076            207#
LPCO    001102            212#
LPMR    001100            210#
LPMS1   001112            220#
LPMS2   001114            222#
LPSADD  001000            159#     281
LPSO    001104            214#
LPSVCT  001002            160#     290
MASK    015136           2349*   2355    2360*   2367#
MES1    016111           2407    2543#
MES2    016216            425    2563#
MES21   016607           2275    2619#
MES3    016243           1395    2567#
MES4    016353            317    2581#
MES5    016276           1706    2572#
MES6    016323           2576#   2664
MINCNT  007636           1339*   1350    1352    1386#
MODE    020156           2670*   2673*   2868#
MONITR  001512            137     320#   2197    2276
NEWIN   014062           2154#   2244
NEWSWR  016566           2226    2611#
NOCLK   002206            368*    381     390     409#    413*
NODIO   002210            369*    383     393     410#    415*
NOLEDS  016030            302*    308*   2509    2530#
NOSCOP  002212            370*    385     396     411#    417*
OCTPRT  015006           2302    2343#
OUTPTA  014204           2176#   2177    2205
pASSCT  001042            176#    426*    427    1317*   1396*   1398    1698*   1707*   1710    2130*   2458    2479    2665*
                         2667    2865*
PB      017110           2698#
PBB     017062           2679    2685    2692#
PC    =%000007            117#    279*    320*    400*    401*    403*    423*    476*   1087*   1100*   1113*   1126*   1139*
```

```
                    1154*  1171*  1187*  1199*  1211*  1223*  1236*  1253*  1311*  1316*  1341*  1342*  1344*
                    1382*  1393*  1426*  1590*  1693*  1704*  1727*  2074*  2089*  2104*  2117*  2125*  2273*
                    2495*  2662*  2679*  2685*  2697*  2717*  2719*  2731*  2793*  2803*  2852*  2860*  2864*
                    2892*  2939*  2952*  2974*  2984*  2990*  2999*  3044*  3158*  3160*  3162*  3209*  3272*
                    3276*  3281*  3285*  3304*  3307*  3324*  3341*  3372*  3511*  3538*  3541*
PD        017114    2699#
PDPDLY    001014     165#  2969   2993
PE        017154    2706#  2716
PEEA      017120    2700#  2718
PICO      017014    2668   2677#  2964
PIC1      017034    2683#  2965
PIC20     020124    2860#
PIC3      017234    2686   2726#  2966
PIC4      017616    2795   2798#  2967
PIC4B     017654    2804#
PRINT =   104000     149#   314    316    324    347    363    424   1394   1705   2185   2210   2221   2225
                    2242   2274   2404   2406   2409   2491   2493   2663   3081   3136   3141   3146   3375
PRINT1    016630     313*  2402   2408*  2628#
PROC      016636    2258*  2265   2631#
PRTOCT=   104005     154#  2223   2411   2414   2417   2420   2423   2426   2429   2432   2435   2438
PS        001024     169#  3533*
PSW       001022     168#   261*   322*   429*  1400*  1547*  1573*  1586*  1598*  1712*  2264*  2464*  2669*
PWRFAL    014464     120    328   2251#
PWRUP     014520    2259   2264#
P3        017312    2736#  2796
P3A       017354    2746#  2753
P3B       017426    2759#  2766
P3C       017500    2772#  2779
P3D       017552    2785#  2792
P4        017700    2809#  2853
P4A       017742    2820#  2832
P4B       020042    2839#  2851
QMARK     016604     364   2243   2618#
RATE      007632    1153*  1170*  1186*  1198*  1210*  1222*  1235*  1252*  1277   1337*  1359*  1360   1384#
RD1       022522    3308*  3345#
RELAY     020660     146   2977#  2991
REPEAT    007336    1299   1332#
RETURN    015572     430*  1397*  1711*  2465   2467*  2470#  2668*
RING      015677    2494   2500#
ROUTPT    020624    2959   2964#
RTCCSR    023174    3529   3532*  3536*  3547#
R0      =%000000     110#   266    268*   271*   272    277*   280*   289*   402*  1343   1345   1346*  1347*
                    1349*  1355   1358*  1368*  1377*  1670*  1902*  1911*  1918*  1932*  1939*  1957*  1965*
                    1983*  1992*  2010*  2021*  2043*  2077*  2078*  2079   2092*  2093*  2094   2148   2192*
                    2217*  2229*  2230   2232   2251   2272*  2742*  2752*  2758*  2765*  2771*  2778*  2784*
                    2791*  2807*  2819*  2831*  2838*  2850*  2878*  2888*  2898*  3222   3223*  3234*  3237
                    3245*  3269   3270*  3271*  3273   3274   3286*  3301   3302*  3303*  3305   3308   3343*
                    3397   3400*  3416*  3460   3463*  3481*
ROX       017056    2677*  2683*  2688#  2706   2710   2715
R1      =%000001     111#   267    269*   273    276*   281*   283    284*   290*   292    293*   2149   2166*
                    2167*  2168   2170   2172   2178   2183   2191*  2195   2198   2203*  2206   2208   2216*
                    2219   2228*  2234*  2235*  2236*  2237*  2239   2252   2271*  2732*  2804*  2879*  2886*
                    2899*  3097   3098*  3099*  3102*  3153*  3154   3159   3161   3188*  3357   3358*  3361*
                    3367*  3371*  3398   3401*  3406*  3409   3415*  3461   3464*  3470*  3473   3480*
```

```
R1Y     017060  2678* 2684* 2689* 2703
R2      =%000002  112* 282* 285* 291* 294* 2150 2190* 2215* 2232* 2233* 2237 2253 2270*
                2699* 2707 2733* 2805* 2900*
R3      =%000003  113* 2151 2189* 2214* 2254 2269* 2698* 2715 2734* 2806*
R4      =%000004  114* 2152 2154* 2172* 2188* 2204 2213* 2255 2268* 2695* 2735* 2749 2762
                2775 2788 2808* 2823 2828 2842 2847 3221 3246* 3251*
R5      =%000005  115* 305* 341* 374* 377* 380* 437* 439* 446* 448* 456* 458* 466*
                468* 479* 491* 493* 503* 505* 515* 517* 527* 529* 540* 542* 552*
                554* 564* 566* 576* 578* 589* 591* 601* 603* 608* 610* 620* 622*
                627* 629* 638* 642* 654* 656* 659* 661* 671* 674* 676* 679* 681*
                691* 693* 696* 698* 701* 703* 712* 715* 718* 720* 722* 725* 727*
                736* 739* 742* 744* 746* 749* 751* 760* 765* 768* 770* 772* 775*
                777* 792* 794* 797* 800* 803* 805* 811* 820* 834* 836* 839* 841*
                844* 846* 853* 856* 860* 863* 865* 881* 883* 886* 888* 891* 893*
                900* 903* 907* 910* 912* 929* 931* 934* 936* 939* 941* 948* 951*
                955* 958* 960* 976* 978* 981* 983* 986* 988* 995* 998* 1002* 1005*
                1007* 1023* 1025* 1028* 1031* 1034* 1036* 1042* 1045* 1053* 1056* 1059* 1061*
                1064* 1066* 1072* 1075* 1077* 1087* 1090* 1100* 1103* 1113* 1116* 1126* 1129*
                1139* 1142* 1157* 1162* 1174* 1179* 1190* 1202* 1214* 1226* 1239* 1245* 1256*
                1261* 1274* 1277* 1280* 1284* 1288* 1290* 1299* 1335* 1337* 1338 1339 1340
                1353* 1354 1356* 1363* 1365* 1368* 1372* 1375* 1377* 1380* 1382* 1407* 1409*
                1411* 1416* 1418* 1426* 1429* 1438* 1440* 1448* 1450* 1458* 1461* 1463* 1471*
                1474* 1476* 1485* 1487* 1499* 1501* 1514* 1516* 1526* 1528* 1538* 1540* 1551*
                1553* 1564* 1566* 1577* 1579* 1590* 1593* 1607* 1609* 1617* 1619* 1629* 1631*
                1639* 1641* 1650* 1652* 1656* 1665* 1667* 1670* 1673* 1719* 1721* 1723* 1730*
                1741* 1743* 1753* 1755* 1765* 1767* 1778* 1780* 1790* 1792* 1802* 1804* 1814*
                1816* 1826* 1828* 1839* 1841* 1849* 1851* 1861* 1863* 1871* 1873* 1883* 1886*
                1888* 1894* 1906* 1909* 1922* 1924* 1930* 1942* 1944* 1947* 1949* 1955* 1969*
                1971* 1977* 1981* 1996* 1998* 2004* 2008* 2025* 2028* 2030* 2039* 2074* 2077*
                2089* 2092* 2104* 2107* 2117* 2120* 2153 2187* 2212* 2256 2267* 2313 2314*
                2318 2320* 2322 2324 2336 2345 2346* 2351* 2352* 2353* 2354 2363* 2386*
                2388* 2390* 2392* 2394* 2396* 2398* 2400* 2511* 2518* 2695* 2703* 2706* 2710*
                2713* 2715* 2730* 2739* 2741* 2746* 2749* 2752* 2758* 2762* 2765* 2771* 2775*
                2778* 2784* 2788* 2791* 2802* 2812* 2814* 2819* 2823* 2826* 2828* 2831* 2836*
                2838* 2842* 2845* 2847* 2850* 2873* 2875* 2878* 2884* 2897* 2904* 2906* 2909*
                2913* 2916* 2919* 2922* 2926* 2930* 2935* 2938* 2981* 2984* 2987* 2990* 3009*
                3012* 3015* 3033* 3039* 3043* 3090* 3112* 3169* 3189* 3196* 3247* 3287* 3310*
                3327* 3344* 3412* 3417* 3420* 3433 3435 3440* 3441* 3475* 3482* 3486* 3502*
                3570* 3577* 3584*
SAV5    015140  2313* 2320 2345* 2363 2368*
SCOPE = 104002  151* 442 452 462 499 511 523 536 548 560 572 585 597
                616 635 668 688 709 733 757 789 1083 1422 1444 1467 1481
                1495 1522 1534 1546 1560 1572 1585 1613 1625 1635 1662 1726 1749
                1761 1774 1786 1798 1810 1822 1835 1845 1857 1867 1879 1901
SCOPEB  015544  2455 2463* 2476 2488
SCOPEC  015500  2299 2453*
SCOPEF  015570  339* 2460 2462* 2466* 2469* 2481
SCOPEG  015556  2457 2459 2461 2466* 2478 2480 2489
SCOPEH  015574  2300 2474*
SCOPEI  015634  2298 2305 2486*
SCOPEJ  015536  2461* 2482
SCOPE0= 104001  150* 831 878 926 973 1020 1050 1938 1964
SCOPE1= 104003  152* 474 487 651 1096 1109 1122 1135 1152 1169 1185 1197 1209
                1221 1234 1251 1298 1310 1412 1434 1454 1510 1601 1647 1677 1736
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                    1917    1991    2018    2070    2085    2100    2113    2124
SDELAY  023112      3528#
SOCOA   021054      3012#   3016
SOFTDI  000172       136#
SOFTSW  000170       135#   2224    2239#
SP    =%000006       116#    260#    266#    267#    276     277     299     321#    428#    1399#   1709#   2148#   2149#
                    2150#   2151#   2152#   2153#   2187    2188    2189    2190    2191    2192    2193    2212    2213
                    2214    2215    2216    2217    2251#   2252#   2253#   2254#   2255#   2256#   2257#   2258    2265#
                    2266    2267    2268    2269    2270    2271    2272    2283#   2284#   2285#   2286    2289#   2290#
                    2291#   2292#   2293    2314    2315#   2346    2347#   2380    2447#   2463    2467    2666#   2961#
                    2977#   3004#   3027#   3064#   3087    3088    3097#   3188    3221#   3222#   3245    3246    3269#
                    3286    3301#   3343    3357#   3371    3397#   3398#   3415    3416    3460#   3461#   3480    3481
SPACE = 104004       153#   2413    2416    2419    2422    2425    2428    2431    2434    2437    2440
SPACEX  014044      2140#   2142#   2144#
SPCHR   014220      2169    2171    2183#
SPCHR1  014254      2184    2195#
SPCHR3  014316      2199    2206#
SPCHR4  014324      2208#
SPCHR5  014440      2175    2220    2242#
STACK   016632       260     321     428    1399    1709    2629#   2666    2961    2977    3004    3027
STSA    021124      3023    3027#
STSB    021140      3030#   3045
STSC    021174      3022#   3026#   3039#
STST    021164      3036#   3040
ST1     021074       143    3021#
ST2     021110       144    3025#
SWR     001036       174#    297     300#    1602    2019    2377    2443    2454    2456    2475    2477    2487    2671
                    2945
SW00  = 000001       106#
SW01  = 000002       105#
SW02  = 000004       104#
SW03  = 000010       103#
SW04  = 000020       102#
SW05  = 000040       101#
SW06  = 000100       100#
SW07  = 000200        99#
SW08  = 000400        98#
SW09  = 001000        97#
SW10  = 002000        96#
SW11  = 004000        95#
SW12  = 010000        94#
SW13  = 020000        93#
SW14  = 040000        92#
SW15  = 100000        91#
TEMP    016674       638#    645#    788#    805     820#    1019#   1036    1045#   1352#   1463    1476    1480#   1482
                    1487    1491#   1494#   1496    1501    1505#   2022#   2041#   2400    2646#
TEMP1   016676      2647#   2897#   2906    3021#   3025#   3030
TEMp2   016700      2648#
TICKS   016720      2656#   2696#   2730#   2802#   2949#   2972#
TIME    023164      3531#   3534    3539#   3543#   3545#
TIMER   020532      2717    2793    2852    2945#
TIMERA  020542      2947#
TIMER1  020564      2950    2952#
TIMER2  020566      2948    2957#
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TITLE   016032           315    2534#
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TPB     001034           173#   2139*   2178*   2324*   2326*   2329*   2333*   2359*
TPS     001032           172#   2137    2176    2316    2327    2331    2357    2441
TSTEND  007302          1310#
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TST11A  013410          2036#   2042    2044
TTYIN = 104006           155#    349    2227    2372
TYPECL  014726          2323    2326#
TYPERA  014670          2316#   2317    2325    2337
TYPERI  014712          2319    2322#
TYPER2  014720          2324#
TYPMES  014650          2297    2311#
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UPCNTB  007254          1285    1293#
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VCEXT   001072           195#
VCIV    001220           253#
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VCYREG  001070           194#  1723  1861  1863  1871  1873  1886  1894  2004  2117  2120  2400  2678
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VECTPS  001120           226#
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WHAT3   002230           377   417#
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                     742     744     749     760     765     768     770     775     792     794     797     803     820
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                     931     934     939     951     958     976     978     981     986     998    1005    1023    1025
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ERRORS DETECTED: 0

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