

# KW11-W

LOGIC TEST

MD-11-DDKWB-A

EP-DDKWB-A-DL-A

OCT 1976

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IDENTIFICATION

|                |                           |
|----------------|---------------------------|
| PRODUCT CODE:  | MAINDEC-11-DDKWB-A-D      |
| PRODUCT NAME:  | WATCHDOG TIMER LOGIC TEST |
| DATE RELEASED: | 21 DECEMBER 1975          |
| MAINTAINER:    | DIAGNOSTIC GROUP          |

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MEMORY STORAGE - 00000 - 012000 OCTAL

LOADING PROCEDURE - (PAPER TAPE SUPPLIED) LOADED USING NORAML  
BINARY PROCEDURE.

MAKE SURE THAT THE FOLLOWING PARAMETERS ARE THE SAME AS  
THOSE OF YOUR SYSTEM.  
IF NOT, PATCH THE TAGS IN ():

DEVICE ADDRESS (CSR) =172400  
(CINT) =172402  
(ECSR) =172404  
(SWBU) =172406

INTERRUPT VECTOR (VADRS) =320  
DEVICE PRIORITY INT. LEVEL(DPRIV) =265 (IN ASCII) (=5)  
MODEL OF COMPUTER- (PDP11) =301 (=A) (05 OR 10 OR 20)

#### SWITCH SETTINGS:

SW00 =1 (UP) --- WILL EXIT ANY PARTICULAR TEST  
SW01 =1 (UP) --- NO TTY WITH THE SYSTEM  
SW02 =1 (UP) --- SELECTS LOGIC TEST  
SW03 =1 (UP) --- SELECTS DELAY TEST  
SW04 =1 (UP) --- SELECTS DYNAMIC TEST  
SW05 =1 (UP) --- SELECTS DELAY: (1) WATCHDOG  
SW05 =0 (DOWN) --- SELECTS DELAY: (2) WARNING AND SHORT LOOP  
SW06 =1 (UP) --- HALTS ON END OF PASS

#### STARTING PROCEDURE:

EITHER A) ONLY IF THERE IS NO TTY WITH THE SYSTEM:

- 1.1 PATCH THE TAG TYSR TO 177570
- 1.2 LOAD ADDRESS 200 AND KEEP SW07 UP.
- 1.3 SET SW01=1 (UP)
- 1.4 SET EITHER SW02=1 --- IF LOGIC TEST TO BE PERFORMED  
OR SW03=1---IF DELAY TEST TO BE PERFORMED  
OR SW04=1 ---IF DYNAMIC TEST TO BE PERFORMED

IF DELAY TEST HAS BEEN SELECTED I.E. SW03=1, THEN

- 1.5 SET SW05=1 ---IF WATCHDOG DELAY TO BE PERFORMED  
OR SET SW05=0 (DOWN)---FOR SHORT LOOP  
AND WARNING DELAY TEST

FOR EXAMPLE, IF THERE IS NO TTY WITH THE SYSTEM, AND  
ONE OF THE TWO DELAY TESTS ---WATCH DOG DELAY ---TO BE PERFORMED,  
THEN SET SW01, SW03, SW05 UP.



1.6 SET SW06=1 -----FOR END OF PASS HALT (OPTIONAL)  
1.7 PRESS START

IF SW01 IS UP AND NEITHER SW02 NOR SW03 NOR SW04 IS UP  
THEN PROGRAM WILL HALT AT LOCATION 7256  
IF SO, GO BACK TO STEP 1.2

IF THERE IS NO ERROR, PROGRAM WILL RUN FOR APPROX. 2 MINUTES  
AT THE END OF WHICH THERE WILL BE A "5" ON THE DISPLAY LIGHTS  
FOR COUPLE OF SECONDS (ONLY IF THE COMPUTER  
IS A 1105/10/20 ) AND PROGRAM WILL HALT AT LOCATION  
252 (ONLY IF SW06 IS UP). PRESS CONTINUE TO CONTINUE  
WITH THIS TEST.

IF THERE IS ANY ERROR, PROGRAM WILL HALT.  
PC OF THE ERROR WILL BE DISPLAYED ON THE LIGHTS.  
ALSO, ADDRESS OF THE ERROR MESSAGE WILL BE STORED  
AT LOCATION 017400.

IF YOU WISH TO RUN ANOTHER TEST, GO BACK TO STEP 1.2.

THERE IS NO END OF PASS FOR DELAY TESTS.

OR B) IF THERE IS A TTY:

-----  
1.1 LOAD ADDRESS 200  
1.2 PRESS START

THE PROGRAM WILL ASK THE FOLLOWING QUESTIONS TO WHICH  
THE OPERATOR MUST RESPOND BY TYPING:

FIRST DEVICE ADDRESS = (ANSWER IN 6 CHARACTERS)  
FIRST INT. VECTOR = (3 CHARACTERS)  
PRIORITY INT. LEVEL = (INPUT INT. LEVEL OF DEVICE 4-7)  
PDP-11 (A)=05, 10, 20 (B)=35, 40 (C)=45, 50 ---ANSWER IS A OR B OR C  
LOGIC TEST (1), DELAY TEST (2), DYNAMIC TEST (3) ---ANSWER IS 1 OR 2 OR 3

IF THE ANSWER TYPED WAS 2  
PROGRAM WILL TYPE OUT ---  
DELAY ADJUSTMENT TEST  
DELAY: (1)WATCHDOG. (2)WARNING & SHORT LOOP ---THIS LINE IS A QUESTION.  
ANSWER IS 1 OR 2

YOU WILL HAVE 15 SECONDS TO ANSWER A QUESTION (VIA TTY).  
IF YOU ARE NOT ANSWERING THE QUESTIONS VIA TTY, THEN  
YOU MUST START AT STEP 1.1 OF PART A) OR START DIRECT AS DESCRIBED  
BELOW.

IF AN ERROR IS ENCOUNTERED WHILE INPUTTING THE DEVICE ADDRESS  
OR INT. VECTOR, THE OPERATOR MAY TYPE A RUB OUT AND REPEAT  
ENTIRE LINE INPUTING. WHEN LINE IS COMPLETE OR IF NO CHANGES  
(FROM STANDARD DEVICE) THE OPERATOR MUST TERMINATE THE LINE  
WITH A CARRIAGE RETURN.

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STARTING ADDRESS 1000:

\*\*\*\*\*

DIRECT STARTING OR RESTARTING OF LOGIC TEST.  
YOU CAN SKIP STEPS 1.2 THRU 1.5 OF PART A) AND START  
DIRECTLY AT ADDRESS 1000.  
BUT BEFORE THAT YOU MUST CHECK THE PARAMETERS  
IF THEY ARE STANDARD.

STARTING ADDRESS 220:

\*\*\*\*\*

DIRECT STARTING OR RESTARTING OF DELAY ADJUSTMENT TEST.  
BUT IF YOU DO NOT HAVE A TTY TO ANSWER ANOTHER  
QUESTION IN DELAY TEST, THEN YOU MUST START AT ADDRESS  
200 I.E. GO BACK TO STEP 1.1 OF PART A).

STARTING ADDRESS 240:

\*\*\*\*\*

DIRECT STARTING OR RESTARTING OF DYNAMIC SYSTEM TEST.



## LOGIC TEST OPERATING PROCEDURE AND DESCRIPTION

\*\*\*\*\*  
 THE LOGIC TEST CONSISTS OF 44 SUB TESTS EACH CONTAINING AN ERROR ROUTINE. LOGIC TEST SHOULD BE STARTED WITH ALL CONSOLE (PDP-11) SWITCHES DOWN. IF AN ERROR IS ENCOUNTERED, THE TELETYPE WILL REPORT WITH FAILING TEST AND HALT. TO LOOP ON A FAILURE CONSOLE SWITCH REGISTER, BIT 14 IS RAISED AND THE TEST IS LOOPE BY DEPRESSING THE CONTINUE KEY. TO INHIBIT THE ERROR TYPING RAISE SWITCH REGISTER BIT 13.

## LOGIC TEST REQUIREMENTS:

\*\*\*\*\*

TO RUN THE LOGIC TEST, THE SUPPLIED TEST PLUG MUST BE CONNECTED TO THE MODULE CONNECTOR. THE T3 DELAY MUST EXCEED T2 BY 50 MICRO-SECONDS. THE ADJUSTMENT OF T1 MUST BE SET AT A MINIMUM.

## LOGIC TEST ERROR REPORTS.

\*\*\*\*\*

## TEST      FAILURE

----

T1      STATUS AND CONTROL REG. NOT CLEAR UPON INITIALIZE.  
 T2      INT. ENABLE BIT 6 OF CSR NOT SET.  
 T3      INT. ENABLE BIT 6 OF CSR NOT CLEAR.  
 T4      AN ILLEGAL INT. IS PRESENT FROM THE MODULE.  
 T5      AN ILLEGAL INT. IS PRESENT AFTER A DELAY TIME OUT.  
 T6      STATUS REGISTER NOT CLEAR AFTER DELAY TIME OUT.  
 T7      STATUS REGISTER WAS AFFECTED BY A CLEAR FLAGS INSTRUCTION.  
 T8      FAILED TO MONITOR A T2 FLAG.  
 T9      ALARM RECEIVED BIT 14 OF CSR SET WITHOUT AN EXT. ENALBE.  
 T10     ALARM RECIEVE FLAG FAILED TO SET AFTER ENABLING THE EXTER  
       NAL WORLD.  
 T11     T2 FLAG FAILED TO CLEAR.  
 T12     RECIEVE FLAG FAILED TO CLEAR.  
 T13     SHORT LOOP (T1) FAILED TO CLEAR.  
 T14     T2 FLAG SET SHOULD HAVE BEEN TEMINATED BY THE LOCK FLOP  
       UPON THE SHORT LOOP GENERATED IN T13.  
 T15     RECEIVE FLAG WAS SET UPON A SHORT LOOP WITHOUT THE  
       EXTERNAL ENABLE.  
 T16     LOCK FLOP FAILED TO CLEAR UPON ENABLING THE EXTERNAL  
       WORLD AND WAITING 5M.SEC. FOR CLEAR ERROR.  
 T17     NO ERROR CHECKING, CONDITIONING FOR T18, T19, AND T20.  
 T18     T1 FLAG FAILED TO CLEAR.  
 T19     T2 FLAG FAILED TO CLEAR.  
 T20     RECEIVE FLAG FAILED TO CLEAR.  
 T21     RECEIVE FLAG FAILED TO SET UPON A TIME OUT OF T3.  
 T22     ALARM REC. FLAG FAILED TO CLEAR.  
 T23     ENABLE FLOP NOT CLEARED AN ALARM OUT.  
 T24     A T2 FLAG FAILED TO RAISE AN INT. AT VECTOR 350.  
 T25     SHORT LOOP FLAG FAILED TO RAISE AN INT. AT VECTOR 350.

T26 ALARM REC. FLAG FAILED TO RAISE AN INT. AT VECTOR 350.  
 T27 SHORT LOOP "LOCK" FAILED TO TERMINATE T3.  
 T28 SHORT LOOP "LOCK" FAILED TO TERMINATE T2.  
 T29 THE CLEARING OF "LOCK" DIDNOT RELEASE T2 TO THE  
 BUS (REFER TO T26, T27, & T28).  
 T30 SHORT LOOP " LOCK" FAILED TO LOCK PULSING OF TIMER.  
 T31 INITIALIZE FAILED TO CLEAR SHORT LOOP FLAG.  
 T32 INITIALIZE FAILED TO CLEAR RECEIVE FLAG.  
 T33 INITIALIZE FAILED TO CLEAR THE LOCK FLOP.  
 T34 INITIALIZE FAILED TO TERMINATE T3.  
 T35 INITIALIZE FAILED TO TERMINATE T2.  
 T36 INCORRECT STATUS IN EXTERNAL STATUS REG.  
 T37 STATUS OF ECSR CHANGED UPON A RESET INSTRUCTION.  
 T38 SWITCH BUS INSTRUCTION FAILED TO CHANGE THE EXTERNAL  
 STATUS REGISTER.  
 T39 THE LATCH FAILED TO PREVENT A 2ND BUS SWITCHING  
 (REFER TO T38).  
 T40 BUS FAILED TO SWITCH TO 2ND LATCH.  
 T41 TERMINATION OF T3 FAILED TO RELEASE THE LATCH.  
 T42 A SWITCH BUS COMMAND FAILED TO CHANGE THE BUS STATUS.  
 T43 A RESET INSTRUCTION FAILED TO CLEAR THE LATCH.  
 T44 MANUAL ENABLE INPUT FAILED.  
 \*\*\*\*\*  
 T38S TEST FOLLOWED BY AN "S" DENOTES SUBTEST.  
 T40S WHICH IS A FAILURE OF THE EXTERNAL STATUS  
 T41S REGISTER (STATUS READ IS INCORRECT).  
 T43S

ALL TESTS MUST BE SUCCESSFULLY COMPLETED BEFORE THE NEXT TEST MAY  
BE EXECUTED.

UPON SUCCESSFUL COMPLETION OF THE LOGIC TEST, THE TELETYPE WILL  
PRINT "PASS".

FOR SCOPING ERRORS, SWITCH REGISTER BIT 7 MAY BE RAISED TO INCREASE  
THE TEST REPEATIBILITY RATE.



DELAY ADJUSTMENT TESTS.  
\*\*\*\*\*

THE OPERATOR MUST RESPOND TO THE QUESTION, "(1) WATCHDOG, (2) WARNING & SHORT LOOP" BY TYPING A 1 OR A 2 FOR DESIRED ADJUSTMENT LOOP TO BE RUN.

DYNAMIC SYSTEM TEST.  
\*\*\*\*\*

THIS TEST IS INTENDED AS AN EXERCISER WHICH SHOULD BE RUN ONLY AFTER COMPLETING THE LOGIC TEST.

THE TEST EXERCISES THE INTERRUPT LOGIC, EXTERNAL STATUS AND DELAYS.

THE TIMER IS PRIMED BY PULSING THE DELAYS AND ENABLING THE INTERRUPT. THE ONLY LEGAL INTERRUPTS ARE THOSE FROM THE T2 DELAY. AFTER EACH LEGAL INTERRUPT, THE EXTERNAL STATUS IS SWITCHED AND TESTED FOR A CORRECT STATUS READING.

A "PASS" IS PRINTED AFTER 100 SUCCESSFUL INTERRUPTS.  
POSSIBLE ERRORS REPORTED ARE:

1. SHORT LOOP FLAG SET
2. EXTERNAL STATUS BAD
3. ILLEGAL INTERRUPT

TO EXIT ANY TEST, RAISE CONSOLE SWITCH REGISTER, BIT 00. THE PROGRAM WILL THEN OUTPUT THE HEADER. MAKE SURE THAT THE SWITCH IS LOWERED BEFORE ENTERING A NEW TEST.

LOGIC TEST FOR WATCH DOG TIMER (HARDWARE MONITOR)  
FOR PDP-11 SYSTEMS.  
THE WATCH DOG TIMER MUST BE PULSED FROM THE  
COMPUTER PROGRAM WITHIN A SPECIFIED TIME TO  
INHIBIT THE TIMER FROM TIMING OUT. UPON A TIME  
OUT CONDITION THE WATCH DOG WILL POST AN  
INTERRUPT ALLOWING THE PROCESSOR A CHANCE TO  
RECOVER BEFORE A SECOND TIME OUT CONDITION  
OCCURS ISSUING AN "ALARM OUT" TO THE EXTERNAL  
WORLD. THE WARNING INTERRUPT IS SENSED AT  
BIT 07 OF THE CONTROLL AND STATUS REGISTER.  
THE TIMER ALSO HAS A "SHORT LOOP" PROTECTION WHICH  
GUARDS AGAINST A PROGRAM FAILURE THAT MAYBE PULSING THE  
TIMER BEFORE A SPECIFIED INTERVAL. THE SHORT LOOP WILL  
POST AN INTERRUPT ALSO AT VECTOR (XXX) WHENEVER PULSED  
TWICE WITHIN A SPECIFIED TIME INTERVAL. THE SHORT LOOP  
INTERRUPT IS SENSED IN THE STATUS REGISTER BY BIT 14.  
THE RECEIVE CIRCUIT ALLOWS FOR AN INTERRUPT (VECTOR XXX) TO BE  
POSTED WHEN AN "ALARM SIGNAL" IS RECEIVED FROM THE  
EXTERNAL WORLD. THE RECEIVE INTERRUPT IS SENSED AT  
BIT 7 OF THE STATUS REGISTER.

FOR TEST PURPOSES THE "ALARM OUT" SIGNAL IS  
JUMPERED TO THE ALARM RECEIVE WITH A SUPPLIED  
TEST PATCH.

1

|             |                                |
|-------------|--------------------------------|
| PS=177776   | ; TELETYPE READER BUFFER       |
| TKB=177562  | ; TELETYPE READER STATUS       |
| TKS=177560  | ; TELETYPE PRINTER BUFFER      |
| TYDB=177566 | ; CONTROLL AND STATUS-WATCHDOG |
| CSR=172400  | ; INTERRUPT CLR INSTRUCTION    |
| CINT=172402 | ; EXTERNAL CSR                 |
| ECSR=172404 | ; SWITCH BUS                   |
| SWBU=172406 | ; SWITCH REGISTER              |
| SR=177570   |                                |
| NULL=104000 |                                |
| NOP=240     |                                |
| HLT=0       |                                |
| SW00=01     |                                |
| SW01=02     |                                |
| SW02=4      |                                |
| SW03=10     |                                |
| SW04=20     |                                |
| SW05=40     |                                |
| SW06=100    |                                |
| RO=%0       |                                |
| R1=%1       |                                |



K01

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R2=%2  
R3=%3  
R4=%4  
R5=%5  
SP=%6  
PC=%7  
;LOAD TRAP CATCHER

;SUBROUTINE RETAIN  
;TELETYPE ROUTINE RETAIN  
;TIME CONTROL ROUTINES  
;ERROR PRINT & SCOPE MODE

[illegible]

[illegible]



```

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      .+2          ;TRAPPED TO PREVIOUS VECTOR  

      HLT  

      ;  

      =4           ;TIME OUT BUSS ERROR  

      T0BE        ;PROCESSOR STATUS  

      340  

      =30  

      NULPRT       ;  

      340         ;;  

               ;;  

      =350         ;WATCH DOG INTERRUPT  

      WAOG        ;SET PROCESSOR STATUS BACK TO 7  

      340         ;RECEIVE FLAG VECTOR  

      RECF  

      340         ;  

      ;  

      ;  

      ;=500  

      TYSR:    177564  

      XCSR:    CSR  

      XCINT:   CINT  

      XECSR:   ECSR  

      XSWBU:   SWBU  

      VADRS:   320  

      DPRIV:   265      ;DEVICE PRIORITY LEVEL (5) IN ASCII  

      PPRIV:   200      ;PROCESSOR PRIORITY LEVEL [DPRIV-1]  

      PDP11:   301  

      ;  

      ;  

      ;=250  

      EOPHLT: HALT     PC      ;THIS IS AN END OF PASS HALT  

                       RTS             ;NOT AN ERROR HALT.THIS HAPPENS ONLY  

                                       ;WHEN SWO6 IS UP.  

                                       ;PRESS CONTINUE TO CONTINUE  

  

      =600  

      STACK: 0         ;STACK LOCATOR  

      =200
```

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```

15:  MOV    #STACK, SP
     JSR    R5, ADDMO
     JMP    HEADER          ;ASK FOR VECTORS AND ADDRESSES
                               ;PRINT HEADER AND TAKE COMMANDS
     ;
     ;=220
     MOV    #STACK, SP
     JMP    DELAY           ;DIRECT ENTRY TO DELAY TEST
     ;
     ;=240
     MOV    #STACK, SP
     JMP    DYNAM           ;DIRECT ENTRY TO DYNAMIC TEST
     ;
LOGIC: ;=1000
      MOV    #STACK, SP    ;INITIALIZE STACK
      NULL
      RESET
      NULL
      JMP    TEST          ;
     ;
*****
***** LOGIC TEST *****
*****
TEST: MOV    #LT, MES      ;SET REGISTER 3 FOR OUTCODE
      JSR    R3, PRINT     ;PRINT "LOGIC TEST"
     ;
     ;TEST THAT ALL STATUS BITS ARE CLEARED IN THE CSR
     ;
T1:   JSR    R1, CHECK
      MOV    #340, PS
      MOV    #T1, LOOP
      BIT    #177777, @XCSR          ;TEST ALL BITS OF STATUS REG
      BEQ    T2
      JSR    R5, ERROR
      MOV    #EE1, MES
      JSR    R3, PRINT
      JSR    R5, SCOPE
      HLT
      JMP    T1          ;STATUS REG NOT CLEAR
     ;
     ;TEST THAT INTERRUPT ENABLE (BIT 6 OF CSR) CAN
     ;BE SET AND CLEARED .
T2:   JSR    R1, CHECK
      MOV    #T2, LOOP
      MOV    #100, @XCSR
      BIT    #100, @XCSR          ;TEST THAT INT.EN. IS SET IN THE CSR
      BNE    T3
      JSR    R5, ERROR
      MOV    #EE2, MES
      JSR    R3, PRINT
      JSR    R5, SCOPE
      HLT
      JMP    T2          ;INT. EN. BIT FAILED TO SET

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```

:
:
T3:  JSR      R1,CHECK
      MOV     #T3,LOOP
      CLR     2XCSR
      BIT     #100,2XCSR           ;CHECK THAT INT ENABLE CLEARED
      BEQ     T4
      JSR     R5,ERROR
      MOV     #EE3,MES
      JSR     R3,PRINT
      JSR     R5,SCOPE
      HLT
      JMP     T3                   ;INT.ENABLE FAILED TO CLEAR
:
:EX
:ENABLE PROCESSOR INTERRUPT AND CHECK FOR ILLEGAL
:INTERRUPTS OF WATCH DOG TIMER
:
T4:  JSR      R1,CHECK
      MOV     #T4,LOOP
      MOV     #AA1,R4              ;SET UP INT RETURN
      MOV     #AA1,R5
      BIS     #100,2XCSR           ;ENABLE INT
      MOV     PPRIV,PS             ;SET PROCESSOR STATUS TO PPRIV
      NOP
      NOP
      MOV     #340,PS              ;WAIT FOR INTERRUPT
      JMP     T5                   ;NO INTERRUPT SO GO
:
AA1: JSR      R5,ERROR              ;CHECK FOR ERROR PRINTOUT
      MOV     #EE4,MES             ;PRINT ERROR MESSAGE

```



```

      JSR      R3,PRINT      ;PRINT ERROR 1
      JSR      R5,SCOPE      ;CHECK FOR SCOPE LOOP
      HLT
      JMP      T4            ;STAY HERE
                               ;RUN TEST OVER ON KEY "COUNT"
      :
      :WAIT FOR POSSIBLE TIME OUT OF DELAYS AND CHECK AGAIN
      :FOR ILLEGAL WATCHDOG INTERRUPTS
T5:   JSR      R1,CHECK
      MOV      #340,PS        ;SET PROCESSOR STATUS TO 7
      JSR      R2,TOUT        ;WAIT FOR TIME OUTS
      MOV      #AA2,R4        ;SET INT RETURN
      MOV      #AA2,R5
      MOV      PPRIV,PS       ;P.S. TO PPRIV
      NOP
      NOP                    ;WAIT FOR INT
      MOV      #340,PS        ;SET STATUS TO 7
      BIC      #100,DXCSR
      JMP      T6
AA2:  JSR      R5,ERROR        ;GO ON
      MOV      #EE5,MES       ;CHECK FOR ERROR PRINT
      JSR      R3,PRINT        ;PRINT ERROR MESSAGE
      JSR      R5,SCOPE        ;PRINT ERROR 1A
      HLT
      JMP      T5            ;ILLEGAL INT AFTER TIME OUT
      :
      :READ THE STATUS WORD TO CHECK THAT ALL BITS ARE
      :CLEAR AT THIS TIME.
T6:   JSR      R1,CHECK
      MOV      #T6,LOOP       ;SET FOR SCOPE LOOP RUN
      BIT      #177777,DXCSR   ;CHECK STATUS REGISTER
      BEQ      T7            ;IF 0 GO TO TEST 7
      JSR      R5,ERROR
      MOV      #EE6,MES
      JSR      R3,PRINT        ;PRINT ERROR2
      JSR      R5,SCOPE        ;CHECK FOR SCOPE LOOP
      HLT
      JMP      T6            ;STAY HERE
                               ;RECYCLE
      :
      :GENERATE A CLEAR COMMAND AND CHECK
      :THAT STATUS WAS UNAFFECTED
T7:   JSR      R1,CHECK
      MOV      #T7,LOOP       ;SET UP FOR SCOPE LOOP RUN
      TST      DXCSR          ;CLR TO FLAGS SHORT LOOP, SECOND CHANCE
      JSR      R2,TOUT
      BIT      #177777,DXCSR
      BEQ      T8            ;ALL CLEAR GO TO TEST 8
      JSR      R5,ERROR
      MOV      #EE7,MES       ;PRINT ERROR 3
      JSR      R3,PRINT

```



```

;TEST THAT T2 FLAG IS CLEARED BY (164002)CINT
T11: JSR    R1,CHECK
      MOV    #T11,LOOP
      TST    2XCINT
      TSTB   2XCSR
      BPL    T12
      JSR    R5,ERROR
      MOV    #EE11,MES
      JSR    R3,PRINT
      JSR    R5,SCOPE
      HLT
      JMP    T11                      ;T2 NOT CLEARED BY CINT(164002)

;CHECK THAT RECIEVE FLAG WAS CLEARED BY CLEAR REC FLAG (BIT 8 OF CSR)
T12: JSR    R1,CHECK
      MOV    #T11,LOOP
      MOV    #000400,2XCSR           ;CLEAR RECIEVE FLAG
      BIT    #040000,2XCSR           ;TEST RECIEVE FLAG
      BEQ    T13
      JSR    R5,ERROR
      MOV    #EE12,MES
      JSR    R3,PRINT
      JSR    R5,SCOPE
      HLT
      JMP    T12                      ;RECEIVE FLG FAILED TO CLR

;ISSUE TWO SUCCESSIVE PULSES TO THE TIMER AND MONITOR BIT 15
;OF THE CSR FOR A SHORT LOOP FLAG
T13: JSR    R1,CHECK
      MOV    #340,PS                 ;SET STATUS TO SEVEN
      MOV    #THW,LOOP               ;SET FOR SCOPE LOOP
      INC    2XCSR                    ;HIT TIMER TWICE
      INC    2XCSR
      TST    2XCSR                    ;BIT 15 SHOULD BE SET

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      BPL      +12
      JSR      R2,TOUT      ;GO WAIT FOR TIMEOUT BRFORE PROCEEDING
      JMP      T14
      JSR      R5,ERROR      ;CHECK FOR ERROR PRINT
      MOV      #EE13,MES      ;PRINT ERROR 13
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      THW      ;SHORT LOOP FLAG FAILED TO SET
      ;
      ;TEST BIT 7 (2ND CHANCE) . BIT 7 SHOULD NOT BE SET
      ;TERMINATED BY LOCK
T14:  JSR      R1,CHECK
      TSTB     @XCSR      ;TEST BIT 7
      BPL      T15      ;CONTINUE TO TEST
      JSR      R5,ERROR
      MOV      #EE14,MES
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      THW      ;T2 (2ND CHANCE) FLAG SET,CHECK LOCK FLOP
      ;LOOP TO TEST 13 ON KEY "CONT"
      ;WAIT 5 M.SEC AND TEST THAT THE ENABLE FLOP PREVRENTED
      ;THE WATCH DOG OUT SIGNAL FROM SETTING THE RECEIVE FLAG
      ;
T15:  JSR      R1,CHECK
      MOV      #340,PS
      JSR      R2,WAITX      ;WAIT FOR POSSIBLE TIME OUT OF T4
      BIT      #040000,@XCSR ;TEST THAT REC.DIDNT SET
      BEQ      T16
      JSR      R5,ERROR
      MOV      #EE15,MES
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      THW      ;REC. FLAG SET WITHOUT AN ENABLE
      ;LOOP ON TEST 13
      ;
      ;ENABLE THE EXTERNAL WORLD AND WAIT 5 M.SEC
      ;FOR THE LOCK FLOP TO BE CLEARED BY CLEAR ERROR
      ;SIGNAL. TEST THAT LOCK FLOP WAS CLEARED BY RESETING
      ;THE 2ND. CHANCE FLAG (T2).
T16:  JSR      R1,CHECK
      MOV      #2,@XCSR      ;ENABLE THE EXTERNAL WORLD
      JSR      R2,WAITX      ;WAIT FOR CLEAR ERROR
      INC      @XCSR      ;SET T2 FLAG AGAIN
      JSR      R2,TOUT      ;TIME OUT DELAYS
      TSTB     @XCSR
      BMI      T17
      JSR      R5,ERROR
      MOV      #EE16,MES

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THW:  JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      THW          ;LOCK FLOP NOT CLEARED BY
      MOV      #2,@XCSR    ;CLEAR ERROR
      JSR      R2,WAITX    ;CLEAR LOCK FOR RECYCLE
      TST      @XCINT      ;CLEAR FLAGS SHORT LOOP, SECOND CHANCE
      MOV      #000400,@XCSR ;CLEAR RECIEVE FLAG
      RESET
      JMP      T13
      ;
      ;WITH RECEIVE AND SHORT LOOP FLAG SET PULSE TIMER
      ;AND WAIT FOR TIME OUT OF T2 THEN ISSUE AN CLEAR INSTRUCTION
      ;AND CHECK THAT ALL FLAGS ARE CLEARED.

```

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```

T17:  JSR      R1,CHECK
      MOV      #340,PS
      MOV      #T17,LOOP      ;LOOP TESTS
      TST      @XCINT          ;CLEAR INTERRUPT FLAGS. SHORT LOOP,SECOND CHANCE
      MOV      #000400,@XCSR   ;CLEAR RECEIVE FLAG
      ;TEST SHORT LOOP INTERRUPT FLAG FOR BEING CLEARED
      ;
T18:  JSR      R1,CHECK
      TST      @XCSR           ;TEST BIT 15 OF CSR
      BPL      T19             ;OK GO ON
      JSR      R5,ERROR        ;CHECK FOR REPORT OF ERROR
      MOV      #EE18,MES       ;SET ERROR PRINT
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      T17             ;SHORT LOOP FLAG FAILED TO CLEAR
                                  ;LOOP TO TEST 17 ON KEY "CONT"
      ;TEST WARNING FLAG (BIT 7) FOR BEING CLEAR
      ;
T19:  JSR      R1,CHECK
      TSTB     @XCSR           ;TEST BIT 07 OF CSR
      BPL      T20             ;OK GO ON
      JSR      R5,ERROR        ;CHECK FOR ERROR REPORT
      MOV      #EE19,MES       ;SET ERROR PRINT
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      T17             ;LOOP TO TEST 17 ON KEY "CONT"
      ;TEST ALARM RECEIVE (BIT 14) FOR BEING CLEAR
      ;
T20:  JSR      R1,CHECK
      BIT      #040000,@XCSR   ;TEST BIT 14 OF CSR
      BEQ      T21
      JSR      R5,ERROR        ;CHECK FOR ERROR REPORT
      MOV      #EE20,MES       ;SET PRINT ERROR T20
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      17              ;BIT 14 OF CSR FAILED TO A CLR
                                  ;LOOP TO TEST 17 ON CONT
      ;
      ;ENABLE ALARM OUT SIGNAL (PROGRAM CONTROL) AND TEST
      ;THAT TIME OUT OF T3 WILL SET ALARM RECEIVE FLOP (BIT 14)
      ;THE ALARM RECEIVE SIGNAL MUST BE CONNECTED TO THE ALARM OUT
      ;AND THE PROGRAM CONTROLLED "RESET" STRAP MUST BE CONNECTED
      ;
T21:  JSR      R1,CHECK
      MOV      #T21,LOOP
      MOV      #340,PS
      MOV      #3,@XCSR        ;START TIMER AND ENABLE "ALARM OUT"
      JSR      R2,TOUT          ;TIME OUT DELAYS
      BIT      #040000,@XCSR   ;CHECK BIT 14 FOR BEING SET
      BEQ      .+6
      JMP      T22
      JSR      R5,ERROR

```



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```

MOV      #EE21,MES      ;SET ERROR PRINTOUT
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T21            ;RECEIVE ALARM FLOP FAILED TO SET
                        ;LOOP ON TEST 21
;
;CLEAR INTERRUPT FLAGS AND CHECK THAT "ALARM RECEIVE"
;FLAG WAS CLEARED
T22:     JSR      R1,CHECK
MOV      #340,2XCSR
MOV      #T22,LOOP      ;SET SCOPE RETURN
MOV      #000400,2XCSR  ;CLEAR ALARM RECEIVE FLAG
BIT      #040000,2XCSR  ;TEST BIT 14 FOR BEING CLEAR
BEQ      T23            ;FLAG CLEAR GO ON

```

```

JSR    R5,ERROR
MOV    #EE22,MES
JSR    R3,PRINT
JSR    R5,SCOPE
HLT
JMP    T22                                ;BIT 14 OF CSR FAILED TO CLEAR
;CHECK "LOCKOUT" FEATURE OF "ALARM OUT" AFTER AN ALARM
;OUT SIGNAL HAS BEEN GENERATED.
T23:   JSR    R1,CHECK
MOV    #340,PS
MOV    #T23,LOOP
MOV    #1,2XCSR                           ;START TIMING
JSR    R2,TOUT                            ;TIME OUT DELAYS
JSR    R2,WAITX                           ;WAIT FOR REC TO -SET
BIT    #040000,2XCSR                      ;TEST THAT LOCK OUT PREVENTED
BEQ    T24                                ;BIT 14 FROM BEING SET
JSR    R5,ERROR
MOV    #EE23,MES
JSR    R3,PRINT
JSR    R5,SCOPE
HLT
JMP    T23                                ;CLEAR ERROR FAILED TO ENABLE FLOP
;ALARM OUT SIGNAL
;DROP PROCESSOR STATUS TO 6 AND CHECK THAT WARNING FLAG WILL GIVE AN
;INTERRUPT AT VECTOR 170
T24:   TST    2XCINT                       ;CLEAR SHORT LOOP, SECOND CHANCE
MOV    #000400,2XCSR                      ;CLEAR RECEIVE FLAG
JSR    R1,CHECK
MOV    #T25,R4                           ;SET INTERRUPT RETURN
MOV    #WRNG,R5                           ;SET FOR INTERRUPT AT WRONG VECTOR
MOV    #T24,LOOP
MOV    #101,2XCSR
JSR    R2,TOUT
MOV    PPRIV,PS                           ;SET STATUS TO PPRIV
NOP                                         ;WAIT FOR INTERRUPT
NOP
MOV    #340,PS                            ;SHOULD HAVE INTERRUPTED
JSR    R5,ERROR                           ;SET STATUS BACK TO SEVEN
MOV    #EE24,MES
JSR    R3,PRINT
JSR    R5,SCOPE
HLT
JMP    T24                                ;WARNING FLAG (BIT 07) FAILED
;TO PRODUCE AN INTERRUPT
;CLEAR FLAGS AND SET THE SHORT LOOP
;FLAG TO CHECK FOR AN INTERRUPT
;
;

```

```

T25:  JSR      R1,CHECK
      RESET
      TST      @XCINT      ;CLEAR INTERRUPTS
      MOV      #AA4,R4     ;SET INTERRUPT RETURN
      MOV      #WRNG,R5    ;SETFOR WRONG VECTOR
      MOV      #T25,LOOP   ;SET SCOPE MODE
      MOV      PPRIV,PS    ;GET STATUS DOWN TO PPRIV
      BIS      #102,@XCSR  ;INT.EN +EXT.EN
      INC      @XCSR       ;SET SHORT LOOP
      INC      @XCSR
      NOP
      NOP                ;SHOULD INT HERE
      MOV      #340,PS     ;NO INT.GET STATUS BACK UP
      JSR      R5,ERROR
      MOV      #EE25,MES   ;SET ERROR PRINT
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      T25        ;SHORT LOOP FLAG FAILED TO RAISE A
                          ;INTERRUPT
AA4:   JSR      R2,WAITX    ;WAIT FOR TIME OUT CLR ERROR
      TST      @XCINT      ;CLEAR FLAGS SHORT LOOP, SECOND CHANCE
      MOV      #000400,@XCSR ;CLEAR RECEIVE FLAG
      JMP      T26

      ;CHECK FOR ALARM RECEIVE FLAG TO GENERATE AN INTERRUPT
      ;BY CLEARING THE WARNING FLAG BEFORE THE RECEIVE
      ;FLAG IS SET. T3>T2 BY AT LEAST 50 MIRCO. SEC.

T26:   JSR      R1,CHECK
      MOV      #340,PS     ;SET PROCESSOR STATUS TO 7
      MOV      #AA5,R5     ;SET INTERRUPT RETURN
      MOV      #WRNG,R4    ;SET FOR WRONG VECTOR
      MOV      #AA4,LOOP   ;SET SCOPE
      MOV      #3,@XCSR    ;START TIMING, ENABLE ALARM OUT
      TSTB     @XCSR       ;WAIT FOR WARNING
      BPL      -4
      TST      @XCINT      ;CLEAR BIT 7 OF CSR
      BIT      #040000,@XCSR ;WAIT FOR ALARM RECEIVE FLAG
      BEQ      -6
      BIS      #100,@XCSR   ;ENABLE INT.-2L
      MOV      PPRIV,PS    ;SET STATUS TO PPRIV
      NOP
      NOP                ;SHOULD INT. HERE
      MOV      #340,PS     ;FAILED TO INT. SET STATUS TO 7
      JSR      R5,ERROR    ;CHECK FOR ERROR REPORT
      MOV      #EE26,MES
      JSR      R3,PRINT
      JSR      R5,SCOPE    ;CHECK FOR SCOPE ROUTINE
      HLT
      JMP      AA4
AA5:   JSR      R2,TOUT     ;CLR FLAGSBEFORE LOOP
      MOV      #000400,@XCSR ;CLEAR POSSIBILITY OF SHORT LOOP
      JMP      T27        ;CLEAR RECEIVE FLAG
                          ;T 27
      ;
      ;

```



```

;CHECK LOCK OUT OF SHORT LOOP BY FIRST CAUSING A
;SHORT LOOP FLAG THEN READING STATUS OF RECEIVE TO CHECK
;THAT T3 HAS BEEN TERMINATED

```

```

T27: JSR    R1,CHECK
      MOV    #AAS,LOOP
      MOV    #340,PS
      TST    @XCINT
      CLR    @XCSR
      MOV    #3,@XCSR      ;SET SHORT LOOP
      INC    @XCSR
      JSR    R2,WAITX      ;5.MILLI.SEC.CLEAR LOCK AND ENABLE
      BIT    #040000,@XCSR
      BNE    T28
      JSR    R5,ERROR
      MOV    #EE27,MES
      JSR    R3,PRINT
      JSR    R5,SCOPE
      HLT
      JMP    AAS           ;SHORT LOOP LOCK FAILED TO TERMINATE T3

```

```

;TEST THAT T2 WAS TERMINATED BY A SHORT LOOP LOCK BY
;TESTING STATUS OF T2

```

```

T28: JSR    R1,CHECK
      MOV    #T28,LOOP
      JSR    R2,TOUT
      MOV    #000400,@XCSR ;CLEAR RECEIVE FLAG
      TST    @XCINT        ;CLR FLAGS SHORT LOOP, SECOND CHANCE
      MOV    #3,@XCSR      ;EXT EN. SET S.LOOP
      INC    @XCSR
      TSTB   @XCSR         ;TEST BIT 7
      BPL    T29
      JSR    R5,ERROR
      MOV    #EE28,MES
      JSR    R3,PRINT
      JSR    R3,SCOPE
      HLT
      JMP    T28           ;LOCK FAILED TO TERMINATE T2
                               ;LOOP ONTEST 28

```

```

;WAIT 5 MILLI SEC. FOR CLEAR ERROR TO RELEASE
;THE LOCK FLOP AND PASS T2 TO BUS

```

```

T29: JSR    R1,CHECK
      JSR    R2,WAITX
      TSTB   @XCSR
      BMI    T30
      JSR    R5,ERROR
      MOV    #EE29,MES
      JSR    R3,PRINT
      JSR    R5,SCOPE
      HLT
      JMP    T28           ;LOCK DIDNT RELEASE T2 TO BUS
                               ;LOOP ON TEST 28
;

```

```

;CHECK THAT LOCK FROM SHORT LOOP FLAG
;LOCKS PULSE ING OF TIMER BY ATTEMPTING TO SET SHORT
;LOOP FLAG AFTER A PREVIOUS SHORT LOOP
T30: JSR      R1,CHECK
      MOV     #340,PS
      MOV     #T30,LOOP
      TST     @XCINT          ;CLEAR FLAGS SHORT LOOP,SECOND CHANCE
      INC     @XCSR
      INC     @XCSR
      TST     @XCINT          ;CLR FLAGS SHORT LOOP,SECOND CHANCE
      INC     @XCSR
      INC     @XCSR
      TST     @XCSR
      BPL     PTR
      JSR     R5,ERROR
      MOV     #EE30,MES
      JSR     R3,PRINT
      JSR     R5,SCOPE
      HLT
      JMP     T30          ;SHORT LOOP LOCK FAILED TO LOCK TIMER
                          ;LOOP ON TEST 30
PTR:  MOV     #2,@XCSR
      JSR     R2,WAITX        ;CLR ERROR
      TST     @XCINT          ;CLEAR FLAGS SHORT LOOP,SECOND CHANCE
;
;GENERATE A SHORT LOOP COMMAND AND CHECK THAT INITIALIZE
;WILL CLEAR THE SHORT LOOP FLAG.
T31: JSR      R1,CHECK
      MOV     #T31,LOOP
      INC     @XCSR          ;SET A SHORT LOOP
      INC     @XCSR
      RESET
      TST     @XCSR          ;TEST SHORT LOOP FLAG FOR CLEAR
      BPL     T32
      JSR     R5,ERROR
      MOV     #EE31,MES
      JSR     R3,PRINT
      JSR     R5,SCOPE
      HLT
      JMP     T31          ;INITIALIZE FAILED TO CLEAR SHORT
                          ;LOOP FLAG
;ENABLE THE EXTERNAL WORLD AND ALLOW THE RECIEVE
;FLAG TO SET THEN CHECK THAT THE INITIALIZE
;CLEARED RECEIVE FLAG.
T32: JSR      R1,CHECK
      MOV     #T32,LOOP
      MOV     #2,@XCSR
      JSR     R2,WAITX        ;5.MILLI SEC SET REC
      RESET

```

```

BIT      #040000, @XCSR      ;TEST RECIEVE FLAG
BEQ      T33
JSR      RS, ERROR
MOV      #EE32, MES
JSR      R3, PRINT
JSR      RS, SCOPE
HLT
JMP      T32      ;INITIALIZE FAILED TO CLEAR REC
              ;FLAG

```

```

;TEST THAT INITIALIZE WILL CLEAR THE LOCK FLOP
;BY SETTING A SHORT LOOP FLAG AND ISSUEING A RESET INSTR
;-UCTION. TEST THAT THE LOCK FLOP IS CLEARED BY SETTING
;A 2ND SHORT LOOP FLAG.

```

```

T33:      JSR      R1, CHECK
          MOV      #T33, LOOP
          INC      @XCSR
          INC      @XCSR
          RESET    ;ATTEMPT TO CLEAR SHORT LOOP
          INC      @XCSR
          INC      @XCSR
          TST      @XCSR      ;TEST SHOT LOOP
          BMI      PTX1
          JSR      RS, ERROR
          MOV      #EE33, MES
          JSR      R3, PRINT
          JSR      RS, SCOPE
          HLT
          JMP      T33      ;INITIALIZE FAILED TO CLEAR LOCK
PTX1:     MOV      #2, @XCSR
          JSR      R2, WAITX      ;WAIT 5.M.S. FOR ERROR TO CLR

```

```

;PULSE TIMER AND ISSUE A RESET INSTRUCTION, WAIT 5.MILLI
;WITH EXTERNAL ENABLE SETAND TEST RECEIVE FLAG TO
;CHECK THAT INITIALIZE TERMINATED T3.

```

```

T34:      JSR      R1, CHECK
          MOV      #T34, LOOP
          MOV      #1, @XCSR      ;PULSE TIMER & EX. EN SET
          RESET
          MOV      #2, @XCSR
          JSR      R2, WAITX      ;WAIT 5. MILLI SEC FOR T4
          BIT      #040000, @XCSR ;TEST RECEIVE FLAG
          BNE      PTX2
          JSR      R2, TOUT
          TST      @XCINT
          JSR      RS, ERROR
          MOV      #EE34, MES
          JSR      R3, PRINT
          JSR      RS, SCOPE
          HLT
          JMP      T34      ;INITIALIZE FAILED TO TERMINATE
          ;T3
PTX2:     JSR      R2, TOUT

```



```

TST      2XCINT      ;CLEAR SHORT LOOP, SECOND CHANCE
MOV      000400,2XCSR ;CLEAR RECEIVE FLAG
;PULSE TIMER AND ISSUE A RESET INSTRUCTION
;WAIT FOR POSSIBLE TIME-OUT OF T2 THEN READ
;STATUS OF T2 TO TEST THAT INITIALIZE
;TERMINATED T2.
T35:     JSR      R1,CHECK
MOV      8T35,LOOP
MOV      83,2XCSR
RESET
JSR      R2,TOUT      ;WAIT FOR DELAYS TO TIME OUT
TSTB     2XCSR        ;TEST BIT 7
BPL      PTX3
TST      2XCINT      ;CLEAR FLAGS
JSR      R5,ERROR
MOV      8EE35,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T35          ;INITIALIZE FAILED TO TERMINATE T2
PTX3:    TST      2XCINT ;CLEAR FLAGS SHORT LOOP, SECOND CHANCE
MOV      000400,2XCSR ;CLEAR RECEIVE FLAG
;TEST STATUS A&B AND TEST THAT BITS 7 & 15 ARE COMPLEMENTS
;15=1 AND 7=0 FROM A RESET CONDITION
T36:     JSR      R1,CHECK
RESET
MOV      8340,PS
MOV      8T36,LOOP
TST      2XCSR        ;CHECK BIT 15 OF ECSR
BPL      TILT
TSTB     2XCSR        ;CHECK BIT 7 OF EXT CSR 15=1
BMI      TILT         ;REPORT ERROR BOTH SAME
JMP      T37          ;OK 15=1 7=0
TILT:    NOP
JSR      R5,ERROR
MOV      8EE36,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T36          ;INCORECT STATUS IN EXT. CSR
;ISSUE A RESET INSTRUCTION AND TEST THAT STATUS
;OF THE EXT. CSR DOESNT CHANGE (NEUTRAL+POSITION):
T37:     JSR      R1,CHECK
MOV      2XCSR,PPL      ;SAVE EXT STATUS
MOV      8T37,LOOP
RESET
JSR      R2,WAITX      ;WAIT FO RELAY
ADD      2XCSR,PPL      ;TEST FOR STATUS CHANGE
BPL      T38
JSR      R5,ERROR

```

```

MOV      #EE37,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T37          ;RESET INSTRUCTION CHANGED STATUS
                     ;OF EXT CSR
:
:WITH LATCH IN NEUTRAL POSITION SWITCH BUSS AND
:CHECK FOR CHANGE OF STATUS IN EXT. CSR
T38:     JSR      R1,CHECK
          RESET
          MOV      #T38,LOOP
          MOV      #EE38,MES
          MOV      @XCSR,PPL          ;SAVE EXT. STATUS
          INC      @XSWBU             ;SWITCH BUSS
          JSR      R2,WAITX
          JSR      R3,OPP              ;CHECK THAT BITS ARE OF OPPOSITE
          ADD      @XCSR,PPL          ;POLARITY
          BMI      T39
          JSR      R5,ERROR
          MOV      #EE38,MES
          JSR      R3,PRINT
          JSR      R5,SCOPE
          HLT
          JMP      T38          ;SWITCHING BUSS FAILED
:
:WITH BUS SWITCHED CHECK THAT LATCH WILL DE-ENERGIZE RELAY ON
:A SECOND SWITCHING OF THE BUS
:TEST THAT STATUS CHANGED (NEUTRAL POSITION)
T39:     JSR      R1,CHECK
          MOV      #T39,LOOP
          MOV      @XCSR,PPL          ;SAVE EXT STATUS
          INC      @XSWBU             ;ATTEMPT TO SWITCH BUSS
          JSR      R2,WAITX           ;WAIT FOR RELAY
          ADD      @XCSR,PPL          ;WAS BUSS STATUS CHANGED
          BMI      T40
          JSR      R5,ERROR
          MOV      #EE39,MES
          JSR      R3,PRINT
          JSR      R5,SCOPE
          HLT
          JMP      T39          ;LATCH FAILED TO PREVENT BUSS CHANGE
:
:ISSUE A SWITCH BUS COMMAND AND CHECK THAT STATUS
:A & B CHANGED TO NEXT LATCH
T40:     JSR      R1,CHECK
          MOV      #T40,LOOP
          MOV      @XCSR,PPL
          INC      @XSWBU             ;SWITCH BUS
          JSR      R2,WAITX           ;5 MILLI SEC FOR RELAY

```

```

MOV      #EE40S,MES
JSR      R3,OPP          ;TEST FOR POL.CHANGE
ADD      @XCSR,PPL      ;TEST THAT STATUS CHANGED
BMI      T41
JSR      R5,ERROR
MOV      #EE40,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T40             ;BUS FAILED TO SWITCH TO 2ND LATCH
:
:
:ENABLE EXTERNAL WORLD AND ALLOW DELAYS TO TIME
:OUT TO CHECK THAT TERMINATION OF T3 WILL RELEASE THE LATCH
:
T41:     JSR      R1,CHECK
MOV      @T40,LOOP
MOV      @XCSR,PPL      ;SAVE STATUS A&B
MOV      @R3,@XCSR      ;ALLOW FOR CLEAR ERROR
JSR      R2,TOUT        ;TIME OUT ALL DELAYS
JSR      R2,WAITX        ;5 MILLI.SEC FOR RELAYS
MOV      #EE41S,MES     ;SET SUBTEST PRINT
JSR      R3,OPP          ;SUBTEST
ADD      @XCSR,PPL
BMI      T42            ;IF STATUS CHANGED GO ON
JSR      R5,ERROR
MOV      #EE41,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T41            ;BUSS FAILED TO SWITCH TO SECOND LATCH
:
:
:ISSUE A SECOND SWITCH BUSS COMAND AND CHECK THAT SWBU (164006)
:WILL SWITCH BUS
:
T42:     JSR      R1,CHECK
MOV      @T42,LOOP
MOV      @XCSR,PPL
INC      @XSWBU          ;ATTEMPT TO SWITCH BUSS
JSR      R2,WAITX        ;5 MILLI SEC FOR RELAY
ADD      @XCSR,PPL      ;DID STATUS CHANGE
BMI      T43            ;IF MINUS STATUS CHANGED
JSR      R5,ERROR
MOV      #EE42,MES
JSR      R3,PRINT
JSR      R5,SCOPE
HLT
JMP      T42            ;LATCH FAILED TO PREVENT BUSS FROM
:                          ;SWITCHING
:
:ISSUE A "RESET" INSTRUCTION AND TEST THAT
:LATCH GETS CLEARED

```



```

T43: JSR R1,CHECK
      MOV #T43,LOOP
      MOV @XCSR,PPL ;SAVE STATUS
      MOV #EE43,MES ;SET SUBTEST PRINT
      RESET ;CLEAR LATCH
      JSR R2,WAITX ;WAIT FOR RELAY
      JSR R3,OPP
      ADD @XCSR,PPL ;TEST FOR STATUS CHANGE
      BMI T44 ;IF MINUS STATUS CHANGED
      JSR R5,ERROR
      MOV #EE43,MES
      JSR R3,PRINT
      JSR R5,SCOPE
      HLT ;RESET FAILED TO RELEASE LATCH
      JMP T43
      :
      :
PPL: 0 ;TEST DATA POINT
      :
      :
      :TEST THAT "MANUAL" EXTERNAL ENABLE CIRCUITRY FUNCTIONS
      :BY SETTING THE ENABLE FLOP FROM A SWITCHING OF THE BUS
      : (VIA TEST CONNECTOR)
      :
T44: JSR R1,CHECK
      MOV #T44,LOOP
      MOV #3,@XCSR
      JSR R2,TOUT ;CLEAR ANY ERROR CONDITIONS
      TST @XCINT ;CLEAR FLAGS SHORT LOOP,SECOND CHANCE
      MOV #000400,@XCSR ;CLEAR RECEIVE FLAG
      INC @XSMBJ
      JSR R2,WAITX ;SWITCH BUS& WAIT FOR RELAY
      INC @XCSR ;GENERATE A SHORT LOOP ERROR,RECEIVE FLAG SHOULD
      INC @XCSR ;GET SET WITH EXTERNAL ENABLE SET BY SWITCH BUS COMMAND
      JSR R2,WAITX
      BIT #40000,@XCSR
      BNE INIT
      JSR R5,ERROR
      MOV #EE44,MES
      JSR R3,PRINT
      JSR R5,SCOPE
      HLT ;MANUAL ENABLE INPUT CIRCUITRY FAILED
      JMP T44
      :
      :
      :INITIALIZE THE WORLD AND PRINT PASS FOR EACH
      :PASS OF TEST CHECK TELETYPE FOR COMMAND INSTRUCTIONS
      :
INIT: RESET ;INITIALIZE WORLD
EOP: MOV #50.,TEMP2
IS: RESET
    DEC TEMP2

```

```

      BNE      1$
      BIT      #SW06,SR
      BEQ      2$
2$:   JSR      PC,EOPHLT
      MOV      #PASS,MES      ;SET PASS PRINT
      JSR      R3,PRINT
      JSR      R1,CHECK        ;CHECK FOR TELTYPE COMMANDS
      MOV      #STACK,SP
      JMP      T1
TEMP2: .WORD 0
      ;
      ;SUBROUTINE TO TEST THAT STATUS A&B ARE OF ADJACENT
      ;POLARITY. THIS ROUTINE IS USED AS A SUBTEST.
OPP:  TST      @XECR          ;TEST BIT 15 OF ESCR
      BPL      +12
      TSTB     @XECR          ;BIT 15=1 TEST BIT 7
      BMI      +14            ;REPORT A&B SAME
      RTS      R3
      TSTB     @XECR          ;15=1 7=0
      BPL      +4            ;REPORT BOTH SAME
      RTS      R3
      JSR      R5,ERROR
      NOP
      NOP
      NOP
      JSR      R3,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      @LOOP          ;LOOP ON FAILING TEST
      RTS      R3            ;OK 15=1 7=0
      TSTB     @XECR          ;15=0 TEST 7
      BPL      +4            ;REPORT BOTH SAME
      RTS      R3            ;OK 15=0 7=1
      JSR      R5,ERROR        ;CHECK FOR ERROR REPORT
      NOP
      NOP
      NOP
      JSR      R2,PRINT
      JSR      R5,SCOPE
      HLT
      JMP      @LOOP          ;LOOP ON FAILING TEST
      ;
      ;

```

```

;*****
;DELAY ADJUSTMENT TEST
;*****
DELAY:  MOV     #340,PS           ;KEEP STATUS AT 7 FOR ENTIRE TEST
        NULL
        RESET
        NULL
        MOV     #DELTST,MES      ;PRINT "DELAY ADJUST TEST"
        JSR     R3,PRINT
LREP:   MOV     #ASK,MES         ;ASK FOR DELAY 1, 2
        JSR     R3,PRINT
        JSR     R1,REC           ;RECIEVE ONE CHARACTER FROM TELE
        JSR     R3,ECHO          ;ECHO CHARACTER
        BIT     #SW01,SR         ;IS THERE A TTY?
        BEQ     2$
        BIT     #SW05,SR         ;ASK FOR DELAY 1 OR 2
        BNE     1$              ;IF SW05 UP,RUN DELAY 1
        MOV     #262,HLD
        BR      2$
1$:     MOV     #261,HLD
2$:     CMP     HLD,#261
        BEQ     D1              ;RUN DELAY 1 (RECEIVE) TIMING TEST
        CMP     HLD,#262
        BEQ     D2              ;RUN DELAY 2 (WARNING & S.L.) TIMING TEST
        MOV     #QU,MES         ;PRINT A ?
        JSR     R3,PRINT
        JMP     LREP            ;REPEAT LINE
;
D1:     MOV     #340,PS
        MOV     #000400,DXCSR    ;CLEAR RECEIVE FLAG
        MOV     #3,DXCSR        ;PULSE WARNING FLAG DELAY
        BIT     #040000,DXCSR    ;MONITOR BIT 14
        BEQ     -6
        JSR     R2,TOUT          ;WAIT APPROX 10.-6 SEC
        JSR     R1,CHECK
        JMP     D1
;RUN WARNING FLAG & SHORT LOOP DELAY TIMING TESTS
D2:     MOV     #340,PS
        TST     DXCNT            ;CLEAR FLAG
        MOV     #1,DXCSR        ;PULSE ALARM DELAY
        TSTB    DXCSR           ;TEST BIT 7
        BPL     -4
        JSR     R2,WAITX
        JSR     R1,CHECK        ;CHECK FOR TELETYPE COMMANDS
        JMP     D2              ;RECYCLE
;
;

```



```

:
:*****
: DYNAMIC SYSTEM TEST
:*****
:
DYMAN:  MOV    #DYTST,MES
        JSR    R3,PRINT
        NULL
        RESET
DYX:    JSR    R1,CHECK
        MOV    @XCSR,SIRE      ;SAVE STATUS
        MOV    #340,PS         ;SET STATUS
        MOV    #HORN,R4        ;SET INT. RETURN
        MOV    #HORN,R5
        MOV    #120,COUNT       ;SET COUNTER FOR 100 PASSES
        MOV    #103,@XCSR       ;START TIMING, ENABLE ALARM OUT
        MOV    PPRIV,PS         ;STATUS=6
        NOP
        JMP    .-2              ;STAY HERE WAIT FOR INTERRUPT
HERE:   MOV    #SLF,MES         ;SHORT LOOP FLAG SET
        JSR    R3,PRINT
        JSR    R2,TOUT          ;TIME OUT DELAYS
        TST    @XCINT           ;CLEAR FLAGS
        JMP    PT               ;RECYCLE TEST
HORN:   TST    @XCSR            ;FIND WHO GAVE INTERRUPT
        BMI    HERE
        TSTB   @XCSR            ;CHECK BIT 7
        BMI    OKK              ;ALL RIGHT GO
        BIT    #040000,@XCSR    ;NOT BIT 7 SO TRY 14
        BEQ    ERR              ;ILLEGAL INT.
        TSTB   @XCSR
        BPL    .-4
OKK:    BIT    #40000,@XCSR      ;BIT 7=1 WAIT FOR 14
        BEQ    .-6
        TST    @XCINT           ;CLEAR FLAGS SHORT LOOP, SECOND CHANCE
        MOV    #000400,@XCSR    ;CLEAR RECEIVE FLAG
        INC    @XSWBU           ;SWITCH BUS
        JSR    R2,WAITX
        ADD    @XCSR,SIRE
        BMI    CLST              ;BR IF STATUS CHANGED
        NULL
        MOV    #BBS,MES         ;REPORT EXT. STATUS BAD
        JSR    R3,PRINT
        JMP    DYX
CLST:   MOV    @XCSR,SIRE
        RESET                   ;CLEAR LATCH
        JSR    R2,WAITX
        ADD    @XCSR,SIRE
        BMI    TIKE
        NULL
        MOV    #BBS,MES
        JSR    R3,PRINT
        JMP    DYX
TIKE:   DEC    COUNT

```

```

      BEQ      .+12          ;BRANCH WHEN DONE
      JSR      R1,CHECK
      JMP      PT
      MOV      #340,PS
      NULL
      MOV      #PASS,MES
      JSR      R3,PRINT
      NULL
      JSR      R2,TOUT
      JSR      R2,TOUT
EOP2:  MOV      #50.,TEMP2
1$:    RESET
      DEC      TEMP2
      BNE      1$
      BIT      #SW06,SR
      BEQ      2$
      JSR      PC,EOPHLT
2$:    JMP      DYX
ERR:   MOV      #INT,MES
      JSR      R3,PRINT
      JSR      R2,TOUT
      TST      JXCINT        ;CLEAR SHORT LOOP,SECOND CHANCE
      MOV      #000400,JXCSR ;CLEAR RECEIVE FLAG
      JMP      PT
COUNT: 0
SIRE:   0
      ;
      ;
      ;PRINT HEADER ROUTINE AND RECIEVE TELETYPE COMMANDS
      ;TO SPECIFY DESIRED TESTS
      ;
HEADER: BIT      #SW01,SR      ;IS THERE A TTY?
      BEQ      1$
      BIT      #SW00,SR      ;IF CAME FROM "CHECK" SUBR
      BNE      1$            ;THEN PRINT HEADER
      BIT      #SW02,SR      ;LOGIC TEST ?
      BNE      TA
      BIT      #SW03,SR      ;DELAY TEST ?
      BNE      TB
      BIT      #SW04,SR      ;DYNAMIC TEST ?
      BNE      TC
1$:    HALT                  ;YOU SHOULD NEVER GET HERE
      CLR      TKB           ;CLEAR DONE OF READER STATUS
      MOV      #HEAD,MES
      JSR      R3,PRINT      ;ASK FOR DESIRED TEST
      JSR      R1,REC        ;RECIEVE ONE CHARACTER
      JSR      R3,ECHO       ;ECHO TELEREADER CHARACTER
      CMP      HLD,#261      ;TEST A=LOGIC TEST
      BEQ      TA
      CMP      HLD,#262      ;TEST B=TIME DELAY TEST
      BEQ      TB
      CMP      HLD,#263      ;TEST C=SYSTEM STATUS TEST
      BEQ      TC
      MOV      #QU,MES
      JSR      R3,PRINT      ;TYPE ?

```

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|      |     |        |                               |
|------|-----|--------|-------------------------------|
| TA:  | JMP | HEADER | ; ILLEGAL CHARACTER TRY AGAIN |
| TB:  | JMP | LOGIC  | ; LOGIC TEST                  |
| TC:  | JMP | DELAY  | ; DELAY TIME LOOP             |
| HLA: | JMP | DYMAN  | ; DYNAMIC TEST                |
| HLB: | 0   |        | ; HOLD TEST DESIRED           |



```

; ECHO CHARACTER IN TELETYPE BUFFER REGISTER
ECHO:  MOV    TKB, TYDB      ; READER BUFFER TO PRINTER BUFFER
      TSTB   @TYSR         ; TEST PRINTER STATUS
      BPL    -4
      RTS    R3
; PRINT DATA SPECIFIED BY LEADING ADDRESS IN REGISTER 4
; UNTIL TERMINATED BY (a)
PRINT: NULL
      MOV    MES, R4
      MOV    #ERRST, R2
      MOV    MES, (R2)+
      CLR    (R2)
1$:    MOVB   (R4)+, DBUF
      CMPB   #100, DBUF
      BEQ    DONE
      CMPB   #45, DBUF
      BNE    OUT
      JSR    R2, LFCR
      JMP    1$
OUT:   JSR    R5, PRT
      BR     PRINT+16
PRT:   MOVB   DBUF, TYDB
      TSTB   @TYSR
      BPL    -4
      RTS    R5
DONE:  NULL
      RTS    R3
DBUF:  0
MES:   0
TEMP1: .WORD 0
;
; RECEIVE ONE CHARACTER FROM TELETYPE READER
; BUFFER AND STORE IN LOC. "HLD"
REC:   MOV    HOLD, (PC)+
1$:    .WORD 0
2$:    TSTB   TKS           ; WAIT FOR KEYBOARD
      BMI    3$
      INC    #0
      BNE    2$
      DEC    1$
      BNE    2$
      MOVB   #215, HLD
      BR     4$
3$:    MOV    TKB, HLD      ; MOV DATA TO LOC. HLD
4$:    RTS    R1
HOLD:  20
;
; 5 MILLI-SEC LOOP
WAIT:  MOV    #1750, TIMI
      DEC    TIMI

```

```

      BNE      -4
      RTS      R2
      ;WAIT 5 MILLI SEC.
WAITX: MOV      SPEED,TIMI      ;LOAD FOR 5 MILLI SEC
      DEC      TIMI
      BNE      -4
      RTS      R2
SPEED: 177777      ;5 MILLI SEC CONSTT
      ;
      ;RETURN FROM SHORT LOOP & WARNING INTERRUPTS
WAOG:  MOV      #STACK,SP      ;FORCE INTERRUPT RETURN OF SHORTLOOP & WARNING
      MOV      R4,PC
      HLT
      ;SHOULD NEVER GET HERE
      ;
      ;RETURN FROM RECIEVE FLAG INTERRUPTS
RECF:  MOV      #STACK,SP
      MOV      R5,PC      ;FORCE INT RET OF REC
      HLT
      ;
      ;CHECK FOR COMMANDS TO MONITOR
      ;TEST REQUIRED
      ;
CHECK: BIT      #1,SR
      BNE      +4
      RTS      R1
      MOV      #3,DXCSR
      JSR      R2,TOUT1
      RESET
      TST      DXCINT      ;CLEAR FLAGS
      JMP      HEADER
      ;
      ;
      ;WHEN VECTORS 170 & 174 ARE INCORRECTLY ASSERTED
      ;ENTER ROUTINE, REPORT ERROR AND RETURN TO FAILING TEST
      ;
WRNG:  MOV      #WRONG,MES
      JSR      R3,PRINT
      TST      (SP)+
      MOV      #340,3(SP)      ;SET RETURN STATUS TO 7
      TST      -(SP)
      RTI      ;RETURN TO FAILING TEST
      ;
      ;BUSS TIME-OUT ERROR SUBROUTINE
      ;

```

```

TOBE:      JSR      R5,ERROR
           MOV      #TOER,MES          ;REPORT TIME OUT ERROR
           JSR      R3,PRINT
           NOP
           RTI
           ;
           ;SUBROUTINE FOR INPUTTING ADDRESSES AND VECTORS
           ;
ADDMO:     MOV      #ASK1,MES          ;ASK FOR "FIRST DEVICE ADDR"
           JSR      R3,PRINT
           CLR      ADDRES
MOD:       JSR      R1,REC              ;REC A CHARACTER
           JSR      R3,ECHO
           CMP      #215,HLD          ;TEST FOR A C.R.
           BEQ      SET
           ASL      ADDRES
           ASL      ADDRES
           ASL      ADDRES
           BIC      #177770,HLD
           ADD      HLD,ADDRES
           JMP      MOD
SET:       TST      ADDRES
           BEQ      STRB
           MOV      ADDRES,XCSR        ;SET DEVICE ADDRESS
           ADD      #2,ADDRES
           MOV      ADDRES,XCINT
           ADD      #2,ADDRES
           MOV      ADDRES,XECSR
           ADD      #2,ADDRES
           MOV      ADDRES,XSWBU
STRB:      M
MOD:       MOV      #ASK2,MES          ;ASK FIRST INT. VECTOR
           JSR      R3,PRINT
           CLR      VADDR
MODA:     JSR      R1,REC
           JSR      R3,ECHO
           CMP      #215,HLD          ;TEST FOR C.R.
           BEQ      SETA
           ASL      VADDR
           ASL      VADDR
           ASL      VADDR
           BIC      #177770,HLD
           ADD      HLD,VADDR
           JMP      MODA
SETA:     TST      VADDR
           BNE      2$
2$:       MOV      VADDRS,VADDR
           BIC      #177000,VADDR
           MOV      #WAOG,VADDR
           ADD      #2,VADDR
           MOV      #340,VADDR
           ADD      #2,VADDR
           MOV      #RECF,VADDR

```



```

      ADD      #2,VADDR
      MOV      #340,SVADDR
STRBA:  MOV      #ASK3,MES      ;ASK FOR VECTOR LEVEL
      JSR      R3,PRINT
      JSR      R1,REC          ;REC ONE CHARACTERS
      JSR      R3,ECHO
      BIT      #SM01,SR        ;IS THERE A TTY?
      BEQ      IS
      MOV      DPRIV,HLD       ;IF NO TTY
IS:     CMP      #264,HLD      ;CHECK FOR A 4
      BNE      .+12
      MOV      #140,PPRIV      ;SET PRIORITY AT 3
      BR      PROTIN
      CMP      #265,HLD
      BNE      .+12
      MOV      #200,PPRIV
      BR      PROTIN
      CMP      #266,HLD
      BNE      .+12
      MOV      #240,PPRIV
      BR      PROTIN
      CMP      #267,HLD
      BNE      .+12
      MOV      #300,PPRIV
      BR      PROTIN
      MOV      #QU,MES
      JSR      R3,PRINT
      JMP      STRBA          ;TRY AGAIN
PROTIM: MOV      #ASK4,MES
      JSR      R3,PRINT
      JSR      R1,REC
      JSR      R3,ECHO
      BIT      #SM01,SR        ;IS THERE A TTY ?
      BEQ      IS
IS:     MOV      PDP11,HLD     ;PDP11-05 OR WHATEVER
      CMP      #301,HLD
      BNE      .+12
      MOV      #1500,SPEED
      BR      KA
      CMP      #302,HLD
      BNE      .+12
      MOV      #3000,SPEED
      BR      KA
      CMP      #303,HLD
      BNE      .+12
      MOV      #6000,SPEED
KA:     RTS      R5
      MOV      #QU,MES
      JSR      R3,PRINT
      JMP      PROTIN

      ADDRES:  0
      VADDR:   0

```

```

TIMEX:  MOV    #STACK, SP      ;REINITIALIZE THE STACK
        MOV    (R4), PC        ;FORCE RETURN FROM INTERRUPT
        HLT                      ;SHOULD NEVER GET HERE

        ;RUN DELAY TIME OUTS, TOTAL TIME AS PER
        ;PROCESSOR TIME 05=4SEC.+ 40=3 SEC+

TOUT:   TSTB    SR
        BR      TOUT1          ;CHANGE TO BPL TO RUN A FAST MODE FOR
RA:      MOV    #12, CNTIM      ;T1, T2, T3<50 MILLI-SEC
        MOV    SPEED, TIMI      ;50 MILLI SEC. WORTH
        DEC     TIMI
        BNE     .-4
        DEC     CNTIM
        BNE     RA
        RTS     R2              ;GO WHEN DONE
TOUT1:   ;RUN LONG TIME OUT FOR ALL DELAYS HERE
        MOV    #5, TIMI         ;SET COUNT TIME
        JSR    R4, TIME
        RTS     R2
CNTIM:   0
TIMI:    0
        ;
NULPRT:  NOP
        TSTB    @TYSR
        BPL     .-4
        CLR     TYDB
        TSTB    @TYSR
        BPL     .-4
        CLR     TYDB
        TSTB    @TYSR
        BPL     .-4
        RTI

LFCR:    MOV    #215, TYDB      ;CARRIAGE RET.
        TSTB    @TYSR
        BPL     .-4
        MOV    #212, TYDB
        TSTB    @TYSR
        BPL     .-4
        RTS     R2
        ;
        ;
ERROR:   ;CHECK FOR ERROR PRINT OUT (BIT 13 OF SWITCH REG.)
        BIT     #20000, SR
        BEQ     .+6             ;IF BIT 13=0 PRINT ERROR
        ADD     #12, R5         ;ADD VALUE TO OMIT ERROR PRINT
        RTS     R5
        ;
SCOPE:   ;CHECK FOR SCOPE LOOP (BIT 14 OF SWITCH REG.)
        MOV     SR, ESTAT

```

```

      BIT      #04C000,ESTAT ;TEST BIT 14 OF SWITCH REGISTER
      BEQ      +12           ;IF BIT 14=1 RUN SCOPE
      MOV      #STACK,SP
      MOV      LOOP,PC      ;FORCE RETURN TO TEST
      RTS      RS           ;RETURN AND HLT
ESTAT: 0
LOOP:  0
      ;
      ;RUN TIME INCREMENTS IN VALUES STORED IN TIMI
TIME:   CLR     XES
      INC     XES           ;COUNT LOOP
      BNE     -4           ;
      DEC     TIMI         ;NUMBER OF COUNT LOOPS
      BNE     -12
      RTS     R4
XES:    0
      ;MESSAGES
      .BYTE
LT:     .ASCII  /%LOGIC TEST%/

EE1:    .ASCII  /T1%/
EE2:    .ASCII  /T2%/
EE3:    .ASCII  /T3%/
EE4:    .ASCII  /T4%/
EE5:    .ASCII  /T5%/
EE6:    .ASCII  /T6%/
EE7:    .ASCII  /T7%/
EE8:    .ASCII  /T8%/
EE9:    .ASCII  /T9%/
EE10:   .ASCII  /T10%/
EE11:   .ASCII  /T11%/
EE12:   .ASCII  /T12%/
EE13:   .ASCII  /T13%/
EE14:   .ASCII  /T14%/
EE15:   .ASCII  /T15%/
EE16:   .ASCII  /T16%/
EE17:   .ASCII  /T17%/
EE18:   .ASCII  /T18%/

```

EE19: .ASCII /T19%a/  
EE20: .ASCII /T20%a/  
EE21: .ASCII /T21%a/  
EE22: .ASCII /T22%a/  
EE23: .ASCII /T23%a/  
EE24: .ASCII /T24%a/  
EE25: .ASCII /T25%a/  
EE26: .ASCII /T26%a/  
EE27: .ASCII /T27%a/  
EE28: .ASCII /T28%a/  
EE29: .ASCII /T29%a/  
EE30: .ASCII /T30%a/  
EE31: .ASCII /T31%a/  
EE32: .ASCII /T32%a/  
EE33: .ASCII /T33%a/  
EE34: .ASCII /T34%a/  
EE35: .ASCII /T35%a/  
EE36: .ASCII /T36%a/  
EE37: .ASCII /T37%a/  
EE38: .ASCII /T38%a/  
EE39: .ASCII /T39%a/  
EE40: .ASCII /T40%a/  
EE41: .ASCII /T41%a/  
EE42: .ASCII /T42%a/  
EE43: .ASCII /T43%a/  
EE44: .ASCII /T44%a/  
EE385: .ASCII /T385%a/



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EE40S: .ASCII /T40S%a/

EE41S: .ASCII /T41S%a/

EE43S: .ASCII /T41S%a/

TOER: .ASCII /BUS ERROR TIME-OUT%a/

PASS: .ASCII /PASS%a/

WRONG: .ASCII /TRAPPED TO WRONG INT. VECTOR%a/

DELTST: .ASCII /%DELAY ADJUSTMENT TEST%a/

ASK: .ASCII /DELAY:(1)WATCHDOG.(2)WARNING & SHORT LOOP%a/

QU: .ASCII /?%a/

HEAD: .ASCII /%LOGIC TEST(1),DELAY TEST(2),DYNAMIC TEST(3)%a/

DYTST: .ASCII /%DYNAMIC TEST%a/

SLF: .ASCII /SHORT LOOP FLAG SET%a/

IINT: .ASCII /ILLEGAL INTERRUPT%a/

BBS: .ASCII /EXT.BUS STATUS BAD%a/

ASK1: .ASCII /%FIRST DEVICE ADDRESS=a/

ASK2: .ASCII /%FIRST INT. VECTOR=a/

ASK3: .ASCII /%PRIORITY INT. LEVEL=a/

ASK4: .ASCII /%PDP-11 (A)=05,10,20 (B)=35,40 (C)=45,50 a/

ERRST: .EVEN  
          .=017400  
          .BLKW 5  
          .END

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DDKWBA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

|        |        |       |       |       |       |       |      |      |       |      |       |       |       |      |  |
|--------|--------|-------|-------|-------|-------|-------|------|------|-------|------|-------|-------|-------|------|--|
| AA1    | 001322 | 627   | 628   | 635#  |       |       |      |      |       |      |       |       |       |      |  |
| AA2    | 001432 | 650   | 651   | 658#  |       |       |      |      |       |      |       |       |       |      |  |
| AA4    | 003446 | 985   | 1001# | 1014  | 1031  |       |      |      |       |      |       |       |       |      |  |
| AA5    | 003626 | 1012  | 1032# | 1042  | 1056  |       |      |      |       |      |       |       |       |      |  |
| ADDMO  | 007756 | 551   | 1767# |       |       |       |      |      |       |      |       |       |       |      |  |
| ADDRES | 010634 | 1769* | 1774* | 1775* | 1776* | 1778* | 1780 | 1782 | 1783* | 1784 | 1785* | 1786  | 1787* | 1788 |  |
|        |        | 1864# |       |       |       |       |      |      |       |      |       |       |       |      |  |
| ASK    | 011627 | 1487  | 2064# |       |       |       |      |      |       |      |       |       |       |      |  |
| ASK1   | 012076 | 1767  | 2103# |       |       |       |      |      |       |      |       |       |       |      |  |
| ASK2   | 012125 | 1790  | 2108# |       |       |       |      |      |       |      |       |       |       |      |  |
| ASK3   | 012151 | 1814  | 2113# |       |       |       |      |      |       |      |       |       |       |      |  |
| ASK4   | 012177 | 1840  | 2117# |       |       |       |      |      |       |      |       |       |       |      |  |
| BBS    | 012052 | 1570  | 1579  | 2098# |       |       |      |      |       |      |       |       |       |      |  |
| CHECK  | 007650 | 580   | 595   | 609   | 625   | 647   | 669  | 684  | 702   | 719  | 735   | 751   | 765   | 780  |  |
|        |        | 801   | 815   | 833   | 858   | 865   | 877  | 889  | 904   | 923  | 940   | 960   | 982   | 1010 |  |
|        |        | 1041  | 1061  | 1082  | 1099  | 1126  | 1144 | 1166 | 1188  | 1213 | 1233  | 1253  | 1271  | 1294 |  |
|        |        | 1312  | 1334  | 1356  | 1374  | 1399  | 1435 | 1513 | 1523  | 1538 | 1584  | 1731# |       |      |  |
|        |        | 359#  | 533   |       |       |       |      |      |       |      |       |       |       |      |  |
| CINT = | 172402 | 1568  | 1573# |       |       |       |      |      |       |      |       |       |       |      |  |
| CLST   | 006770 | 1877* | 1881* | 1888# |       |       |      |      |       |      |       |       |       |      |  |
| CNTIM  | 010724 | 1543* | 1582* | 1607# |       |       |      |      |       |      |       |       |       |      |  |
| COUNT  | 007200 | 358#  | 532   |       |       |       |      |      |       |      |       |       |       |      |  |
| CSR =  | 172400 | 1657* | 1658  | 1660  | 1667  | 1673# |      |      |       |      |       |       |       |      |  |
| DBUF   | 007512 | 556   | 1481# | 1641  |       |       |      |      |       |      |       |       |       |      |  |
| DELAY  | 006254 | 1485  | 2058# |       |       |       |      |      |       |      |       |       |       |      |  |
| DELTST | 011577 | 1659  | 1671# |       |       |       |      |      |       |      |       |       |       |      |  |
| DONE   | 007506 | 537#  | 1820  |       |       |       |      |      |       |      |       |       |       |      |  |
| DPRIV  | 000514 | 560   | 1534# | 1642  |       |       |      |      |       |      |       |       |       |      |  |
| DYMAN  | 006530 | 1534  | 2084# |       |       |       |      |      |       |      |       |       |       |      |  |
| DYTST  | 011763 | 1538# | 1572  | 1581  | 1600  |       |      |      |       |      |       |       |       |      |  |
| DYX    | 006546 | 1499  | 1507# | 1514  |       |       |      |      |       |      |       |       |       |      |  |
| D1     | 006420 | 1501  | 1517# | 1524  |       |       |      |      |       |      |       |       |       |      |  |
| D2     | 006466 | 1490  | 1630  | 1646# | 1771  | 1794  | 1817 | 1843 |       |      |       |       |       |      |  |
| ECHO   | 007370 | 360#  | 534   |       |       |       |      |      |       |      |       |       |       |      |  |
| ECSR = | 172404 | 586   | 1943# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE1    | 011134 | 742   | 1961# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE10   | 011200 | 757   | 1963# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE11   | 011205 | 771   | 1965# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE12   | 011212 | 791   | 1967# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE13   | 011217 | 805   | 1969# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE14   | 011224 | 821   | 1971# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE15   | 011231 | 841   | 1973# |       |       |       |      |      |       |      |       |       |       |      |  |
| EE16   | 011236 | 1975# |       |       | </    |       |      |      |       |      |       |       |       |      |  |

[illegible]



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DDKWBA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

|        |          |       |       |       |       |       |       |       |       |       |       |       |       |       |
|--------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| LOGIC  | 001000   | 563*  | 1640  |       |       |       |       |       |       |       |       |       |       |       |
| LOOP   | 011070   | 582*  | 596*  | 610*  | 626*  | 670*  | 685*  | 703*  | 736*  | 752*  | 766*  | 782*  | 860*  | 905*  |
|        |          | 925*  | 942*  | 963*  | 987*  | 1014* | 1042* | 1062* | 1101* | 1127* | 1145* | 1167* | 1189* | 1214* |
|        |          | 1236* | 1255* | 1273* | 1295* | 1313* | 1335* | 1357* | 1375* | 1400* | 1459  | 1471  | 1925  | 1928* |
| LREP   | 006302   | 1487* | 1504  |       |       |       |       |       |       |       |       |       |       |       |
| LT     | 011117   | 573   | 1940* |       |       |       |       |       |       |       |       |       |       |       |
| MES    | 007514   | 573*  | 586*  | 601*  | 615*  | 636*  | 659*  | 674*  | 691*  | 710*  | 723*  | 742*  | 757*  | 771*  |
|        |          | 791*  | 805*  | 821*  | 841*  | 869*  | 881*  | 893*  | 913*  | 931*  | 949*  | 971*  | 996*  | 1027* |
|        |          | 1052* | 1071* | 1087* | 1111* | 1134* | 1152* | 1176* | 1199* | 1222* | 1244* | 1261* | 1274* | 1282* |
|        |          | 1302* | 1317* | 1322* | 1340* | 1345* | 1364* | 1377* | 1384* | 1413* | 1433* | 1485* | 1487* | 1502* |
|        |          | 1534* | 1548* | 1570* | 1579* | 1588* | 1601* | 1627* | 1637* | 1653  | 1655  | 1674* | 1747* | 1758* |
|        |          | 1767* | 1790* | 1814* | 1837* | 1840* | 1859* |       |       |       |       |       |       |       |
| MOD    | 007774   | 1770* | 1779  |       |       |       |       |       |       |       |       |       |       |       |
| MODA   | 010150   | 1793* | 1802  |       |       |       |       |       |       |       |       |       |       |       |
| NOP    | = 000240 | 364*  |       |       |       |       |       |       |       |       |       |       |       |       |
| NULL   | = 104000 | 363*  | 564   | 566   | 1482  | 1484  | 1536  | 1569  | 1578  | 1587  | 1590  | 1652  | 1671  |       |
| NULPRT | 010730   | 517   | 1892* |       |       |       |       |       |       |       |       |       |       |       |
| OKK    | 006706   | 1556  | 1561* |       |       |       |       |       |       |       |       |       |       |       |
| OPP    | 006134   | 1278  | 1318  | 1341  | 1380  | 1444* |       |       |       |       |       |       |       |       |
| OUT    | 007462   | 1661  | 1664* |       |       |       |       |       |       |       |       |       |       |       |
| PASS   | 011533   | 1433  | 1588  | 2048* |       |       |       |       |       |       |       |       |       |       |
| PC     | =%000007 | 380*  | 544*  | 1432* | 1599* | 1681* | 1715* | 1720* | 1868* | 1925* |       |       |       |       |
| PDP11  | 000520   | 539*  | 1846  |       |       |       |       |       |       |       |       |       |       |       |
| PPL    | 005724   | 1254* | 1258* | 1275* | 1279* | 1296* | 1299* | 1314* | 1319* | 1336* | 1342* | 1358* | 1361* | 1376* |
|        |          | 1381* | 1392* |       |       |       |       |       |       |       |       |       |       |       |
| PPRIV  | 000516   | 538*  | 630   | 652   | 966   | 988   | 1022  | 1545  | 1823* | 1827* | 1831* | 1835* |       |       |
| PRINT  | 007406   | 574   | 587   | 602   | 616   | 638   | 660   | 675   | 692   | 711   | 724   | 743   | 758   | 772   |
|        |          | 792   | 806   | 822   | 842   | 870   | 882   | 894   | 914   | 932   | 950   | 972   | 997   | 1028  |
|        |          | 1053  | 1072  | 1088  | 1112  | 1135  | 1153  | 1177  | 1200  | 1223  | 1245  | 1262  | 1283  | 1303  |
|        |          | 1323  | 1346  | 1365  | 1385  | 1414  | 1434  | 1456  | 1468  | 1486  | 1488  | 1503  | 1535  | 1549  |
|        |          | 1571  | 1580  | 1589  | 1602  | 1628  | 1638  | 1652* | 1665  | 1748  | 1759  | 1768  | 1791  | 1815  |
|        |          | 1838  | 1841  | 1860  |       |       |       |       |       |       |       |       |       |       |
|        |          | 1824  | 1828  | 1832  | 1836  | 1840* | 1861  |       |       |       |       |       |       |       |
| PROTIM | 010476   | 1664  | 1667* |       |       |       |       |       |       |       |       |       |       |       |
| PRT    | 007470   | 354*  | 581*  | 630*  | 633*  | 648*  | 652*  | 655*  | 704*  | 781*  | 816*  | 859*  | 906*  | 941*  |
| PS     | = 177776 | 966*  | 969*  | 988*  | 994*  | 1011* | 1022* | 1025* | 1043* | 1100* | 1235* | 1481* | 1507* | 1517* |
|        |          | 1540* | 1545* | 1586* |       |       |       |       |       |       |       |       |       |       |
|        |          | 1544* | 1552  | 1585  | 1606  |       |       |       |       |       |       |       |       |       |
| PT     | 006604   | 1109  | 1117* |       |       |       |       |       |       |       |       |       |       |       |
| PTR    | 004226   | 1174  | 1181* |       |       |       |       |       |       |       |       |       |       |       |
| PTX1   | 004506   | 1195  | 1204* |       |       |       |       |       |       |       |       |       |       |       |
| PTX2   | 004624   | 1219  | 1227* |       |       |       |       |       |       |       |       |       |       |       |
| PTX3   | 004732   | 1502  | 1637  | 1837  | 1859  | 2073* |       |       |       |       |       |       |       |       |
| QU     | 011702   | 1878* | 1882  |       |       |       |       |       |       |       |       |       |       |       |
| RA     | 010664   | 1489  | 1629  | 1681* | 1770  | 1793  | 1816  | 1842  |       |       |       |       |       |       |
| REC    | 007520   | 525   | 1719* | 1811  |       |       |       |       |       |       |       |       |       |       |
| RECF   | 007640   | 373*  |       |       |       |       |       |       |       |       |       |       |       |       |
| RO     | =%000000 | 374*  | 580*  | 595*  | 609*  | 625*  | 647*  | 669*  | 684*  | 702*  | 719*  | 735*  | 751*  | 765*  |
| R1     | =%000001 | 780*  | 801*  | 815*  | 833*  | 858*  | 865*  | 877*  | 889*  | 904*  | 923*  | 940*  | 960*  | 982*  |
|        |          | 1010* | 1041* | 1061* | 1082* | 1099* | 1126* | 1144* | 1166* | 1189* | 1213* | 1233* | 1253* | 1271* |
|        |          | 1294* | 1312* | 1334* | 1356* | 1374* | 1399* | 1435* | 1489* | 1513* | 1523* | 1538* | 1584* | 1629* |
|        |          | 1692* | 1733* | 1770* | 1793* | 1816* | 1842* |       |       |       |       |       |       |       |
|        |          | 375*  | 649*  | 687*  | 706*  | 738*  | 788*  | 817*  | 835*  | 837*  | 847*  | 908*  | 944*  | 945*  |
| R2     | =%000002 | 965*  | 1001* | 1032* | 1048* | 1063* | 1083* | 1118* | 1147* | 1182* | 1193* | 1196* | 1204* | 1217* |
|        |          | 1257* | 1277* | 1298* | 1316* | 1338* | 1339* | 1360* | 1379* | 1402* | 1406* | 1409* | 1468* | 1512* |
|        |          | 1522* | 1550* | 1566* | 1575* | 1591* | 1592* | 1603* | 1654* | 1655* | 1656* | 1662* | 1701* | 1708* |

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DDKWBA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

|       |          |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| TOER  | 011507   | 1758  | 2043# |       |       |       |       |       |       |       |       |       |       |       |
| TOUT  | 010650   | 649   | 687   | 706   | 788   | 837   | 908   | 944   | 965   | 1032  | 1063  | 1196  | 1204  | 1217  |
|       |          | 1338  | 1402  | 1512  | 1550  | 1591  | 1592  | 1603  | 1875# |       |       |       |       |       |
| TOUT1 | 010710   | 1735  | 1876  | 1885# |       |       |       |       |       |       |       |       |       |       |
| TYDB  | = 177566 | 357#  | 1646* | 1667* | 1895* | 1898* | 1904* | 1907* |       |       |       |       |       |       |
| TYSR  | 000500   | 531#  | 1647  | 1668  | 1893  | 1896  | 1899  | 1905  | 1908  |       |       |       |       |       |
| T1    | 001030   | 580#  | 582   | 590   | 1437  |       |       |       |       |       |       |       |       |       |
| T10   | 001752   | 721   | 735#  |       |       |       |       |       |       |       |       |       |       |       |
| T11   | 002036   | 740   | 751#  | 752   | 761   | 766   |       |       |       |       |       |       |       |       |
| T12   | 002112   | 755   | 765#  | 775   |       |       |       |       |       |       |       |       |       |       |
| T13   | 002172   | 769   | 780#  | 851   |       |       |       |       |       |       |       |       |       |       |
| T14   | 002270   | 789   | 801#  |       |       |       |       |       |       |       |       |       |       |       |
| T15   | 0023     | 803   | 815#  |       |       |       |       |       |       |       |       |       |       |       |
| T16   | 002410   | 819   | 833#  |       |       |       |       |       |       |       |       |       |       |       |
| T17   | 002526   | 839   | 858#  | 860   | 873   | 885   |       |       |       |       |       |       |       |       |
| T18   | 002560   | 865#  |       |       |       |       |       |       |       |       |       |       |       |       |
| T19   | 002622   | 867   | 877#  |       |       |       |       |       |       |       |       |       |       |       |
| T2    | 001110   | 584   | 595#  | 596   | 605   |       |       |       |       |       |       |       |       |       |
| T20   | 002664   | 879   | 889#  |       |       |       |       |       |       |       |       |       |       |       |
| T21   | 002730   | 891   | 904#  | 905   | 917   |       |       |       |       |       |       |       |       |       |
| T22   | 003026   | 911   | 923#  | 925   | 935   |       |       |       |       |       |       |       |       |       |
| T23   | 003114   | 928   | 940#  | 942   | 953   |       |       |       |       |       |       |       |       |       |
| T24   | 003212   | 947   | 958#  | 963   | 975   |       |       |       |       |       |       |       |       |       |
| T25   | 003330   | 961   | 982#  | 987   | 1000  |       |       |       |       |       |       |       |       |       |
| T26   | 003470   | 1004  | 1010# |       |       |       |       |       |       |       |       |       |       |       |
| T27   | 003644   | 1034  | 1041# |       |       |       |       |       |       |       |       |       |       |       |
| T28   | 003752   | 1050  | 1061# | 1062  | 1075  | 1091  |       |       |       |       |       |       |       |       |
| T29   | 004052   | 1069  | 1082# |       |       |       |       |       |       |       |       |       |       |       |
| T3    | 001170   | 599   | 609#  | 610   | 619   |       |       |       |       |       |       |       |       |       |
| T30   | 004120   | 1085  | 1099# | 1101  | 1115  |       |       |       |       |       |       |       |       |       |
| T31   | 004244   | 1126# | 1127  | 1138  |       |       |       |       |       |       |       |       |       |       |
| T32   | 004326   | 1132  | 1144# | 1145  | 1156  |       |       |       |       |       |       |       |       |       |
| T33   | 004414   | 1150  | 1166# | 1167  | 1180  |       |       |       |       |       |       |       |       |       |
| T34   | 004520   | 1188# | 1189  | 1203  |       |       |       |       |       |       |       |       |       |       |
| T35   | 004642   | 1213# | 1214  | 1226  |       |       |       |       |       |       |       |       |       |       |
| T36   | 004744   | 1233# | 1236  | 1248  |       |       |       |       |       |       |       |       |       |       |
| T37   | 005040   | 1241  | 1253# | 1255  | 1265  |       |       |       |       |       |       |       |       |       |
| T38   | 005126   | 1259  | 1271# | 1273  | 1286  |       |       |       |       |       |       |       |       |       |
| T39   | 005232   | 1280  | 1294# | 1295  | 1306  |       |       |       |       |       |       |       |       |       |
| T4    | 001246   | 613   | 625#  | 626   | 641   |       |       |       |       |       |       |       |       |       |
| T40   | 005322   | 1300  | 1312# | 1313  | 1326  | 1335  |       |       |       |       |       |       |       |       |
| T41   | 005424   | 1320  | 1334# | 1349  |       |       |       |       |       |       |       |       |       |       |
| T42   | 005534   | 1343  | 1356# | 1357  | 1368  |       |       |       |       |       |       |       |       |       |
| T43   | 005624   | 1362  | 1374# | 1375  | 1388  |       |       |       |       |       |       |       |       |       |
| T44   | 005726   | 1382  | 1399# | 1400  | 1417  |       |       |       |       |       |       |       |       |       |
| T5    | 001352   | 634   | 647#  | 663   |       |       |       |       |       |       |       |       |       |       |
| T6    | 001462   | 657   | 669#  | 670   | 678   |       |       |       |       |       |       |       |       |       |
| T7    | 001534   | 672   | 684#  | 685   | 695   |       |       |       |       |       |       |       |       |       |
| T8    | 001616   | 689   | 702#  | 703   | 714   | 736   | 746   |       |       |       |       |       |       |       |
| T9    | 001706   | 708   | 719#  | 727   |       |       |       |       |       |       |       |       |       |       |
| VADDR | 010636   | 1792* | 1797* | 1798* | 1799* | 1801* | 1803  | 1805* | 1806* | 1807* | 1808* | 1809* | 1810* | 1811* |
|       |          | 1812* | 1813* | 1865# |       |       |       |       |       |       |       |       |       |       |
| VADRS | 000512   | 536#  | 1805  |       |       |       |       |       |       |       |       |       |       |       |
| WAIT  | 007572   | 1698# |       |       |       |       |       |       |       |       |       |       |       |       |
| WAITX | 007610   | 738   | 817   | 835   | 847   | 945   | 1001  | 1048  | 1083  | 1118  | 1147  | 1182  | 1193  | 1257  |
|       |          | 1277  | 1298  | 1316  | 1339  | 1360  | 1379  | 1406  | 1409  | 1522  | 1566  | 1575  | 1705# |       |



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DDKWBA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

|       |          |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| WAOG  | 007630   | 523   | 1714* | 1807  |       |       |       |       |       |       |       |       |       |       |
| WRNG  | 007706   | 962   | 986   | 1013  | 1747* |       |       |       |       |       |       |       |       |       |
| WRONG | 011541   | 1747  | 2051* |       |       |       |       |       |       |       |       |       |       |       |
| XCINT | 000504   | 533*  | 686   | 753   | 848   | 861   | 958   | 984   | 1002  | 1018  | 1044  | 1065  | 1102  | 1105  |
|       |          | 1119  | 1197  | 1205  | 1220  | 1227  | 1403  | 1518  | 1551  | 1563  | 1604  | 1737  | 1784* |       |
| XCSR  | 000502   | 532*  | 583   | 597*  | 598   | 611*  | 612   | 629*  | 656*  | 671   | 688   | 705*  | 707   | 720   |
|       |          | 737*  | 739   | 754   | 767*  | 768   | 783*  | 784*  | 785   | 802   | 818   | 834*  | 836*  | 838   |
|       |          | 846*  | 849*  | 862*  | 866   | 878   | 890   | 907*  | 909   | 924*  | 926*  | 927   | 943*  | 946   |
|       |          | 959*  | 964*  | 989*  | 990*  | 991*  | 1003* | 1015* | 1016  | 1019  | 1021* | 1033* | 1045* | 1046* |
|       |          | 1047* | 1049  | 1064* | 1066* | 1067* | 1068  | 1084  | 1103* | 1104* | 1106* | 1107* | 1108  | 1117* |
|       |          | 1128* | 1129* | 1131  | 1146* | 1149  | 1168* | 1169* | 1171* | 1172* | 1173  | 1181* | 1190* | 1192* |
|       |          | 1194  | 1206* | 1215* | 1218  | 1228* | 1337* | 1401* | 1404* | 1407* | 1408* | 1410  | 1508* | 1509* |
|       |          | 1510  | 1519* | 1520  | 1544* | 1553  | 1555  | 1557  | 1559  | 1561  | 1564* | 1605* | 1734* | 1782* |
| XECSR | 000506   | 534*  | 1237  | 1239  | 1254  | 1258  | 1275  | 1279  | 1296  | 1299  | 1314  | 1319  | 1336  | 1342  |
|       |          | 1358  | 1361  | 1376  | 1381  | 1444  | 1446  | 1449  | 1461  | 1539  | 1567  | 1573  | 1576  | 1786* |
| XES   | 011114   | 1931* | 1932* | 1937* |       |       |       |       |       |       |       |       |       |       |
| XSWBU | 000510   | 535*  | 1276* | 1297* | 1315* | 1359* | 1405* | 1565* | 1788* |       |       |       |       |       |
| .     | = 017412 | 383*  | 384   | 386   | 388   | 390   | 392   | 394   | 396   | 398   | 400   | 402   | 404   | 406   |
|       |          | 408   | 410   | 412   | 414   | 416   | 418   | 420   | 422   | 424   | 426   | 428   | 430   | 432   |
|       |          | 434   | 436   | 438   | 440   | 442   | 444   | 446   | 448   | 450   | 452   | 454   | 456   | 458   |
|       |          | 460   | 462   | 464   | 466   | 468   | 470   | 472   | 474   | 476   | 478   | 480   | 482   | 484   |
|       |          | 486   | 488   | 490   | 492   | 494   | 496   | 498   | 500   | 502   | 504   | 506   | 508   | 510   |
|       |          | 513*  | 516*  | 522*  | 530*  | 542*  | 547*  | 549*  | 554*  | 558*  | 562*  | 787   | 910   | 1017  |
|       |          | 1020  | 1445  | 1447  | 1450  | 1462  | 1511  | 1521  | 1547  | 1560  | 1562  | 1583  | 1648  | 1669  |
|       |          | 1700  | 1707  | 1732  | 1822  | 1826  | 1830  | 1834  | 1848  | 1852  | 1856  | 1880  | 1894  | 1897  |
|       |          | 1900  | 1906  | 1909  | 1916  | 1923  | 1933  | 1935  | 2126* | 2127* | 2128* |       |       |       |



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DDKWBA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ADD  | 1258 | 1279 | 1299 | 1319 | 1342 | 1361 | 1381 | 1567 | 1576 | 1778 | 1783 | 1785 | 1787 | 1801 | 1808 |
| ASL  | 1810 | 1812 | 1917 |      |      |      |      |      |      |      |      |      |      |      |      |
| BEQ  | 1774 | 1775 | 1776 | 1797 | 1798 | 1799 |      |      |      |      |      |      |      |      |      |
|      | 584  | 613  | 672  | 689  | 721  | 769  | 819  | 891  | 910  | 928  | 947  | 1020 | 1150 | 1431 | 1492 |
|      | 1499 | 1501 | 1511 | 1558 | 1562 | 1583 | 1598 | 1616 | 1632 | 1634 | 1636 | 1659 | 1773 | 1781 | 1796 |
| BIC  | 1819 | 1845 | 1916 | 1923 |      |      |      |      |      |      |      |      |      |      |      |
| BIS  | 656  | 1777 | 1800 | 1806 |      |      |      |      |      |      |      |      |      |      |      |
| BIT  | 629  | 989  | 1021 |      |      |      |      |      |      |      |      |      |      |      |      |
|      | 583  | 598  | 612  | 671  | 688  | 720  | 739  | 768  | 818  | 890  | 909  | 927  | 946  | 1019 | 1049 |
|      | 1149 | 1194 | 1410 | 1430 | 1491 | 1493 | 1510 | 1557 | 1561 | 1597 | 1615 | 1617 | 1619 | 1621 | 1623 |
| BMI  | 1731 | 1818 | 1844 | 1915 | 1922 |      |      |      |      |      |      |      |      |      |      |
|      | 708  | 839  | 1085 | 1174 | 1240 | 1280 | 1300 | 1320 | 1343 | 1362 | 1382 | 1447 | 1554 | 1556 | 1568 |
|      | 1577 | 1684 |      |      |      |      |      |      |      |      |      |      |      |      |      |
| BNE  | 599  | 740  | 1050 | 1195 | 1411 | 1429 | 1494 | 1596 | 1618 | 1620 | 1622 | 1624 | 1661 | 1686 | 1688 |
|      | 1700 | 1707 | 1732 | 1804 | 1822 | 1826 | 1830 | 1834 | 1848 | 1852 | 1856 | 1880 | 1882 | 1933 | 1935 |
| BPL  | 755  | 787  | 803  | 867  | 879  | 1017 | 1069 | 1109 | 1132 | 1219 | 1238 | 1259 | 1445 | 1450 | 1462 |
|      | 1521 | 1560 | 1648 | 1669 | 1894 | 1897 | 1900 | 1906 | 1909 |      |      |      |      |      |      |
| BR   | 1496 | 1665 | 1690 | 1824 | 1828 | 1832 | 1836 | 1850 | 1854 | 1876 |      |      |      |      |      |
| CLR  | 611  | 1045 | 1626 | 1656 | 1769 | 1792 | 1895 | 1898 | 1931 |      |      |      |      |      |      |
| CMP  | 1498 | 1500 | 1631 | 1633 | 1635 | 1772 | 1795 | 1821 | 1825 | 1829 | 1833 | 1847 | 1851 | 1855 |      |
| CMPB | 1658 | 1660 |      |      |      |      |      |      |      |      |      |      |      |      |      |
| DEC  | 1428 | 1582 | 1595 | 1687 | 1699 | 1706 | 1879 | 1881 | 1934 |      |      |      |      |      |      |
| HALT | 543  | 1625 |      |      |      |      |      |      |      |      |      |      |      |      |      |
| INC  | 783  | 784  | 836  | 990  | 991  | 1047 | 1067 | 1103 | 1104 | 1106 | 1107 | 1128 | 1129 | 1168 | 1169 |
|      | 1171 | 1172 | 1276 | 1297 | 1315 | 1359 | 1405 | 1407 | 1408 | 1565 | 1685 | 1932 |      |      |      |
| JMP  | 552  | 556  | 560  | 567  | 590  | 605  | 619  | 634  | 641  | 657  | 663  | 678  | 695  | 714  | 727  |
|      | 746  | 761  | 775  | 789  | 795  | 809  | 825  | 845  | 851  | 873  | 885  | 897  | 911  | 917  | 935  |
|      | 953  | 975  | 1000 | 1004 | 1031 | 1034 | 1056 | 1075 | 1091 | 1115 | 1138 | 1156 | 1180 | 1203 | 1226 |
|      | 1241 | 1248 | 1265 | 1286 | 1306 | 1326 | 1349 | 1368 | 1388 | 1417 | 1437 | 1459 | 1471 | 1504 | 1514 |
|      | 1524 | 1547 | 1552 | 1572 | 1581 | 1585 | 1600 | 1606 | 1639 | 1640 | 1641 | 1642 | 1663 | 1738 | 1779 |
|      | 1802 | 1839 | 1861 |      |      |      |      |      |      |      |      |      |      |      |      |
| JSR  | 551  | 574  | 580  | 585  | 587  | 588  | 595  | 600  | 602  | 603  | 609  | 614  | 616  | 617  | 625  |
|      | 635  | 638  | 639  | 647  | 649  | 658  | 660  | 661  | 669  | 673  | 675  | 676  | 684  | 687  | 690  |
|      | 692  | 693  | 702  | 706  | 709  | 711  | 712  | 719  | 722  | 724  | 725  | 735  | 738  | 741  | 743  |
|      | 744  | 751  | 756  | 758  | 759  | 765  | 770  | 772  | 773  | 780  | 788  | 790  | 792  | 793  | 801  |
|      | 804  | 806  | 807  | 815  | 817  | 820  | 822  | 823  | 833  | 835  | 837  | 840  | 842  | 843  | 847  |
|      | 858  | 865  | 868  | 870  | 871  | 877  | 880  | 882  | 883  | 889  | 892  | 894  | 895  | 904  | 908  |
|      | 912  | 914  | 915  | 923  | 930  | 932  | 933  | 940  | 944  | 945  | 948  | 950  | 951  | 960  | 965  |
|      | 970  | 972  | 973  | 982  | 995  | 997  | 998  | 1001 | 1010 | 1026 | 1028 | 1029 | 1032 | 1041 | 1048 |
|      | 1051 | 1053 | 1054 | 1061 | 1063 | 1070 | 1072 | 1073 | 1082 | 1083 | 1086 | 1088 | 1089 | 1099 | 1110 |
|      | 1112 | 1113 | 1118 | 1126 | 1133 | 1135 | 1136 | 1144 | 1147 | 1151 | 1153 | 1154 | 1166 | 1175 | 1177 |
|      | 1178 | 1182 | 1188 | 1193 | 1196 | 1198 | 1200 | 1201 | 1204 | 1213 | 1217 | 1221 | 1223 | 1224 | 1233 |
|      | 1243 | 1245 | 1246 | 1253 | 1257 | 1260 | 1262 | 1263 | 1271 | 1277 | 1278 | 1281 | 1283 | 1284 | 1294 |
|      | 1298 | 1301 | 1303 | 1304 | 1312 | 1316 | 1318 | 1321 | 1323 | 1324 | 1334 | 1338 | 1339 | 1341 | 1344 |
|      | 1346 | 1347 | 1356 | 1360 | 1363 | 1365 | 1366 | 1374 | 1379 | 1380 | 1383 | 1385 | 1386 | 1399 | 1402 |
|      | 1406 | 1409 | 1412 | 1414 | 1415 | 1432 | 1434 | 1435 | 1452 | 1456 | 1457 | 1464 | 1468 | 1469 | 1486 |
|      | 1488 | 1489 | 1490 | 1503 | 1512 | 1513 | 1522 | 1523 | 1535 | 1538 | 1549 | 1550 | 1566 | 1571 | 1575 |
|      | 1580 | 1584 | 1589 | 1591 | 1592 | 1599 | 1602 | 1603 | 1628 | 1629 | 1630 | 1638 | 1662 | 1664 | 1735 |
|      | 1748 | 1757 | 1759 | 1768 | 1770 | 1771 | 1791 | 1793 | 1794 | 1815 | 1816 | 1817 | 1838 | 1841 | 1842 |
|      | 1843 | 1860 | 1886 |      |      |      |      |      |      |      |      |      |      |      |      |
| MOV  | 550  | 555  | 559  | 563  | 573  | 581  | 582  | 586  | 596  | 597  | 601  | 610  | 615  | 626  | 627  |
|      | 628  | 630  | 633  | 636  | 648  | 650  | 651  | 652  | 655  | 659  | 670  | 674  | 685  | 691  | 703  |
|      | 704  | 705  | 710  | 723  | 736  | 737  | 742  | 752  | 757  | 766  | 767  | 771  | 781  | 782  | 791  |
|      | 805  | 816  | 821  | 834  | 841  | 846  | 849  | 859  | 860  | 862  | 869  | 881  | 893  | 905  | 906  |
|      | 907  | 913  | 924  | 925  | 926  | 931  | 941  | 942  | 943  | 949  | 959  | 961  | 962  | 963  | 964  |
|      | 966  | 969  | 971  | 985  | 986  | 987  | 988  | 994  | 996  | 1003 | 1011 | 1012 | 1013 | 1014 | 1015 |

.MAIN. MACY11 27(732) 10-SEP-76 10:03 PAGE 55  
DDKWBA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

|        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|        | 1022 | 1025 | 1027 | 1033 | 1042 | 1043 | 1046 | 1052 | 1062 | 1064 | 1066 | 1071 | 1087 | 1100 | 1101 |
|        | 1111 | 1117 | 1127 | 1134 | 1145 | 1146 | 1152 | 1167 | 1176 | 1181 | 1189 | 1190 | 1192 | 1199 | 1206 |
|        | 1214 | 1215 | 1222 | 1228 | 1235 | 1236 | 1244 | 1254 | 1255 | 1261 | 1273 | 1274 | 1275 | 1282 | 1295 |
|        | 1296 | 1302 | 1313 | 1314 | 1317 | 1322 | 1335 | 1336 | 1337 | 1340 | 1345 | 1357 | 1358 | 1364 | 1375 |
|        | 1376 | 1377 | 1384 | 1400 | 1401 | 1404 | 1413 | 1426 | 1433 | 1436 | 1481 | 1485 | 1487 | 1495 | 1497 |
|        | 1502 | 1507 | 1508 | 1509 | 1517 | 1519 | 1534 | 1539 | 1540 | 1541 | 1542 | 1543 | 1544 | 1545 | 1548 |
|        | 1564 | 1570 | 1573 | 1579 | 1586 | 1588 | 1593 | 1601 | 1605 | 1627 | 1637 | 1646 | 1653 | 1654 | 1655 |
|        | 1681 | 1691 | 1698 | 1705 | 1714 | 1715 | 1719 | 1720 | 1734 | 1747 | 1750 | 1758 | 1767 | 1782 | 1784 |
|        | 1786 | 1788 | 1790 | 1805 | 1807 | 1809 | 1811 | 1813 | 1814 | 1820 | 1823 | 1827 | 1831 | 1835 | 1837 |
|        | 1840 | 1846 | 1849 | 1853 | 1857 | 1859 | 1867 | 1868 | 1877 | 1878 | 1885 | 1904 | 1907 | 1921 | 1924 |
|        | 1925 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MOV8   | 1657 | 1667 | 1689 |      |      |      |      |      |      |      |      |      |      |      |      |
| NOP    | 631  | 632  | 653  | 654  | 967  | 968  | 992  | 993  | 1023 | 1024 | 1242 | 1453 | 1454 | 1455 | 1465 |
| RESET  | 1466 | 1467 | 1546 | 1760 | 1789 | 1892 |      |      |      |      |      |      |      |      |      |
|        | 565  | 850  | 983  | 1130 | 1148 | 1170 | 1191 | 1216 | 1234 | 1256 | 1272 | 1378 | 1425 | 1427 | 1483 |
|        | 1537 | 1574 | 1594 | 1736 |      |      |      |      |      |      |      |      |      |      |      |
| RTI    | 1752 | 1761 | 1901 |      |      |      |      |      |      |      |      |      |      |      |      |
| RTS    | 544  | 1448 | 1451 | 1460 | 1463 | 1649 | 1670 | 1672 | 1692 | 1701 | 1708 | 1733 | 1858 | 1883 | 1887 |
|        | 1910 | 1918 | 1926 | 1936 |      |      |      |      |      |      |      |      |      |      |      |
| TST    | 686  | 753  | 785  | 848  | 861  | 866  | 958  | 984  | 1002 | 1018 | 1044 | 1065 | 1102 | 1105 | 1108 |
|        | 1119 | 1131 | 1173 | 1197 | 1205 | 1220 | 1227 | 1237 | 1403 | 1444 | 1518 | 1551 | 1553 | 1563 | 1604 |
|        | 1737 | 1749 | 1751 | 1780 | 1803 |      |      |      |      |      |      |      |      |      |      |
| TSTB   | 707  | 754  | 802  | 838  | 878  | 1016 | 1068 | 1084 | 1218 | 1239 | 1446 | 1449 | 1461 | 1520 | 1555 |
|        | 1559 | 1647 | 1668 | 1683 | 1875 | 1893 | 1896 | 1899 | 1905 | 1908 |      |      |      |      |      |
| .ASCII | 1940 | 1943 | 1945 | 1947 | 1949 | 1951 | 1953 | 1955 | 1957 | 1959 | 1961 | 1963 | 1965 | 1967 | 1969 |
|        | 1971 | 1973 | 1975 | 1977 | 1979 | 1981 | 1983 | 1985 | 1987 | 1989 | 1991 | 1993 | 1995 | 1997 | 1999 |
|        | 2001 | 2003 | 2005 | 2007 | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | 2021 | 2023 | 2025 | 2027 | 2029 |
|        | 2031 | 2034 | 2037 | 2040 | 2043 | 2048 | 2051 | 2058 | 2064 | 2073 | 2075 | 2084 | 2088 | 2093 | 2098 |
|        | 2103 | 2108 | 2113 | 2117 |      |      |      |      |      |      |      |      |      |      |      |
| .BLKW  | 2128 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .BYTE  | 1939 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .ENABL | 4    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .END   | 2129 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .EVEN  | 2126 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .LIST  | 4    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .NLIST | 4    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .REM   | 5    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .REPT  | 384  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| .WORD  | 1438 | 1675 | 1682 |      |      |      |      |      |      |      |      |      |      |      |      |

ERRORS DETECTED: 0  
DEFAULT GLOBALS GENERATED: 0

\*DDKWBA,DDKWBA,SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DDKWBA.P11  
RUN-TIME: 5 9 3 SECONDS  
RUN-TIME RATIO: 30/18=1.6  
CORE USED: BK (15 PAGES)



**Smaller runtime: 5 Seconds, 24 MCS, 176 disk reads, 2 disk writes, 52 pages**

00000000111111111122222222223333333333444444444455555555556666666666777777777788888888889999999999000000000011111111112222222222333312