KW11-F

REAL TIME CLOCK TEST

MD-11-DZKWB-G

EP DZKWB G DL A

FICHE 1 OF 1

OCT 1976

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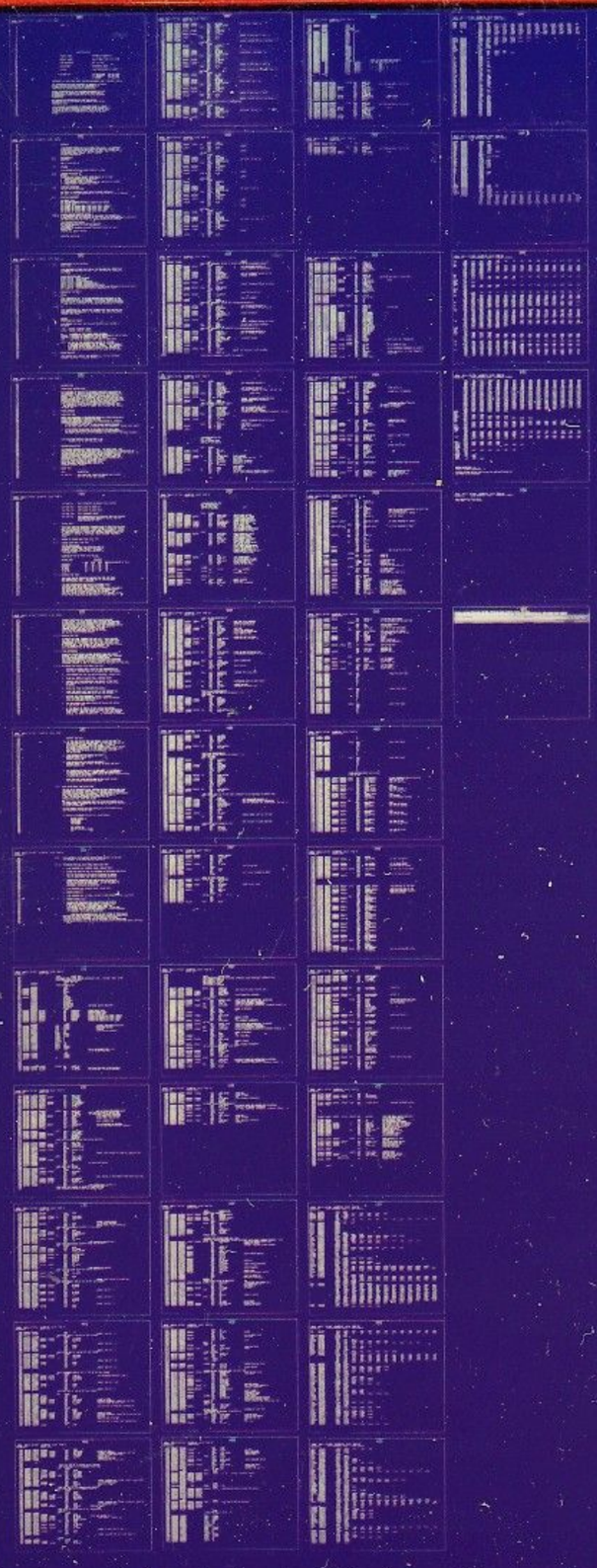

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IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DZKWB-G-D	
PRODUCT NAME:	KW11-P REAL TIME CLOCK TEST	
DATE RELEASED:	DEC. 21,1975	
MAINTAINER:	DIAGNOSTIC GROUP	
AUTHOR:	JOHN RODENHISER/JIM LACEY	
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                                1.0     ABSTRACT

                                        THIS PROGRAM TESTS THE KW11-P REAL TIME CLOCK.  IT CONTAINS
                                        A SERIES OF INCREMENTAL ROUTINES THAT TEST THE CONTROL AND
                                        STATUS REGISTER, COUNT SET BUFFER, COUNTER, AND INTERRUPT VEC-
                                        TOR ADDRESS USING 100KHZ, 10KHZ, LINE AND
                                        EXTERNAL FREQUENCIES.

                                2.0     REQUIREMENTS
                                2.1     EQUIPMENT

                                        PDP-11 WITH KW11-P

                                2.2     STORAGE

                                        THIS PROGRAM OCCUPIES MEMORY FROM 0 TO 11626.

                                3.0     LOADING PROCEDURE
                                3.1     METHOD
                                PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED
                                1.  ABSOLUTE LOADER MUST BE IN MEMORY.
                                2.  PLACE BINARY TAPE IN READER.
                                3.  LOAD ADDRESS #7500 (# DETERMINED BY LOCATION OF LOADER).
                                4.  PRESS "START" (PROGRAM WILL LOAD).

                                4.0     STARTING PROCEDURE
                                4.1     CONTROL SWITCH SETTINGS

                                        SET SW0=1 TO SUPPRESS TESTS USING EXTERNAL FREQUENCY.
                                        SET SW2=1 TO INCLUDE REPEATABILITY TEST T25 & T26 IF COW IS PRESENT

                                4.2     STARTING ADDRESSES

                                        200 BASIC TEST
                                        204 RESTART ADDRESS-PRIMARILY USED BY XOR TESTER
                                        210 TIMING TEST
                                        214 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 100KHZ.
                                        220 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 10KHZ.
                                        224 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 60HZ.
                                        230 DOUBLE OR SINGLE REAL TIME CLOCK TEST 50HZ

                                4.3     PROGRAM AND/OR OPERATOR ACTION
                                **NOTE: IF NO HARDWARE SWITCH REGISTER IS AVAILABLE THE PROGRAM WILL
                                        AUTOMATICALLY USE THE CONTENTS OF LOC. 176 AS THE SOFTWARE SWITCH REGISTER.
                                        THE USER SHOULD SET UP THIS LOC. BEFORE STARTING THE PROGRAM.

                                        LOAD PROGRAM INTO MEMORY
                                        SET SWITCH REGISTER TO STARTING ADDRESS
                                        LOAD ADDRESS.
                                        IF DESIRED TO SUPPRESS EXTERNAL FREQUENCY TESTS SET SW0=1.
                                        PRESS START
                                        PROGRAM WILL BEGIN TESTING


                                5.      OPERATING PROCEDURE
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                        5.1     OPERATIONAL SWITCH SETTINGS
                        5.1.1   BASIC TEST

                                WITH SWITCHES 12 THRU 15=0 (DOWN) THE PROGRAM WILL PRINT OUT
                                ON ERRORS AND CONTINUE IN TEST.  BELL WILL RING AT COMPLETION
                                OF A PASS.

                                SWITCH SETTINGS ARE:
                                SW15=1 OR UP...HALT ON ERROR
                                SW14=1 OR UP...SCOPE LOOP
                                SW13=1 OR UP...INHIBIT PRINTOUT
                                SW11=1 OR UP...SINGLE ITERATIONS ONLY
                                SW4 =1 OR UP...ENABLE SYNCHRONIZATION TESTS
                                SW3 =1 OR UP...ADJUSTS DELAYS FOR 11/70 OR 11/45 WITH MOS OR BIPOLAR MEMORY
                                SW2 =1 OR UP...CLK2 PRESENT-EXECUTE REPEATABILITY TESTS

                        5.2     SUBROUTINE ABSTRACTS

                        5.2.1   SCOPE

                                THIS SUBROUTINE CALL IS PLACED BETWEEN EACH SUB-TEST IN THE
                                BASIC TEST SECTION.  IT RECORDS THE STARTING ADDRESS OF EACH
                                SUB-TEST AS IT IS BEING ENTERED.  IF A SCOPE LOOP IS REQUESTED,
                                IT WILL JUMP TO THE START OF THE SUB-TEST INDICATED BY "SCOPE".

                        5.2.2   HLT

                                THIS SUBROUTINE CALL PRINTS THE ADDRESS THAT TAGS THE FAILING
                                SUB-TEST AND THE CONTENTS OF THE CONTROL AND STATUS REGISTER,
                                COUNTER, AND "TEMP".


                        6.      ERRORS
                        6.1     ERROR PRINTOUT FORMAT

                                WITH SW13=0 (OR DOWN) THE FOLLOWIG PRINTOUT WILL APPEAR ON
                                AN ERROR:

                                  PC     STATUS  COUNTER  TEMP
                                XXXXXX  XXXXXX  XXXXXX  XXXXXX

                                PC      = ADDRESS OF TEST WHERE ERROR OCCURRED
                                STATUS  = CONTENTS OF COMMAND AND STATUS REGISTER AT TIME OF ERROR
                                COUNTER = CONTENTS OF COUNTER AT TIME OF ERROR
                                TEMP    = CONTENTS OF ADDRESS "TEMP" USED BY SOME TESTS.

                                NOTE:  NOT ALL OF THE INFORMATION PRINTED IS INTENDED
                                       TO BE USEFUL FOR EVERY TYPE OF ERROR.  THIS IS SIMPLY
                                       A STANDARD ERROR REPORT FOR ALL ERRORS.  THE OPERATOR
                                       MUST REFER TO THE PROGRAM LISTING AT THE ADDRESS OR
                                       THE ERROR FOR A DESCRIPTION OF THE CAUSE OF THE ERROR.

                        6.2     ERROR RECOVERY

                                WITH SWITCH 15=1 (OR UP) THE PROGRAM WILL HALT ON AN ERROR.
                                DEPRESS "CONTINUE" TO RESUME TESTING.
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                        7.      RESTRICTIONS

                        7.1     OPERATIONAL RESTRICTIONS

                                FOR PURPOSES OF TESTING THE EXTERNAL FREQUENCY SELECTION IT
                                IS NECESSARY TO SUPPLY A KNOWN FREQUENCY TO THE EXTERNAL FRE-
                                QUENCY INPUT. THIS PROGRAM USES THE INTERNAL 60HZ FOR ITS
                                SOURCE.  TO DO THIS IT IS REQUIRED THAT A JUMPER WIRE BE CON-
                                NECTED BETWEEN PINS CF1 AND DA1 OF THE SLOT IN WHICH THE CLOCK
                                MODULE IS INSERTED.  IF THIS IS NOT DONE, THEN THE PROGRAM MUST
                                ALWAYS BE RUN WITH SW0=1 TO SUPPRESS THE EXTERNAL TESTS.
                                * IF A SECOND P CLOCK IS BEING USED FOR TEST PURPOSES, SET
                                  THE SWITCH REG = 000004 TO ENABLE TESTS T25 AND T26, DURING
                                THE BASE TEST

                        8.      MISCELLANEOUS

                        8.1     EXECUTION TIME

                                BASIC TEST REQUIRES 11 SECONDS PER PASS W/O ITERATIONS 66 WITH.
                                TIMING TEST REQUIRES 4 MINUTES PER PASS.
                                DOUBLE OR SINGLE REAL TIME CLOCK TEST-DETERMINED BY OPERATOR
                                SUGGESTED EXECUTION TIMES ARE:
                                1.  IF THE SINGLE CLOCK TEST IS RUN WITHOUT BEING FOLLOWED
                                    BY THE DUAL CLOCK TEST: 17 MINUTES FOR EACH FREQUENCY (100KHZ,10KHZ,60KHZ)

                                2.  IF THE SINGLE CLOCK TEST IS FOLLOWED BY THE DUAL TEST
                                    RUN SINGLE CLOCK TEST FOR ONE MINUTE (FOR EACH FREQUENCY)
                                    RUN DUAL CLOCK TEST FOR FIFTY SECONDS (10 PRINTOUTS) (FOR EACH FREQUENCY)


                                NOTE:THIS TIME NOMINAL TIME FOR PDP-11/05
                                       OTHER C.P.U.'S THE TIME WILL VARY


                        9.      PROGRAM DESCRIPTION

                                THE PROGRAM CONSISTS OF THREE SECTIONS:  THE BASIC TEST  THE
                                TIMING TEST AND THE REAL TIME CLOCK TEST.  THE BASIC TEST CHECKS EACH OF
                                THE INDIVIDUAL BITS IN THE CONTROL AND STATUS REGISTER, COUNT SET BUFFER, AND
                                COUNTER ALONG WITH PROPER OPERATION UNDER INTERRUPT CONTROL
                                (SINGLE OR REPEATED INTERRUPTS) COUNT UP OR COUNT DOWN, AND
                                REPEATABILITY.  THE TIMING TEST USES ALL CLOCK FREQUENCIES TO
                                RING THE TELETYPE BELL AT 10 SECOND INTERVALS.
                                THE CLOCK TEST PROVIDES A REAL TIME CLOCK
                                WHOSE ACCURARCY CAN BE MEASURED AGAINST AN
                                ACCURATE EXTERNAL SOURCE.

                        9.1     BASIC TEST

                                TEST            DESCRIPTION

                                T0 THRU T9      TEST THAT CSR, COUNT SET BUFFER AND COUNTER
                                                BITS MAY BE SET AND CLEARED.
```

T10 THRU T11	TEST FIX(BIT5) TO SINGLE CLOCK COUNTER.
T12 THRU T15	TEST CLOCK TO COUNT UP.
T16 THRU T19	TEST CLOCK TO COUNT DOWN.
T20 THRU T24	TEST INTERRUPT MODES.
T25 THRU T26	TEST REPEATABILITY BY CHECKING THAT THE COUNTER CONTAINS THE SAME NUMBER OF COUNTS OVER TWO EQUAL PERIODS OF TIME.

9.2 TIMING TEST

THIS TEST USES THE REPEATED INTERRUPT MODE TO RING THE TELETYPE BELL AT 10 SECOND INTERVALS. FIRST THE BELL IS RUNG AT 10 SECOND INTERVALS FOR 1 MINUTE USING 100HKZ, FOLLOWED BY 1 MINUTE AT 10KHZ FOLLOWED BY 1 MINUTE AT LINE FREQ.(60HZ OR 50HZ) AND (IF SW0=0) 1 MINUTE AT LINE FREQ. USING EXTERNAL FREQUENCY INPUT.

9.3 DOUBLE OR SINGLE REAL TIME CLOCK TEST

9.3.1 SINGLE CLOCK REAL TIME TEST

THE 24 HOUR CYCLE:
THIS TEST TRANSFORMS YOUR COMPUTER INTO AN ACCURATE DIGITAL "WALL CLOCK." A NORMAL CLOCK'S 12 HOUR CYCLE HAS BEEN REPLACED BY A 24 HOUR CYCLE.

EXAMPLES OF THE 24 HOUR CYCLE FOLLOW:

ACTUAL TIME	PRINTOUT			
	HRS	MINS	SECS	TENTHS+HUNDRETHS OF SECS.
MIDNIGHT	00	00	00	00
8:32 AM	08	32	00	00
12 NOON	12	00	00	00
2:15 PM	14	15	00	00
11:30 PM	23	30	00	00

9.3.1.1 ENTERING THE TIME

THE CLOCK CAN BE UPDATED BY HOLDING THE CTRL KEY DOWN AND TAPPING THE I KEY. THE CTRL KEY IS THEN RELEASED, AND THE STARTING TIME IS ENTERED.

THE MOST SIGNIFICANT HOUR DIGIT IS ENTERED FIRST. THIS DIGIT MUST BE A ZERO, A ONE OR A TWO. THE LEAST SIGNIFICANT HOURS DIGIT IS ENTERED NEXT FOLLOWED BY THE TWO MINUTES DIGIT, FOLLOWED BY THE TWO SECONDS DIGIT. THE FRACTION OF A SECOND DIGITS ARE NOT ENTERED. THE USER WILL ENTER A TOTAL OF SIX DIGITS WITH NO SPACES, COLONS, OR ANY OTHER CHARACTERS BETWEEN DIGITS. THE USER MUST

ENTER A TIME THAT WILL OCCUR A HALF MINUTE OR MORE
IN THE FUTURE, TO ALLOW ENOUGH TIME TO ENTER THE REQUIRED
INFORMATION. AFTER THE INFORMATION HAS BEEN ENTERED, THE
USER MONITORS THE TIME STANDARD. WHEN THAT STANDARD REACHES
THE TIME ENTERED VIA THE KEYBOARD, THE USER HITS THE
CARRAGE RETURN (CR) KEY TO START THE CLOCK.
NOTE THAT THE CHARACTERS WILL NOT BE PRINTED
OUT AS THE TIME IS BEING ENTERED.

9:3.1.2 READING THE TIME

TO PRINT THE TIME, DEPRESS THE CTRL KEY. WHILE HOLDING
THE CTRL KEY DOWN, SMARTLY TAP THE T KEY. THE TIME WHICH
CORRESPONDS TO THE INSTANT THAT THE T KEY WAS DOWN, WILL
BE PRINTED OUT. THE FORMAT OF THE PRINTOUT WILL BE SIMULAR
TO THAT SHOWN IN THE 24 HOUR TIME EXAMPLE. THE
ONLY DIFFERENCE WILL BE THE ABSENCE OF SPACES.

9.3.1.3 TIME REFERENCES

SINCE THE SYSTEM CLOCK IS MORE ACCURATE THAN MANY WRIST
WATCHES, IT IS A GOOD IDEA TO USE AN ACCURATE TIME STANDARD.
MANY TELEPHONE COMPANIES PROVIDE A NUMBER WHERE
THE TIME, SYNCHRONIZED TO THE NATIONAL BUREAU OF STANDARDS
RADIO STATION (WWV), IS AVAILABLE. CONSULT WITH YOUR LOCAL
TELEPHONE COMPANY TO SEE IF THIS SERVICE IS AVAILABLE IN YOUR AREA.

9.3.1.4 PROCEDURE FOR SINGLE CLOCK REAL TIME TEST.

1. PERFORM THE BASIC TEST, PRIOR TO THE PERFORMANCE OF
   THIS TEST. PROCEED ONLY IF THE BASIC TEST HAS PASSED.

2. LOAD ADDRESS 214 VIA THE SWITCH REGISTER, (100KHZ TEST)

3. PLACE ALL ZEROS IN SWITCH REG., DEPRESS START

4. EXAMINE YOUR TIME REFERENCE, AND SELECT A TIME THAT
   WILL ALLOW YOU ENOUGH TIME TO ENTER THE TIME VIA THE
   KEYBOARD.

5. ENTER THE TIME, AS DESCRIBED PREVIOUSLY.

6. START THE CLOCK (HIT THE CR KEY) AT THE INSTANT THE
   TIME REFERENCE CORRELATES WITH THE TIME ENTERED.

7. MONITOR YOUR TIME REFERENCE, EXACTLY 1 MINUTE
   FROM THE TIME YOU STARTED THE CLOCK, READ THE PROGRAM
   CLOCK AS DESCRIBED PREVIOUSLY.

8. THE ONE MINUTE TIME ERROR SHOULD BE WITHIN ONE SECOND
   OF THE ACTUAL TIME.

9. IF THE RESULT OF STEP 8 IS NOT WITHIN ONE SECOND,
   ALLOW EXACTLY ONE MORE MINUTE TO PASS (FROM THE ORIGINAL
   START TIME). READ THE TIME AGAIN. IF THE TOTAL ERROR
   DOUBLED, THE BOARD IS DEFECTIVE. IF THE ERROR IS CONSTANT,

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                        RESTART THE TEST.

                    10.* IF THE ONE MINUTE TEST WAS PASSED, ALLOW THE TEST TO
                        RUN FOR EXACTLY 16 MINUTES MORE.  AT THE EXACT END OF THE
                        16TH MINUTE INTERVAL, READ THE CLOCK.  IT SHOULD
                        BE WITHIN THREE SECONDS OF THE CORRECT TIME.  IF IT IS NOT,
                        THE BOARD IS DEFECTIVE. IN THE EVENT THAT THE DUAL CLOCK
                        REAL TIME TEST IS GOING TO BE PERFORMED, THIS STEP
                        CAN BE OMITTED.

                    11. LOAD ADDRESS 220 VIA SWITCH REGISTER,
                        DEPRESS START (10KHZ TEST)
                        REPEAT STEPS 3-10

                    12. LOAD ADDRESS 224 VIA SWITCH REGISTER,
                        DEPRESS START (224 IF 60HZ, OR 230 IF 50HZ LINE TEST)
                        REPEAT STEPS 3-10


                     *  THE DURATION OF THIS TEST IS ARBITRARY, IT IS NOMINALLY
                        A THOUSAND SECOND TEST.  LONGER TESTS ARE PERMISSIBLE.
                        THE RESULTS OF LONG TERM TESTS SHOULD BE WITHIN (PLUS OR MINUS)
                        1 MINUTE FOR A 24 HR TEST.

                        NOTE THAT THE TIME CAN BE READ AT ANY POINT WITHIN
                        THE TEST WITHOUT AFFECTING THE TEST.


            9.3.2   DUAL CLOCK REAL TIME CLOCK TEST

                        THE USE OF A TEMPORARY CLOCK (REFERED AS COW) REDUCES THE TIME
                        REQUIRED FOR THE REAL TIME TEST.  THE SECOND CLOCK INTERRUPTS
                        THE FIRST CLOCK EVERY FIVE SECONDS.  THE DURATION OF THE COMBINED
                        REAL TIMES TESTS, WHEN THE DUAL CLOCK TEST IS USED IS
                        1 MIN : 50 SEC/FREQ VERSUS 17 MIN/FREQ FOR THE
                        SINGLE CLOCK REAL TIME TEST ALONE.

                        THE DUAL CLOCK TEST REQUIRES THAT THE CLOCK BE STARTED AS IN
                        THE SINGLE MODE.  RAISING SWITCHES #0 AND #2 CAUSE THE PRINTOUT
                        TO OCCUR AUTOMATICALLY.

                        THE COW MODULE SHOULD ONLY BE INSTALLED IN THE SYSTEM WHILE
                        THIS DIAGNOSTIC IS BEING USED.


                        TO CONVERT A STANDARD P CLOCK TO A "COW" MODULE:

                        1.      REMOVE JUMPER A4
                                CSR=772560
                                CSB=772562
                                CTR=772564

                        2.      ADD JUMPER V8
                                VECTOR LOCATION IS 504
                                PSW             "       " 506
```

NOTE: THIS VECTOR IS IN FLOATING VECTOR SPACE,CAUTION IS ADVICED
WITH RESPECT TO ALLOWING VECTOR CONFLICTS.

9.3.2.1 PROCEDURE FOR DUAL CLOCK REAL TIME CLOCK TEST

1. LOAD ADDRESS 214, DEPRESS START (100KHZ TEST)

2. ENTER THE TIME VIA THE TTY KEYBOARD AS DESCRIBED PREVIOUSLY

3. SET THE SWITCHES IN THE SWITCH REGISTER TO 000005,
THE TTY WILL PRINT THE TIME AT 5 SECOND INTERVALS

4. CONSECUTIVE PRINTOUTS WILL BE WITHIN 5.00 PLUS OR
MINUS .01 SECONDS OF EACH OTHER. ALLOW THE TEST TO
RUN FOR AT LEAST TEN PRINTOUTS. IF THE TOLERANCE IS
EXCEEDED, THE CLOCK IS DEFECTIVE.

5. LOAD ADDRESS 220, DEPRESS START (10KHZ TEST)

6. REPEAT STEPS 2-4

7. LOAD ADDRESS 224, IF 60HZ, OR 230 IF 50HZ DEPRESS START (LINE TEST)

8. REPEAT STEPS 2 & 3

9. CONSECUTIVE PRINTOUTS WILL BE WITHIN 5.00 PLUS OR
MINUS .04 SECONDS OF EACH OTHER. TYPICALLY, AND
5.00 PLUS OR MINUS .2 SECONDS WORST CASE, DUE
TO POSSIBLE AC LINE FREQUENCY VARIATIONS. ALLOW THE
TEST TO RUN FOR AT LEAST TEN PRINTOUTS. IF THE TOLERANCE
IS EXCEEDED, THE CLOCK IS DEFECTIVE.

10. THIS KW11-P DIAGNOSTIC WILL GO OUT & FIND IF THIS SHOULD
RUN WITH CPU THAT HAS A SWITCH REG. OR WILL RUN WITH A PDP-11/04
THAT HAS NO SWITCH REGISTER. IF CPU HAS NO SWITCH REG.
LOCATION 176 EQUALS SOFTWARE SWITCH REGISTER. IN THE ABOVE TEST
TYPING ↑G(CONTROL-G) WILL ALLOW YOU TO ENTER/ALTER THE SOFTWARE SWITCH SETTINGS
. . .ENDR

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                                .SBTTL          BASIC TEST
                                ;COPYRIGHT 1971, 1972 DIGITAL EQUIPMENT CORP., MAYNARD, MASS. 01754
                                ;JOHN RODENHISER/JIM LACEY
                                        .ENABL AMA,ABS
            000000                      .=0
                                ;TRAP CATCHER 0-200
            000030                      .=30
 000030     005630                      PRINT
 000032     000340                      340
 000034     006130                      SCOPEC
 000036     000340                      340
            000046                      .=46
 000046     005154                      LOGICAL
            104000                      HLT=EMT
            177776                      CC=177776
            000240                      NOP=240
            104400                      SCOPE=TRAP
            000176                      SOFTSR=176              ;SOFTWARE SWITCH REGISTER
            000776                      BUFF=776
            000200                      .=200
 000200     000137  001046              JMP     @#BEGIN2        ;START BASIC TEST
 000204     000137  001130              JMP     @#BEGIN         ;RESTART BASIC TEST
 000210     000137  005170              JMP     @#BEGIN1        ;START TIMING TEST
 000214     000137  006640              JMP     @#K100HZ        ;DOUBLE OR SINGAL CLK TEST. 100KHZ.
 000220     000137  006724              JMP     @#K10HZ         ;DOUBLE OR SINGLE CLK TEST. 10KHZ.
 000224     000137  007010              JMP     @#H60Z          ;DOUBLE OR SINGLE CLK TEST. 60HZ.
 000230     000137  007074              JMP     @#H50Z          ;DOUBLE OR SINGLE CLK TEST. 50HZ

            001000                      .=1000
 001000     172540          CSR:        172540                  ;CONTROL AND STATUS REGISTER
 001002     172542          CSB:        172542                  ;COUNT SET BUFFER
 001004     172544          CTR:        172544                  ;COUNTER
 001006     000104          CKV:        104                     ;CLOCK VECTOR ADDRESS
 001010     000106          CKVS:       106
 001012     177566          TDBR:       177566
 001014     177564          TCSR:       177564
 001016     000000          TEMP1:      0
 001020     000000          TEMP:       0
 001022     000001          ICOUNT:     1
 001024     177740          DEL1:       -40
 001026     177730          DEL2:       -50
 001030     160000          DEL3:       -20000
 001032     160000          DEL4:       -20000
 001034     177700          ADJ:        -100                    ;DELAY ADJUSTMENT FOR 11/70
                                                                ; & 11/45 WITH MOS MEM.
 001036     177660                      -120                    ;
 001040     140000                      -40000                  ;
 001042     140000                      -40000                  ;
 001044     177570          SR:         177570

 001046     012706  000776  BEGIN2:     MOV     #BUFF,%6
 001052     004737  011566              JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
 001056     004737  011524              JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
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  486  001062  013746  000004                 MOV     @#4,-(%6)
  487  001066  012737  001210  000004         MOV     #XOR,@#4
  488  001074  005737  177060                 TST     @#177060
  489  001100  012637  000004                 MOV     (%6)+,@#4
  490  001104  012737  177777  006232         MOV     #-1,@#XORFLG
  491  001112  012737  000001  001022         MOV     #1,@#ICOUNT
  492  001120  012702  006464                 MOV     #XORM,%2
  493  001124  004737  006246                 JSR     %7,TOP
  494
  495  001130  012706  000776         BEGIN:  MOV     #BUFF,%6        ;SET UP STACK FOR SCOPE LOOPS
  496  001134  004737  011566                 JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
  497  001140  004737  011524                 JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
  498  001144  012737  005552  000024         MOV     #PWRF1,24       ;INIT POWER FAIL POINTER
  499  001152  005077  005406                 CLR     @PSW            ;CLEAR PROC. STATUS REG.
  500  001156  005037  001020                 CLR     TEMP
  501  001162  005037  006230                 CLR     SCOPEF          ;INIT. SCOPEF TAG
  502  001166  005037  001016                 CLR     TEMP1
  503  001172  012737  001234  006244         MOV     #T0,RETURN      ;SET UP RESTART OF PROGRAM
  504  001200  005037  005744                 CLR     PRINT1          ;INITIALIZE ERROR PRINTOUT READING
  505  001204  000137  001234                 JMP     T0
  506
  507  001210  022626                 XOR:    CMP     (%6)+,(%6)+
  508  001212  012637  000004                 MOV     (%6)+,@#4
  509  001216  012737  000005  001022         MOV     #5,@#ICOUNT
  510  001224  005037  006232                 CLR     @#XORFLG
  511  001230  000137  001130                 JMP     @#BEGIN
  512                                 ;TEST INIT TO CLEAR CONTROL AND STATUS REGISTER
  513
  514  001234  013746  000004         T0:     MOV     @#4,-(%6)
  515  001240  012737  001272  000004         MOV     #CSRT,@#4
  516  001246  012777  100377  177524         MOV     #100377,@CSR
  517  001254  000005                         RESET
  518  001256  032777  100377  177514         BIT     #100377,@CSR
  519  001264  001413                         BEQ     T1
  520  001266  104000                         HLT                     ;ERROR, INIT FAILED TO CLEAR ALL BITS OF CSR.
  521  001270  000411                         BR      T1
  522  001272  022626                 CSRT:   CMP     (%6)+,(%6)+
  523  001274  012637  000004                 MOV     (%6)+,@#4
  524  001300  032777  040000  177536         BIT     #40000,@SR
  525  001306  001352                         BNE     T0
  526  001310  000000                         HALT                    ;NO SSYN FROM DEVICE
  527  001312  000750                         BR      T0
  528                                 ;TEST COUNT SET BUFFER
  529  001314  012637  000004         T1:     MOV     (%6)+,@#4
  530  001320  104400                         SCOPE
  531  001322  012777  177777  177452         MOV     #-1,@CSB
  532  001330  005777  177446                 TST     @CSB
  533  001334  001401                         BEQ     .+4
  534  001336  104000                         HLT                     ;ERR, FAILED TO GIVE ZERO'S FROM WRITE ONLY REG.
  535  001340  012737  177777  001020         MOV     #-1,@#TEMP
  536  001346  012777  000000  177430         MOV     #0,@CTR
  537  001354  023777  001020  177422         CMP     @#TEMP,@CTR
  538  001362  001401                         BEQ     .+4
  539  001364  104000                         HLT                     ;CTR CHANGED WHEN WRITTEN TO
  540                                 ;TEST COUNT SET BUFFER TO ACCEPT A COUNT PATTERN
  541                                 ;TEST COUNTER TO CONTAIN COUNT SET BUFFER VALUE
```

```
                                        CLR     TEMP
                                        SCOPE
001374  013777  001020  177400  T3:     MOV     TEMP,@CSB
001402  023777  001020  177374          CMP     TEMP,@CTR
001410  001401                          BEQ     .+4
001412  104000                          HLT                             ;ERROR, CTR NOT=TEMP
001414  005237  001020                  INC     TEMP                    ;+1 TO COUNT PATTERN
001420  001365                          BNE     T3                      ;REPEAT UNTIL COUNT OVERFLOWS
                                ;TEST THAT CTR REMAINS CONSTANT IF RUN CLEAR
001422  104400                  T3A:    SCOPE
001424  005077  177350                  CLR     @CSR
001430  012777  177777  177344          MOV     #-1,@CSB
001436  013737  001030  001020          MOV     @#DEL3,@#TEMP
001444  005237  001020          1$:     INC     @#TEMP
001450  001375                          BNE     1$
001452  022777  177777  177324          CMP     #-1,@CTR
001460  001401                          BEQ     .+4
001462  104000                          HLT                             ;CTR CHANGED ALTHOUGH RUN 0
                                ;TEST THAT CTR REMAINS CONSTANT WHEN CSR IS REF'D
001464  104400                  T3B:    SCOPE
001466  005077  177306                  CLR     @CSR
001472  012777  177777  177302          MOV     #-1,@CSB
001500  013737  001030  001020          MOV     @#DEL3,@#TEMP

001506  012777  177736  177264  1$:     MOV     #177736,@CSR
001514  017700  177260                  MOV     @CSR,%0
001520  012777  000000  177252          MOV     #0,@CSR
001526  017700  177246                  MOV     @CSR,%0
001532  005237  001020                  INC     @#TEMP
001536  001363                          BNE     1$
001540  022777  177777  177236          CMP     #-1,@CTR
001546  001401                          BEQ     .+4
001550  104000                          HLT                             ;CTR CHANGED BY CSR REF
                                ;TEST INIT TO CLEAR COUNT SET BUFFER WHEN IT IS =-1
001552  104400                  T4:     SCOPE
001554  012777  177777  177220          MOV     #-1,@CSB
001562  000005                          RESET
001564  005777  177214                  TST     @CTR
001570  001401                          BEQ     .+4
001572  104000                          HLT                             ;ERROR, INIT FAILED TO CLEAR CSB
                                ;TEST RATE SELECT (BIT,2) MAY BE SET AND CLEARED
001574  104400                  T5:     SCOPE
001576  012777  000002  177174          MOV     #2,@CSR
001604  022777  000002  177166          CMP     #2,@CSR
001612  001401                          BEQ     .+4
001614  104000                          HLT                             ;ERROR, CSR NOT = 2
001616  012777  000004  177154          MOV     #4,@CSR
001624  022777  000004  177146          CMP     #4,@CSR
001632  001401                          BEQ     .+4
001634  104000                          HLT                             ;ERROR, CSR NOT = 4
001636  012777  000006  177134          MOV     #6,@CSR
001644  022777  000006  177126          CMP     #6,@CSR
001652  001401                          BEQ     .+4
001654  104000                          HLT                             ;ERROR, CSR NOT = 6
001656  005077  177116                  CLR     @CSR
001662  005777  177112                  TST     @CSR
```

```
  598  001666  001401                          BEQ     .+4
  599  001670  104000                          HLT                             ;ERROR, CSR NOT = 0
  600                                  ;TEST MODE (BIT 3) CAN BE SET AND CLEARED
  601  001672  104400                  T6:     SCOPE
  602  001674  012777  000010  177076          MOV     #10,@CSR
  603  001702  022777  000010  177070          CMP     #10,@CSR
  604  001710  001401                          BEQ     .+4
  605  001712  104000                          HLT                             ;ERROR, CSR NOT = 10
  606  001714  005077  177060                  CLR     @CSR
  607  001720  005777  177054                  TST     @CSR
  608  001724  001401                          BEQ     .+4
  609  001726  104000                          HLT                             ;ERROR, CSR NOT = 0
  610                                  ;TEST UP/DN (BIT 4) CAN BE SET AND CLEARED
  611  001730  104400                  T7:     SCOPE
  612  001732  012777  000020  177040          MOV     #20,@CSR
  613  001740  022777  000020  177032          CMP     #20,@CSR
  614  001746  001401                          BEQ     .+4
  615  001750  104000                          HLT                             ;ERROR, CSR NOT = 20
  616  001752  005077  177022                  CLR     @CSR
  617  001756  005777  177016                  TST     @CSR
  618  001762  001401                          BEQ     .+4
  619  001764  104000                          HLT                             ;ERROR, CSR NOT = 0
  620
  621
  622                                  ;TEST INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
  623  001766  104400                  T9:     SCOPE
  624  001770  012737  000340  177776          MOV     #340,CC                 ;SET PROCESSOR PRIORITY LEVEL 7
  625  001776  012777  000100  176774          MOV     #100,@CSR
  626  002004  022777  000100  176766          CMP     #100,@CSR
  627  002012  001401                          BEQ     .+4
  628  002014  104000                          HLT                             ;ERROR, CSR NOT = 100
  629  002016  005077  176756                  CLR     @CSR
  630  002022  005777  176752                  TST     @CSR
  631  002026  001401                          BEQ     .+4
  632  002030  104000                          HLT                             ;ERROR, CSR NOT = 0
  633                                  ;TEST RUN (BIT 0) CAN BE SET AND CLEARED
  634
  635  002032  104400                  T9A:    SCOPE
  636  002034  005077  176740                  CLR     @CSR
  637  002040  005037  001020                  CLR     TEMP
  638  002044  013777  001020  176730          MOV     TEMP,@CSB               ;START AT ZERO
  639  002052  012777  000021  176720          MOV     #21,@CSR                ;DISABLE INTERRUPT, COUNT UP, SET RUN
  640  002060  032777  000001  176712          BIT     #1,@CSR                 ;CHECK IF ZERO IS STILL SET
  641  002066  001001                          BNE     .+4
  642  002070  104000                          HLT                             ;CSR LOST BIT 0 AFTER BIT INSTRUCTION
  643  002072  104400                          SCOPE
  644  002074  005077  176700                  CLR     @CSR
  645  002100  005037  001020                  CLR     TEMP
  646  002104  013777  001020  176670          MOV     TEMP,@CSB               ;START AT ZERO
  647  002112  012777  000020  176660          MOV     #20,@CSR                ;DISABLE INTERRUPT, COUNT UP, DO NOT SET RUN
  648  002120  052777  000001  176652          BIS     #1,@CSR                 ;SET RUN
  649  002126  032777  000001  176644          BIT     #1,@CSR                 ;CHECK IF BIT 0 IS SET
  650  002134  001001                          BNE     .+4
  651  002136  104000                          HLT                             ;CSR LOST BIT 0 AFTER A BIS INSTRUCTION
  652  002140  104400                          SCOPE
  653  002142  005077  176632                  CLR     @CSR
```

```
                                        CLR     TEMP
                                        MOV     TEMP,@CSB               ;START AT ZERO
                                        MOV     #21,@CSR                ;DISABLE INTERRUPT, COUNT UP, SET RUN
                                        MOV     #20,@CSR                ;LEAVE ALL SAME RESET RUN
                                        BIT     #1,@CSR                 ;CHECK BIT 0
                                        BEQ     .+4                     ;BRANCH IF NOT SET
                                        HLT                             ;CSR PICKED BIT 0 ON A MOV.

                                ; TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
                                ; SET UP/DN (BIT 4) =0 TO ENABLE COUNT DOWN
                                T10:    SCOPE
                                        CLR     @CSR
                                        MOV     #-1,@CSB
                                        MOV     #-2,TEMP
                                T10A:   MOV     #40,@CSR
                                        CMP     TEMP,@CTR
                                        BEQ     .+4
                                        HLT                             ;ERROR, COUNTER NOT = TEMP, DIDN'T COUNT DOWN
                                        DEC     TEMP                    ;-1 TO PATTERN COUNT
                                        CMP     TEMP,#0                 ;DONE ALL COUNTS?
                                        BNE     T10A                    ;NO
                                ;TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
                                ;SET UP/DN (BIT 4)=1 TO ENABLE COUNT UP
                                T11:    SCOPE
                                        CLR     @CSR
                                        CLR     @CSB
                                        MOV     #1,TEMP
                                T11A:   MOV     #60,@CSR
                                        CMP     TEMP,@CTR
                                        BEQ     .+4
                                        HLT                             ;ERROR, COUNTER NOT = TEMP, FAILED TO COUNT UP.
                                        INC     TEMP                    ;+1 TO PATTERN COUNT
                                        CMP     TEMP,#0         ;DONE ALL COUNTS ?
                                        BNE     T11A                    ;NO
                                ;TEST CLOCK TO COUNT DOWN AT ALL FREQUENCIES
                                ;100KHZ
                                T12:    SCOPE
                                        CLR     @CSR
                                        MOV     #2,@CSB         ;COUNT SET BUFFER TO 2
                                        MOV     #1,@CSR                 ;DOWN COUNT , 100KHZ, GO
                                        MOV     @#DEL1,@#TEMP
                                T12A:   TSTB    @CSR
                                        BMI     T12B
                                        ADD     #1,@#TEMP
                                        BNE     T12A
                                        BIC     #1,@CSR
                                        HLT                             ;ERROR, P INTR (BIT 7) NOT = 1.
                                T12B:   TST     @CTR
                                        BEQ     .+4
                                        HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0

                                ;10KHZ
                                T13:    SCOPE
                                        CLR     @CSR
                                        MOV     #2,@CSB
```

```
   710  002442  012777  000003  176330          MOV     #3,@CSR          ;DOWN COUNT, 10KHZ, GO
   711  002450  013737  001026  001020          MOV     @#DEL2,@#TEMP
   712  002456  105777  176316          T13A:   TSTB    @CSR
   713  002462  100410                          BMI     T13B
   714  002464  062737  000001  001020          ADD     #1,@#TEMP
   715  002472  001371                          BNE     T13A
   716  002474  042777  000001  176276          BIC     #1,@CSR
   717  002502  104000                          HLT                      ;ERROR, P INTR (BIT 7) NOT = 1.
   718  002504  005777  176274          T13B:   TST     @CTR
   719  002510  001401                          BEQ     .+4
   720  002512  104000                          HLT                      ;ERROR, COUNTER DID NOT COUNTDOWN TO 0
   721                                  ;LINE FREQ.
   722  002514  104400                  T14:    SCOPE
   723  002516  005737  006232                  TST     @#XORFLG
   724  002522  100432                          BMI     T15
   725  002524  005077  176250                  CLR     @CSR
   726  002530  012777  000002  176244          MOV     #2,@CSB
   727  002536  012777  000005  176234          MOV     #5,@CSR          ;DOWN COUNT, LINE FREQ., GO
   728  002544  013737  001030  001020          MOV     @#DEL3,@#TEMP
   729  002552  105777  176222          T14A:   TSTB    @CSR
   730  002556  100410                          BMI     T14B
   731  002560  062737  000001  001020          ADD     #1,@#TEMP
   732  002566  001371                          BNE     T14A
   733  002570  042777  000001  176202          BIC     #1,@CSR
   734  002576  104000                          HLT                      ;ERROR, P INTR (BIT 7) NOT=1
   735  002600  005777  176200          T14B:   TST     @CTR
   736  002604  001401                          BEQ     .+4
   737  002606  104000                          HLT                      ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
   738                                  ;EXT FREQ
   739  002610  104400                  T15:    SCOPE
   740  002612  032777  000001  176224          BIT     #1,@SR           ;
   741  002620  001032                          BNE     T16              ;
   742  002622  005077  176152                  CLR     @CSR
   743  002626  012777  000002  176146          MOV     #2,@CSB
   744  002634  012777  000007  176136          MOV     #7,@CSR          ;DOWN COUNT, EXT., GO
   745  002642  013737  001032  001020          MOV     @#DEL4,@#TEMP
   746  002650  105777  176124          T15A:   TSTB    @CSR
   747  002654  100410                          BMI     T15B
   748  002656  062737  000001  001020          ADD     #1,@#TEMP
   749  002664  001371                          BNE     T15A
   750  002666  042777  000001  176104          BIC     #1,@CSR
   751  002674  104000                          HLT                      ;ERROR, P INTR (BIT 7) NOT=1
   752  002676  005777  176102          T15B:   TST     @CTR
   753  002702  001401                          BEQ     .+4
   754  002704  104000                          HLT                      ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
   755
   756                                  ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
   757                                  ;100 KHZ
   758  002706  104400                  T16:    SCOPE
   759  002710  005077  176064                  CLR     @CSR
   760  002714  012777  177776  176060          MOV     #-2,@CSB
   761  002722  012777  000021  176050          MOV     #21,@CSR         ;UP COUNT, 100 KHZ, GO
   762  002730  013737  001024  001020          MOV     @#DEL1,@#TEMP
   763  002736  105777  176036          T16A:   TSTB    @CSR
   764  002742  100410                          BMI     T16B
   765  002744  062737  000001  001020          ADD     #1,@#TEMP
```

```
   766  002752  001371                          BNE     T16A
   767  002754  042777  000001  176016          BIC     #1,@CSR
   768  002762  104000                          HLT                             ;ERROR
   769  002764  005777  176014        T16B:     TST     @CTR
   770  002770  001401                          BEQ     .+4
   771  002772  104000                          HLT                             ;ERROR
   772                                  ;10 KHZ
   773  002774  104400                T17:      SCOPE
   774  002776  005077  175776                  CLR     @CSR
   775  003002  012777  177776  175772          MOV     #-2,@CSB
   776  003010  012777  000023  175762          MOV     #23,@CSR                ;UP COUNT, 10 KHZ, GO
   777  003016  013737  001026  001020          MOV     @#DEL2,@#TEMP
   778  003024  105777  175750        T17A:     TSTB    @CSR
   779  003030  100410                          BMI     T17B
   780  003032  062737  000001  001020          ADD     #1,@#TEMP
   781  003040  001371                          BNE     T17A
   782  003042  042777  000001  175730          BIC     #1,@CSR
   783  003050  104000                          HLT                             ;ERROR
   784  003052  005777  175726        T17B:     TST     @CTR
   785  003056  001401                          BEQ     .+4
   786  003060  104000                          HLT                             ;ERROR
   787                                  ;LINE FREQ.
   788  003062  104400                T18:      SCOPE
   789  003064  005737  006232                  TST     @#XORFLG
   790  003070  100432                          BMI     T19
   791  003072  005077  175702                  CLR     @CSR
   792  003076  012777  177776  175676          MOV     #-2,@CSB
   793  003104  012777  000025  175666          MOV     #25,@CSR                ;UP COUNT, LINE, GO
   794  003112  013737  001030  001020          MOV     @#DEL3,@#TEMP
   795  003120  105777  175654        T18A:     TSTB    @CSR
   796  003124  100410                          BMI     T18B
   797  003126  062737  000001  001020          ADD     #1,@#TEMP
   798  003134  001371                          BNE     T18A
   799  003136  042777  000001  175634          BIC     #1,@CSR
   800  003144  104000                          HLT                             ;ERROR
   801  003146  005777  175632        T18B:     TST     @CTR
   802  003152  001401                          BEQ     .+4
   803  003154  104000                          HLT                             ;ERROR
   804
   805                                  ;EXT FREQ.
   806  003156  104400                T19:      SCOPE
   807  003160  032777  000001  175656          BIT     #1,@SR                  ;
   808  003166  001033                          BNE     T20                     ;
   809  003170  005077  175604                  CLR     @CSR
   810  003174  012777  177776  175600          MOV     #-2,@CSB
   811  003202  012777  000027  175570          MOV     #27,@CSR                ;UP COUNT, EXT FREQ, GO
   812  003210  013737  001032  001020          MOV     @#DEL4,@#TEMP
   813  003216  105777  175556        T19A:     TSTB    @CSR
   814  003222  100411                          BMI     T19B
   815  003224  062737  000001  001020          ADD     #1,@#TEMP
   816  003232  001371                          BNE     T19A
   817  003234  042777  000001  175536          BIC     #1,@CSR
   818  003242  104000                          HLT                             ;ERROR,
   819  003244  000005                          RESET
   820  003246  005777  175532        T19B:     TST     @CTR
   821  003252  001401                          BEQ     .+4
```

```
                                        HLT                             ;ERROR,
                                ;TEST THAT INTERRUPT OCCURS TO PROPER VECTOR WITH PROCESSOR PRIORITY 4
                                T20:    SCOPE
003260  012737  000200  177776          MOV     #200,CC                 ;SET PROCESSOR PRIORITY 4
003266  005077  175516                  CLR     @CKVS                   ;CLEAR INTERRUPT RETURN STATUS
003272  005077  175502                  CLR     @CSR
003276  012777  000002  175476          MOV     #2,@CSB
003304  012777  003346  175474          MOV     #T20A,@CKV              ;SET UP INTERRUPT RETURN VECTOR
003312  012777  000101  175460          MOV     #101,@CSR               ;ENABLE INTERRUPT
003320  013737  001024  001020          MOV     @#DEL1,@#TEMP
003326  005237  001020          1$:     INC     @#TEMP
003332  001375                          BNE     1$
003334  042777  000001  175436          BIC     #1,@CSR
003342  104000                          HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR.
003344  000420                          BR      T21
003346  017737  175426  001020  T20A:   MOV     @CSR,@#TEMP
003354  105737  001020                  TSTB    @#TEMP
003360  100401                          BMI     .+4
003362  104000                          HLT                             ;DONE NOT SET ON INT.
003364  032737  000001  001020          BIT     #1,@#TEMP
003372  001401                          BEQ     .+4
003374  104000                          HLT                             ;RUN NOT CLEARED
003376  005077  175376                  CLR     @CSR
003402  012706  000776                  MOV     #BUFF,%6
                                ;TEST THAT INTERRUPT OCCURS WITH PROCESSOR PRIORITY 5
003406  104400                  T21:    SCOPE
003410  012737  000240  177776          MOV     #240,CC                 ;SET PROCESSOR PRIORITY 5
003416  012777  003472  175362          MOV     #T21A,@CKV              ;SET UP INTERRUPT RETURN STATUS
003424  005077  175350                  CLR     @CSR
003430  012777  000002  175344          MOV     #2,@CSB
003436  012777  000101  175334          MOV     #101,@CSR               ;ENABLE INTERRUPT
003444  013737  001024  001020          MOV     @#DEL1,@#TEMP
003452  005237  001020          1$:     INC     @#TEMP
003456  001375                          BNE     1$
003460  042777  000001  175312          BIC     #1,@CSR
003466  104000                          HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR
003470  000404                          BR      T22
003472  005077  175302          T21A:   CLR     @CSR                    ;RETURN HERE AFTER INTERRUPT
003476  012706  000776                  MOV     #BUFF,%6
                                ;TEST THAT INTERRUPT IS INHIBITED WITH PROCESSOR PRIORITY 6
003502  104400                  T22:    SCOPE
003504  012737  000300  177776          MOV     #300,CC                 ;SET PROCESSOR PRIORITY 6
003512  012777  003562  175266          MOV     #T22A,@CKV              ;SET UP INTERRUPT RETURN
003520  005077  175254                  CLR     @CSR
003524  012777  000002  175250          MOV     #2,@CSB
003532  012777  000101  175240          MOV     #101,@CSR               ;INTERRUPT ENABLE
003540  013737  001024  001020          MOV     @#DEL1,@#TEMP
003546  005237  001020          1$:     INC     @#TEMP
003552  001375                          BNE     1$
003554  005077  175220                  CLR     @CSR
003560  000406                          BR      T23
003562  042777  000001  175210  T22A:   BIC     #1,@CSR
003570  104000                          HLT                     ;ERROR, INT SHOULDN'T HAVE OCCURRED
003572  012706  000776                  MOV     #BUFF,%6

                                ;TEST SINGLE INTERRUPT (MODE 0) ON OVERFLOW
```

```
                                T23:    SCOPE
003576  104400                          
003600  012737  000200  177776        MOV     #200,CC                 ;SET PROCESSOR PRIORITY 4
003606  005077  175166                CLR     @CSR
003612  012777  177776  175162        MOV     #-2,@CSB
003620  012777  003662  175160        MOV     #T23A,@CKV              ;SET INTERRUPT RETURN
003626  012777  000121  175144        MOV     #121,@CSR               ;INTERRUPT ENABLE, UP COUNT, 100 KHZ, GO
003634  013737  001024  001020        MOV     @#DEL1,@#TEMP
003642  062737  000001  001020  T23AA: ADD     #1,@#TEMP                       ;WASTE TIME
003650  001374                        BNE     T23AA
003652  042777  000001  175120        BIC     #1,@CSR
003660  104000                        HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR.
003662  005077  175112          T23A: CLR     @CSR                    ;RETURN HERE AFTER INTERRUPT.
003666  012706  000776                MOV     #BUFF,%6                ;RESET STACK
                                ;TEST REPEATED INTERRUPT (MODE 1).
003672  104400                  T24:  SCOPE
003674  012737  177700  001016        MOV     #-100,TEMP1             ;SET UP COUNTER FOR INTER
003702  012777  003754  175076        MOV     #T24B,@CKV              ;SET INTERRUPT RETURN
003710  012777  000010  175064        MOV     #10,@CSB                ;SET UP COUNT SET BUFFER
003716  012777  000111  175054        MOV     #111,@CSR               ;INTERRUPT ENABLE, REPEATED INTERRUPTS, 100 KHZ,
003724  013737  001024  001020  T24A: MOV     @#DEL1,@#TEMP
003732  062737  000001  001020        ADD     #1,@#TEMP
003740  001374                        BNE     .-6
003742  042777  000001  175030        BIC     #1,@CSR
003750  104000                        HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR
003752  000406                        BR      T24C
003754  022626                  T24B: CMP     (6)+,(6)+               ;POP STACK
003756  005237  001016                INC     TEMP1                   ;DONE 100 INTERRUPTS?
003762  001360                        BNE     T24A                    ;NO
003764  005077  175010                CLR     @CSR                    ;CLEAR CLOCK


                                ;SYNCHRONIZATION TEST
                                ;NO. 1 FOR
                                ;KW11-P BOARDS THAT
                                ;ARE REV F OR GREATER


003770  104400                  T24C: SCOPE
003772  005003                        CLR     %3                      ;
003774  032777  000020  175042        BIT     #20,@SR
004002  001002                        BNE     1$                      ;
004004  000137  004244                JMP     T25                     ;
004010  012777  010000  174764  1$:   MOV     #10000,@CSB             ;LOAD COUNTER
004016  012777  000001  174754        MOV     #1,@CSR                 ;GO COUNT DOWN, 100 KHZ
004024  017700  174754                MOV     @CTR,%0                 ;SAVE CTR
004030  020027  010000                CMP     %0,#10000               ;DID COUNT INCREASE?
004034  101404                        BLOS    2$                      ;BRANCH IF OK TO 1$
004036  010037  001020                MOV     %0,@#TEMP               ;
004042  104000                        HLT                             ;SYNC ERROR
004044  000404                        BR      T24D                    ;END TEST
004046  005077  174726          2$:   CLR     @CSR                    ;CLR CSR
004052  005203                        INC     %3                      ;NO OF TIMES THROUGH PROGRAM DETECTS 2(16)
004054  001355                        BNE     1$                      ;2(16) YET, IF NOT GO BACK TO LOOP 1
```

```
                                        ;SYNCHRONIZATION TEST
                                        ;NO. 2 FOR KW11-P
                                        ;BOARDS THAT ARE
                                        ;REV F OR GREATER

004056  104400                  T24D:   SCOPE
004060  017746  174722                  MOV     @CKV,-(%6)      ;SAVE CLOCK VECTOR
004064  012777  000340  002472          MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
004072  005037  004226                  CLR     TIKTIK          ;CLEAR CLOCK COUNTER
004076  005037  006556                  CLR     CNT             ;CLEAR ITERATION COUNT
004102  012777  004220  174676          MOV     #CLKSER,@CKV    ;SETUP INTR SERVICE RTN
004110  012777  000300  174672          MOV     #300,@CKVS      ;SETUP INTR PSW
004116  012777  000010  174656          MOV     #10,@CSB        ;KW11 COUNT = 10
004124  012777  000111  174646          MOV     #111,@CSR       ;SET TO RUN @100KH
                                                                ;INTR ENABLE & COUNT DOWN
                                                                ;AND REPEAT INTR MODE
004132                          LOOP:
004132  012777  000340  002424          MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
004140  004737  004230                  JSR     PC,TYPE         ;100MS DELAY @PR7
004144  005077  002414                  CLR     @PSW            ;PS=0 ALLOWS INTRS
004150  013701  004226                  MOV     TIKTIK,R1       ;GET CURRENT CLK COUNT
004154  004737  004230                  JSR     PC,TYPE         ;100MS DELAY @PR0
004160  023701  004226                  CMP     TIKTIK,R1       ;ANY INTRS DURING DELAY?
004164  001001                          BNE     1$              ;IF YES,GO TO 1$
004166  104000                          HLT                     ;ELSE THERE WAS AN ERROR
                                                                ;CHECK FOR JUMPERS ON THE
                                                                ;KW11-P BOARD NEAR I.C.
                                                                ;LOCATIONS E41 & E51 ON REV F
                                                                ;BOARD & GREATER ONLY
004170                          1$:
004170  005237  006556                  INC     CNT
004174  022737  000170  006556          CMP     #120.,CNT       ;120 ITERATIONS?
004202  001353                          BNE     LOOP            ;IF NOT,GO BACK TO LOOP
004204  012677  174576                  MOV     (%6)+,@CKV      ;ELSE RESTORE THE VECTOR
004210  005077  174564                  CLR     @CSR            ;CLEAR CONTROL REG
004214  000137  004244                  JMP     T25             ;AND GO TO NEXT TEST

004220                          CLKSER:
004220  005237  004226                  INC     TIKTIK          ;INC CLK COUNTER
004224                          CLKXIT:
004224  000002                          RTI                     ;ELSE EXIT RTN

004226  000000                  TIKTIK: 0

004230  105777  174560          TYPE:   TSTB    @TCSR           ;READY TO SEND
004234  100375                          BPL     TYPE            ;BR IF NOT
004236  110077  174550                  MOVB    R0,@TDBR        ;SEND THEM A MESSAGE
004242  000207                          RTS     PC
```

```
                                        ;TEST 100 KHZ REPEATABILITY
004244  104400                  T25:    SCOPE
004246  032777  000004  174570          BIT     #4,@SR          ;ARE TWO CLK'S PRESENT
004254  001002                          BNE     3$              ;BRANCH IF SW#2 IS UP
004256  000137  004720                  JMP     T27             ;EXIT IF ONLY ONE CLK
004262  005077  174512          3$:     CLR     @CSR
004266  012777  000000  174506          MOV     #0,@CSB         ;SET CTR
004274  012777  000021  174476          MOV     #21,@CSR        ;COUNT UP 100KHZ GO
004302  004537  004376                  JSR     R5,DELY         ;GO TO DELAY SUBROUTINE
004306  105777  174466                  TSTB    @CSR            ;TEST DONE BIT SET
004312  100001                          BPL     1$
004314  104000                          HLT                     ;DONE BIT SET TOO SOON
004316  017737  174462  001020  1$:     MOV     @CTR,@#TEMP     ;DONE NOT SET SO SAVE CTR
004324  005077  174450                  CLR     @CSR
004330  012777  000000  174444          MOV     #0,@CSB
004336  012777  000021  174434          MOV     #21,@CSR
004344  004537  004376                  JSR     R5,DELY
004350  105777  174424                  TSTB    @CSR
004354  100001                          BPL     2$
004356  104000                          HLT
004360  017737  174420  001016  2$:     MOV     @CTR,@#TEMP1    ;HERE WE ARE SAVING SEC CNT
004366  004537  004426                  JSR     R5,CACL         ;GO DETERMINE ACCURACY OF CNT'S
004372  104000                          HLT
004374  000432                          BR      T25A

004376  005077  002120          DELY:   CLR     @CSR1           ;DELAY SUBROUTINE
004402  012777  001130  002110          MOV     #1130,@CSB1
004410  012777  000021  002104          MOV     #21,@CSR1
004416  105777  002100          1$:     TSTB    @CSR1,          ;WAIT 600 MIL.
004422  100375                          BPL     1$
004424  000205                          RTS     R5

004426  013700  001020          CACL:   MOV     @#TEMP,R0       ;COMPARE CTR1 WITH CTR2
004432  013701  001016                  MOV     @#TEMP1,R1
004436  160001                          SUB     R0,R1
004440  100001                          BPL     1$
004442  005401                          NEG     R1
004444  022701  000005          1$:     CMP     #5,R1           ;DIFFERENCE MUST BE LESS THAN 5
004450  002401                          BLT     2$
004452  005725                          TST     (R5)+           ;UPDATE RETURN
004454  010137  001020          2$:     MOV     R1,TEMP         ;DEFRENCE FOR PRINT OUT
004460  000205                          RTS     R5

                                        ;TEST 10 KHZ REPEATABILITY
                                        ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
                                        ;FOR 10KHZ.
004462  104400                  T25A:   SCOPE
004464  005077  174310                  CLR     @CSR
004470  012777  000000  174304          MOV     #0,@CSB
004476  012777  000023  174274          MOV     #23,@CSR
004504  004537  004376                  JSR     R5,DELY
004510  105777  174264                  TSTB    @CSR
004514  100001                          BPL     1$
004516  104000                          HLT
004520  017737  174260  001020  1$:     MOV     @CTR,@#TEMP
004526  005077  174246                  CLR     @CSR
```

```
1046  004532  012777  000000  174242          MOV     #0,@CSB
1047  004540  012777  000023  174232          MOV     #23,@CSR
1048  004546  004537  004376                  JSR     R5,DELY
1049  004552  105777  174222                  TSTB    @CSR
1050  004556  100001                          BPL     2$
1051  004560  104000                          HLT
1052  004562  017737  174216  001016  2$:     MOV     @CTR,@#TEMP1
1053  004570  004537  004426                  JSR     R5,CACL
1054  004574  104000                          HLT
1055
1056                                  ;TEST LINE REPEATABILITY
1057                                  ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
1058                                  ;FOR LINE FREQ.
1059  004576  104400                  T26:    SCOPE
1060  004600  005737  006232                  TST     @#XORFLG
1061  004604  100445                          BMI     T27
1062  004606  005077  174166                  CLR     @CSR
1063  004612  012777  000000  174162          MOV     #0,@CSB
1064  004620  012777  000025  174152          MOV     #25,@CSR
1065  004626  004537  004376                  JSR     R5,DELY
1066  004632  105777  174142                  TSTB    @CSR
1067  004636  100001                          BPL     1$
1068  004640  104000                          HLT
1069  004642  017737  174136  001020  1$:     MOV     @CTR,@#TEMP
1070  004650  005077  174124                  CLR     @CSR
1071  004654  012777  000000  174120          MOV     #0,@CSB
1072  004662  012777  000025  174110          MOV     #25,@CSR
1073  004670  004537  004376                  JSR     R5,DELY
1074  004674  105777  174100                  TSTB    @CSR
1075  004700  100001                          BPL     2$
1076  004702  104000                          HLT
1077  004704  017737  174074  001016  2$:     MOV     @CTR,@#TEMP1
1078  004712  004537  004426                  JSR     R5,CACL
1079  004716  104000                          HLT
1080                                  ;TEST ERROR (BIT 15) TO SET WHEN INTERRUPT IS NOT SERVICED IN REPEAT MODE
1081  004720  104400                  T27:    SCOPE
1082  004722  005077  174052                  CLR     @CSR
1083  004726  012737  000340  177776          MOV     #340,CC                 ;SET PROCESSOR PRIORITY 7
1084  004734  012777  000002  174040          MOV     #2,@CSB                 ;SET COUNTER FOR FAST INTERRUPTS
1085  004742  012777  000111  174030          MOV     #111,@CSR               ;INT EN, REPEATED INT, DOWN COUNT, 100 KHZ, GO
1086  004750  013737  001024  001020          MOV     @#DEL1,@#TEMP
1087  004756  062737  000001  001020          ADD     #1,@#TEMP
1088  004764  001374                          BNE     .-6
1089  004766  005777  174006                  TST     @CSR
1090  004772  100404                          BMI     1$
1091  004774  042777  000001  173776          BIC     #1,@CSR
1092  005002  104000                          HLT                             ;ERROR, ERROR (BIT 15) NOT SET
1093  005004  005077  173770          1$:     CLR     @CSR
1094  005010  005777  173764                  TST     @CSR
1095  005014  100001                          BPL     .+4
1096  005016  104000                          HLT                             ;ERR, FAILED TO CLEAR WHEN REF.
1097                                  ;TEST BIT 15 IS CLEARED BY INIT
1098  005020  104400                  T27A:   SCOPE
1099  005022  012737  000340  177776          MOV     #340,CC
1100  005030  012777  000002  173744          MOV     #2,@CSB
1101  005036  012777  000111  173734          MOV     #111,@CSR
```

```
 1102  005044  013737  001024  001020          MOV     @#DEL1,@#TEMP
 1103  005052  062737  000001  001020          ADD     #1,@#TEMP
 1104  005060  001374                          BNE     .-6
 1105  005062  005777  173712                  TST     @CSR
 1106  005066  100404                          BMI     1$
 1107  005070  042777  000001  173702          BIC     #1,@CSR
 1108  005076  104000                          HLT                             ;BIT 15 NOT SET
 1109  005100  000005                  1$:     RESET
 1110  005102  005777  173672                  TST     @CSR
 1111  005106  100001                          BPL     .+4
 1112  005110  104000                          HLT                             ;BIT 15 NOT CLEARED BY RESET
 1113  005112  104400                          SCOPE
 1114
 1115                                  ;BELL ON PASS COMPLETE
 1116  005114  012777  000207  173670  TSTEND: MOV     #207,@TDBR
 1117  005122  105777  173666                  TSTB    @TCSR
 1118  005126  100375                          BPL     .-4
 1119  005130  012777  000000  173654          MOV     #0,@TDBR                ;SEND A NULL CHAR.
 1120  005136  105777  173652                  TSTB    @TCSR
 1121  005142  100375                          BPL     .-4
 1122  005144  013702  000042                  MOV     @#42,%2
 1123  005150  001405                          BEQ     TRPA
 1124  005152  000005                          RESET
 1125  005154  004712                  LOGICAL:        JSR     %7,(2)
 1126  005156  000240                          NOP
 1127  005160  000240                          NOP
 1128  005162  000240                          NOP
 1129  005164  000137  001130          TRPA:   JMP     BEGIN
```

```
1130
1131                                    .SBTTL          TIMING TEST
1132                                    ;RING TELETYPE BELL AT 10 SECOND INTERVALS USING REPEATED INTERRUPT MODE
1133                                    ;1ST MINUTE = 100 KHZ
1134                                    ;2ND MINUTE = 10 KHZ
1135                                    ;3RD MINUTE = LINE
1136                                    ;4TH MINUTE = EXTERNAL
1137
1138  005170  012706  000776           BEGIN1: MOV     #BUFF,%6
1139  005174  004737  011566                   JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1140  005200  013777  001010  173600           MOV     CKVS,@CKV
1141  005206  012777  000002  173574           MOV     #RTI,@CKVS
1142  005214  012737  005562  000024           MOV     #PWRF2,24       ;INIT POWER FAIL POINTER
1143  005222  000005                           RESET
1144                                  ;100 KHZ
1145  005224  012777  141520  173550           MOV     #50000.,@CSB    ;INIT COUNT SET BUFFER FOR .5 SECONDS
1146  005232  012700  177772                   MOV     #-6,%0          ;COUNT 6(10 SECOND) INTERVALS
1147  005236  012701  177754           T28:    MOV     #-20.,%1        ;COUNT 20(.5 SECOND) INTERVALS
1148  005242  012777  000111  173530           MOV     #111,@CSR       ;100 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1149  005250  000001                   T28A:   WAIT
1150  005252  005201                           INC     %1              ;DONE 10 SECONDS?
1151  005254  001375                           BNE     T28A            ;NO
1152  005256  105777  173532                   TSTB    @TCSR
1153  005262  100375                           BPL     .-4
1154  005264  012777  000207  173520           MOV     #207,@TDBR
1155  005272  005200                           INC     %0              ;DONE 6 TIMES?
1156  005274  001360                           BNE     T28             ;NO
1157  005276  042777  000101  173474           BIC     #101,@CSR       ;YES DISABLE INTERRUPTS
1158                                  ;10 KHZ
1159  005304  012777  011610  173470           MOV     #5000.,@CSB     ;INIT COUNT SET BUFFER FOR .5 SECONDS
1160  005312  012700  177772                   MOV     #-6,%0          ;COUNT 6(10SECOND) INTERVALS
1161  005316  012701  177754           T29:    MOV     #-20.,%1        ;COUNT 20(.5 SECOND) INTERVALS
1162  005322  012777  000113  173450           MOV     #113,@CSR       ;10 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1163  005330  000001                   T29A:   WAIT
1164  005332  005201                           INC     %1              ;DONE 10 SECONDS?
1165  005334  001375                           BNE     T29A            ;NO
1166  005336  105777  173452                   TSTB    @TCSR           ;YES, RING BELL
1167  005342  100375                           BPL     .-4
1168  005344  012777  000207  173440           MOV     #207,@TDBR
1169  005352  005200                           INC     %0              ;DONE 6 TIMES?
1170  005354  001360                           BNE     T29             ;NO
1171  005356  042777  000101  173414           BIC     #101,@CSR       ;YES, DISABLE INTERRUPTS
1172                                  ;SET UP FOR 10 SECONDS AT LINE FREQ.
1173  005364  005737  006232                   TST     @#XORFLG
1174  005370  100677                           BMI     BEGIN1
1175  005372  012737  001130  005550           MOV     #600.,LINE
1176  005400  032777  000002  173436           BIT     #2,@SR
1177  005406  001403                           BEQ     .+10
1178  005410  012737  000764  005550           MOV     #500.,LINE
1179                                  ;LINE
1180  005416  013777  005550  173356           MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
1181  005424  012700  177772                   MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
1182  005430  012777  000115  173342           MOV     #115,@CSR       ;LINE, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1183  005436  000001                   T30:    WAIT
1184  005440  105777  173350                   TSTB    @TCSR
1185  005444  100375                           BPL     .-4
```

```
1186  005446  012777  000207  173336          MOV     #207,@TDBR      ;RING BELL
1187  005454  005200                          INC     %0              ;DONE 6 TIMES
1188  005456  001367                          BNE     T30             ;NO
1189  005460  042777  000101  173312          BIC     #101,@CSR       ;YES--DISABLE INTERRUPTS
1190  005466  032777  000001  173350          BIT     #1,@SR          ;
1191  005474  001235                          BNE     BEGIN1          ;
1192                                ;EXTERNAL (LINE FOR MAINTENANCE)
1193  005476  013777  005550  173276          MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
1194  005504  012700  177772                  MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
1195  005510  012777  000117  173262          MOV     #117,@CSR       ;EXT FREQ, REPEATED INTERRUPTS, INTERRUPT ENABLE , GO
1196  005516  000001                  T31:    WAIT
1197  005520  105777  173270                  TSTB    @TCSR
1198  005524  100375                          BPL     .-4
1199  005526  012777  000207  173256          MOV     #207,@TDBR      ;RING BELL
1200  005534  005200                          INC     %0              ;DONE 6 TIMES
1201  005536  001367                          BNE     T31             ;NO
1202  005540  042777  000100  173232          BIC     #100,@CSR       ;YES, DISABLE INTERRUPTS
1203  005546  000610                          BR      BEGIN1          ;REPEAT
1204  005550  001130                  LINE:   600.
```

```
                                        .SBTTL          SUBROUTINES
                                        ;POWER FAIL HANDLERS
005552  012737  001130  005626  PWRF1:  MOV     #BEGIN,PWRRTN
005560  000403                          BR      PWRDWN
005562  012737  005170  005626  PWRF2:  MOV     #BEGIN1,PWRRTN
005570  012737  005600  000024  PWRDWN: MOV     #PWRUP,24
005576  000000                          HALT
005600  012706  000776          PWRUP:  MOV     #BUFF,%6
005604  005000                          CLR     %0
005606  005200                          INC     %0
005610  001376                          BNE     .-2
005612  012702  006416                  MOV     #MSGPWR,%2
005616  004737  006246                  JSR     %7,TOP
005622  000177  000000                  JMP     @PWRRTN
005626  001130                  PWRRTN: BEGIN

                                        ;ENTERED WITH SYSTEM TRAP CALL (HLT)
                                        ;PRINT PC, STATUS REGISTER, COMAND REGISTER, BYTE COUNT, CURRENT ADDRESS,  DATA
005630  037727  173210  020000  PRINT:  BIT     @SR,#20000              ;TEST FOR INHIBIT PRINT OUT
005636  001401                          BEQ     .+4                     ;BRANCH TO PRINT
005640  000002                          RTI                             ;INHIBIT, RETURN TO MAIN STREAM
005642  012702  006350                  MOV     #MSG1,%2
005646  005737  005744                  TST     PRINT1
005652  001402                          BEQ     .+6
005654  012702  006412                  MOV     #MSG2,%2
005660  004737  006246                  JSR     %7,TOP                  ;PRINT ERROR HEADING
005664  005237  005744                  INC     PRINT1
005670  011602                          MOV     (6),%2
005672  162702  000002                  SUB     #2,%2
005676  004737  005746                  JSR     %7,OCTPRT               ;PRINT PC
005702  017702  173072                  MOV     @CSR,%2
005706  004737  005746                  JSR     %7,OCTPRT               ;PRINT STATUS REGISTER
005712  017702  173066                  MOV     @CTR,%2
005716  004737  005746                  JSR     %7,OCTPRT               ;PRINT COUNTER
005722  013702  001020                  MOV     TEMP,%2
005726  004737  005746                  JSR     %7,OCTPRT               ;PRINT TEMP
005732  005777  173106                  TST     @SR                     ;CHECK SR FOR HALT SWITCH
005736  100001                          BPL     .+4
005740  000000                          HALT                            ;HALT ON ERROR UP
005742  000002                          RTI                             ;RETURN TO MAINLINE
005744  000000          PRINT1: 0
                                        ;PRINT OCTAL VALUE IN REGISTER2
005746  012737  000060  006060  OCTPRT: MOV     #'0,CHAR                ;INITIALIZE 1ST NUMBER AS 0
005754  005702                          TST     %2                      ;IS VALUE POSITIVE
005756  100003                          BPL     OCT1                    ;YES PRINT 0
005760  012737  000061  006060          MOV     #'1,CHAR                ;NO PRINT 1
005766  004737  006062          OCT1:   JSR     %7,OCTP
005772  006102                          ROL     %2
005774  006102                          ROL     %2
005776  012737  177773  006056          MOV     #-5,OCT                 ;COUNT 5 DIGITS
006004  006102          OCT2:   ROL     %2
006006  006102                          ROL     %2
006010  006102                          ROL     %2
006012  010237  006060                  MOV     %2,CHAR                 ;SAVE DIGIT
006016  042737  177770  006060          BIC     #177770,CHAR            ;CLEAR OTHER BITS
006024  052737  000060  006060          BIS     #60,CHAR                ;MAKE ASCII DIGIT
```

```
1261  006032  006002                        ROR     %2
1262  006034  004737  006062                JSR     %7,OCTP                 ;PRINT
1263  006040  006102                        ROL     %2
1264  006042  005237  006056                INC     OCT                     ;+1 TO DIGIT COUNT
1265  006046  001356                        BNE     OCT2                    ;NOT DONE
1266  006050  004737  006100                JSR     %7,SP3
1267  006054  000207                        RTS     %7                      ;EXIT
1268  006056  000000              OCT:      0
1269  006060  000000              CHAR:     0
1270  006062  105777  172726      OCTP:     TSTB    @TCSR
1271  006066  100375                        BPL     .-4                     ;WAIT FOR READY
1272  006070  013777  006060  172714        MOV     CHAR,@TDBR              ;PRINT
1273  006076  000207                        RTS     %7
1274                              ;TYPE 3 SPACES
1275  006100  012702  006112      SP3:      MOV     #SP3A,%2
1276  006104  004737  006246                JSR     %7,TOP
1277  006110  000207                        RTS     %7
1278  006112  020057  027440      SP3A:     .ASCII  ;/  /;
1279                                        .EVEN
1280
1281  006116  022606              SCOPEB:   CMP     (6)+,%6                 ;REPOSITION THE STACK
1282  006120  012637  177776                MOV     (6)+,CC
1283  006124  000177  000114                JMP     @RETURN                 ;SCOPE RETURN
1284
1285                              ;SCOPE OR/AND ITERATION LOOP FOR EACH TEST
1286  006130  032777  040000  172706  SCOPEC:  BIT     #40000,@SR              ;TEST SR FOR SCOPE.
1287  006136  001367                        BNE     SCOPEB                  ;YES SCOPE
1288  006140  005737  006232                TST     @#XORFLG
1289  006144  100011                        BPL     1$
1290  006146  013746  000004                MOV     @#4,-(%6)
1291  006152  012737  006234  000004        MOV     #XORA,@#4
1292  006160  005737  177060                TST     @#177060
1293  006164  012637  000004                MOV     (%6)+,@#4               ;RESTORE STACK
1294  006170  032777  004000  172646  1$:    BIT     #4000,@SR               ;NO - TEST FOR ITERATION
1295  006176  001007                        BNE     SCOPEG                  ;INHIBIT ITERATION
1296  006200  023737  006230  001022        CMP     SCOPEF,ICOUNT
1297  006206  001403                        BEQ     SCOPEG                  ;EXIT - DONE
1298  006210  005237  006230                INC     SCOPEF                  ;INCREMENT COUNT
1299  006214  000740                        BR      SCOPEB                  ;LOOP SOME MORE
1300  006216  005037  006230      SCOPEG:   CLR     SCOPEF                  ;CLEAR COUNT
1301  006222  011637  006244                MOV     @%6,RETURN              ;SAVE SCOPE RETURN POINTER
1302  006226  000002                        RTI                             ;RETURN INLINE-NEXT TEST
1303  006230  000000              SCOPEF:   0                               ;COUNT LOCATION FOR INTERATION LOOP
1304  006232  000000              XORFLG:   0
1305  006234  022626              XORA:     CMP     (%6)+,(%6)+
1306  006236  012637  000004                MOV     (%6)+,@#4
1307  006242  000725                        BR      SCOPEB
1308  006244  001130              RETURN:   BEGIN                           ;ADDRESS OF LAST TEST
1309                              ;MOV ADDRESS OF MESSAGE TO REGISTER 2
1310                              ;THEN JSR %7,TOP
1311  006246  142777  000177  172540  TOP:     BICB    #177,@TCSR              ;CLR INT FLAG
1312  006254  112237  006346                MOVB    (2)+,EOMK               ;MOVE IN EOM MARKER
1313  006260  121237  006346      TOP1:     CMPB    @%2,EOMK                ;COMPARE FOR EOM
1314  006264  001001                        BNE     .+4                     ;NO
1315  006266  000207                        RTS     %7                      ;YES, EXIT
1316  006270  121227  000100                CMPB    @%2,#'@
```

```
1317  006274  001406                        BEQ     TOP2
1318  006276  105777  172512                TSTB    @TCSR                   ;CK TTY
1319  006302  100375                        BPL     .-4                     ;WAIT FOR DONE
1320  006304  112277  172502                MOVB    (2)+,@TDBR              ;MOVE CHARACTER
1321  006310  000763                        BR      TOP1                    ;BRANCH BACK
1322  006312  105777  172476        TOP2:   TSTB    @TCSR
1323  006316  100375                        BPL     .-4
1324  006320  112777  000215  172464      MOVB    #215,@TDBR              ;SEND CARRIAGE RETURN
1325  006326  105777  172462                TSTB    @TCSR
1326  006332  100375                        BPL     .-4
1327  006334  112777  000212  172450      MOVB    #212,@TDBR              ;SEND LINE FEED
1328  006342  005202                        INC     %2                      ;INCRMTN R2
1329  006344  000745                        BR      TOP1                    ;NO EOM, SO LOOP
1330  006346     000        EOMK:   .BYTE   0
1331        006350                .EVEN
1332  006350  040057  020040  041520  MSG1:   .ASCII  ;/@ PC    STATUS  COUNTER  TEMP@/;
1333  006356  020040  020040  052123
1334  006364  052101  051525  020040
1335  006372  047503  047125  042524
1336  006400  020122  052040  046505
1337  006406  040120     057
1338        006412                .EVEN
1339  006412  040057     057    MSG2:   .ASCII  ;/@/;
1340        006416                .EVEN
1341  006416  040057  042522  052123  MSGPWR: .ASCII  ;/@RESTARTING AFTER A POWER FAILURE@@/;
1342  006424  051101  044524  043516
1343  006432  040440  052106  051105
1344  006440  040440  050040  053517
1345  006446  051105  043040  044501
1346  006454  052514  042522  040100
1347  006462     057
1348        006464                .EVEN
1349  006464  040057  047531  020125  XORM:   .ASCII  ;/@YOU ARE ON AN XOR TESTER@/;
1350  006472  051101  020105  047117
1351  006500  040440  020116  047530
1352  006506  020122  042524  052123
1353  006514  051105  027500
1354                                  .EVEN
1355                          ;TIMER FOR KW11-P CLOCK
1356                          ;
1357  006520  172562          CSB1:   172562
1358  006522  172560          CSR1:   172560
1359  006524  172564          CTR1:   172564
1360  006526  000504          CKV1:   504
1361  006530  000506          CKVS1:  506
1362  006532  000000          CLKFLG: 0
1363  006534  000000          INTFLG: 0
1364  006536  177566          PDBR:   177566
1365  006540  177564          PCSR:   177564
1366  006542  000064          PVEC:   64
1367  006544  000066          PVECS:  66
1368  006546  177562          KDBR:   177562
1369  006550  177560          KCSR:   177560
1370  006552  000060          KVEC:   60
1371  006554  000062          KVECS:  62
1372  006556  000000          CNT:    0
```

```
1373  006560  000000                    CNT1:    0
1374  006562  000000                    CNTB:    0
1375          000211                    CTRLI=211
1376          000224                    CTRLT=224
1377  006564  177776                    PSW:     177776
1378  006566  000000                    HRS1:    0
1379  006570  000000                    HRS2:    0
1380  006572  000000                    MIN1:    0
1381  006574  000000                    MIN2:    0
1382  006576  000000                    SEC1:    0
1383  006600  000000                    SEC2:    0
1384  006602  000000                    LST:     0
1385  006604  000000                    MST:     0
1386  006606  000000                    HRS1A:   0
1387  006610  000000                    HRS2A:   0
1388  006612  000000                    MIN1A:   0
1389  006614  000000                    MIN2A:   0
1390  006616  000000                    SEC1A:   0
1391  006620  000000                    SEC2A:   0
1392  006622  000000                    LSTA:    0
1393  006624  000000                    MSTA:    0
1394  006626  000000                    TMPSWR:  0          ;TEMP LOC FOR SOFT-SWR CONTENTS
1395  006630      000                   BYT1:    .BYTE 0    ;LOC FOR 1ST # INPUT VIA TTY
1396  006631      000                   BYT2:    .BYTE 0    ;  "   "  2ND  "   "   "   "
1397  006632      000                   BYT3:    .BYTE 0    ;  "   "  3RD  "   "   "   "
1398  006633      000                   BYT4:    .BYTE 0    ;  "   "  4TH  "   "   "   "
1399  006634      000                   BYT5:    .BYTE 0    ;  "   "  5TH  "   "   "   "
1400  006635      000                   BYT6:    .BYTE 0    ;  "   "  6TH  "   "   "   "
1401  006636      000                   BYT7:    .BYTE 0    ;  "   "  7TH  "   "   "   "
1402          006640                    .EVEN
1403
1404
1405
1406                                    ;
1407  006640  012706  000776            K100HZ:  MOV    #BUFF,%6   ;
1408  006644  004737  011566                     JSR    %7,SWADJ   ;HAS THIS CPU HAVE A SWITCH REG.?
1409  006650  005077  177710                     CLR    @PSW       ;
1410  006654  012737  000000  007614             MOV    #0,CLK+2   ;100KHZ
1411  006662  012737  000131  007622             MOV    #131,CLK1+2
1412  006670  012700  010272                     MOV    #TABL,%0
1413  006674  012701  010312                     MOV    #TABL1,%1
1414  006700  004537  007160                     JSR    %5,@#MOVE
1415  006704  012737  000043  010422             MOV    #35.,CLK3+2    ;LEAST VALUE
1416  006712  012737  001217  010452             MOV    #655.,CLK4+2   ;MOST VALUE
1417  006720  000137  007174                     JMP    @#INIT
1418
1419  006724  012706  000776            K10HZ:   MOV    #BUFF,%6   ;
1420  006730  004737  011566                     JSR    %7,SWADJ   ;HAS THIS CPU HAVE A SWITCH REG.?
1421  006734  005077  177624                     CLR    @PSW       ;
1422  006740  012737  164217  007614             MOV    #-13561,CLK+2  ;10KHZ
1423  006746  012737  000133  007622             MOV    #133,CLK1+2
1424  006754  012700  010272                     MOV    #TABL,%0
1425  006760  012701  010332                     MOV    #TABL2,%1
1426  006764  004537  007160                     JSR    %5,@#MOVE
1427  006770  012737  000000  010422             MOV    #0.,CLK3+2
1428  006776  012737  001130  010452             MOV    #600.,CLK4+2
```

```
 1429  007004  000137  007174                    JMP     @#INIT
 1430
 1431  007010  012706  000776          H60Z:     MOV     #BUFF,%6        ;
 1432  007014  004737  011566                    JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
 1433  007020  005077  177540                    CLR     @PS%W           ;
 1434  007024  012737  177733  007614            MOV     #-45.,CLK+2             ;60HZ
 1435  007032  012737  000135  007622            MOV     #135.,CLK1+2
```

```
1436  007040  012700  010272                MOV   #TABL,%0
1437  007044  012701  010352                MOV   #TABL3,%1
1438  007050  004537  007160                JSR   %5,@#MOVE
1439  007054  012737  000000  010422        MOV   #0.,CLK3+2
1440  007062  012737  001130  010452        MOV   #600.,CLK4+2
1441  007070  000137  007174                JMP   @#INIT
1442
1443  007074  012706  000776          H50Z: MOV   #BUFF,%6          ;
1444  007100  004737  011566                JSR   %7,SWADJ          ;HAS THIS CPU HAVE A SWITCH REG.?
1445  007104  005077  177454                CLR   @PSW              ;
1446  007110  012737  177742  007614        MOV   #-36,CLK+2        ;50HZ
1447  007116  012737  000135  007622        MOV   #135,CLK1+2
1448  007124  012700  010272                MOV   #TABL,%0
1449  007130  012701  010372                MOV   #TABL4,%1
1450  007134  004537  007160                JSR   %5,@#MOVE
1451  007140  012737  000000  010422        MOV   #0.,CLK3+2
1452  007146  012737  001104  010452        MOV   #580.,CLK4+2
1453  007154  000137  007174                JMP   @#INIT
1454
1455  007160  012702  177771          MOVE: MOV   #-7,%2
1456  007164  012120                  1$:   MOV   (%1)+,(%0)+
1457  007166  005202                        INC   %2
1458  007170  001375                        BNE   1$
1459  007172  000205                        RTS   %5
1460
1461  007174  013737  005552  000024  INIT: MOV   PWRF1,24         ;
1462  007202  012706  000776                MOV   #BUFF,%6          ;INITIALIZE
1463  007206  005037  006602                CLR   @#LST
1464  007212  005037  006604                CLR   @#MST
1465  007216  012737  000060  006566        MOV   #60,@#HRS1
1466  007224  012737  000060  006570        MOV   #60,@#HRS2
1467  007232  012737  000060  006572        MOV   #60,@#MIN1
1468  007240  012737  000060  006574        MOV   #60,@#MIN2
1469  007246  012737  000060  006576        MOV   #60,@#SEC1
1470  007254  012737  000060  006600        MOV   #60,@#SEC2
1471  007262  012777  010412  171516        MOV   #CLKI,@CKV
1472  007270  012777  000340  171512        MOV   #340,@CKVS
1473  007276  012777  007504  177246        MOV   #KINTR,@KVEC
1474  007304  012777  000200  177242        MOV   #200,@KVECS
1475  007312  012777  000200  177224        MOV   #200,@PVECS
1476  007320  012777  000100  177222        MOV   #100,@KCSR
1477  007326  005037  006532                CLR   @#CLKFLG
1478  007332  005037  006534                CLR   @#INTFLG
1479  007336  005077  171436          START: CLR   @CSR
1480  007342  005077  171434                CLR   @CSB
1481  007346  032777  000002  171470  WAITA: BIT   #2,@SR            ;WAIT LOOP, SW 1 CAUSE WAIT
1482  007354  001401                        BEQ   CLKON
1483  007356  000001                  WAITB: WAIT
1484  007360  032777  000001  171456  CLKON: BIT   #1,@SR            ;SW 0 TURNS ON CLK2
1485  007366  001432                        BEQ   3$
1486  007370  032777  000004  171446        BIT   #4,@SR            ;SW 2 DETERMINES PRESENCE OF CLOCK 2.
1487  007376  001426                        BEQ   3$
1488  007400  005737  006532                TST   @#CLKFLG          ;CLKFLG ALLOW CLK 2 TO BE TURNED ON
1489  007404  001360                        BNE   WAITA             ;ONLY ONCE
1490  007406  005077  177106                CLR   @CSB1
1491  007412  012777  007702  177106        MOV   #KOUT,@CKV1
```

```
1492  007420  012777  000200  177102          MOV     #200,@CKVS1
1493  007426  012737  177777  006532          MOV     #-1,@#CLKFLG
1494  007434  012777  141521  177056          MOV     #141521,@CSB1
1495  007442  012777  000113  177052          MOV     #113,@CSR1              ;TURN ON CLK 2
1496  007450  000137  007356                  JMP     WAITB
1497  007454  005037  006532          3$:     CLR     @#CLKFLG                ;CLEAR CLK 2 IF PRESENT
1498  007460  032777  000004  171356          BIT     #4,@SR
1499  007466  001404                          BEQ     4$
1500  007470  005077  177026                  CLR     @CSR1
1501  007474  005077  177020                  CLR     @CSB1
1502  007500  000137  007346          4$:     JMP     WAITA
1503
1504  007504  017701  177036          KINTR:  MOV     @KDBR,%1                ;KEYBOARD INTERRUPT HANDLER
1505  007510  022701  000207                  CMP     #207,%1         ;IS CHAR A ↑G(CONTROL-G)?
1506  007514  001557                          BEQ     CNGSWR          ;IF YES,GO TO CNGSWR
1507  007516  022701  000211                  CMP     #CTRLI,%1
1508  007522  001404                          BEQ     KIN
1509  007524  022701  000224                  CMP     #CTRLT,%1
1510  007530  001464                          BEQ     KOUT
1511  007532  000002                          RTI
1512
1513
1514  007534  005077  171240          KIN:    CLR     @CSR                    ;HANDLER FOR CTRL I
1515  007540  005077  171236                  CLR     @CSB                    ;SETUP TIME OF DAY
1516  007544  012737  177772  006556          MOV     #-6,@#CNT
1517  007552  012737  006566  006560          MOV     #HRS1,@#CNT1            ;INPUT
1518  007560  005037  006602                  CLR     LST
1519  007564  005037  006604                  CLR     MST
1520  007570  012777  007630  176754          MOV     #KINI,@KVEC
1521  007576  000002                          RTI
1522
1523  007600  012777  007504  176744  KINI2:  MOV     #KINTR,@KVEC            ;AWAIT A CHAR TO START
1524  007606  017701  176734                  MOV     @KDBR,%1
1525  007612  012777  000000  171162  CLK:    MOV     #0,@CSB                 ;CLK 1
1526  007620  012777  000131  171152  CLK1:   MOV     #131,@CSR
1527  007626  000002                          RTI
1528
1529  007630  013704  006560          KINI:   MOV     @#CNT1,%4               ;STORE TIME OF DAY
1530  007634  017701  176706                  MOV     @KDBR,%1
1531  007640  042701  000300                  BIC     #300,%1
1532  007644  010124                          MOV     %1,(%4)+
1533  007646  010437  006560                  MOV     %4,@#CNT1
1534  007652  005237  006556                  INC     @#CNT
1535  007656  001003                          BNE     1$
1536  007660  012777  007600  176664          MOV     #KINI2,@KVEC
1537  007666  000002                  1$:     RTI
1538
1539  007670  017737  176652  007700  HOLDIT: MOV     @KDBR,@#HOLD            ;DUMMY INTERRUPT SERVICE ROUTINE
1540  007676  000002                          RTI
1541
1542  007700  000000                  HOLD:   0
1543
1544  007702  005037  006534          KOUT:   CLR     @#INTFLG                ;INPUT HANDLER FOR CTRL T
1545  007706  012777  007670  176636          MOV     #HOLDIT,@KVEC           ;SET DUMMY VECTOR
1546  007714  012700  006566                  MOV     #HRS1,%0                ;GET TIME OF DAY INTO
1547  007720  012703  006606                  MOV     #HRS1A,%3               ;WORK AREA
```

```
1548  007724  012704  177770          MOV     #-10,%4
1549  007730  012023                1$: MOV     (%0)+,(%3)+
1550  007732  005204                    INC     %4
1551  007734  001375                    BNE     1$
1552  007736  017701  171042          MOV     @CTR,%1
1553  007742  005737  006534          TST     @#INTFLG        ;SEE IF CLK HAS INTERRUPTED IN THIS TIME
1554  007746  001355                    BNE     KOUT            ;CALC VALUE OF CTR
1555  007750  005737  007614          TST     @#CLK+2         ;IS CLOCK RUNNING AT 100KHZ ?
1556  007754  001416                    BEQ     2$
1557  007756  163701  007614          SUB     @#CLK+2,%1      ;SUB INIT VALUE
1558  007762  006301                    ASL     %1
1559  007764  006301                    ASL     %1
1560  007766  023727  007614  164217    CMP     @#CLK+2,#-13561 ;IS CLOCK RUNNING AT 10KHZ ?
1561  007774  001405                    BEQ     3$
1562  007776  000301                10$: SWAB    %1
1563  010000  023727  007614  177742    CMP     @#CLK+2,#-36    ;IS CLOCK RUNNING AT 50HZ ?
1564  010006  001001                    BNE     2$
1565  010010  006301                3$: ASL     %1
1566  010012  005000                2$: CLR     %0
1567  010014  005003                    CLR     %3
1568  010016  012704  010272        5$: MOV     #TABL,%4
1569  010022  005701                6$: TST     %1
1570  010024  100001                    BPL     4$
1571  010026  061403                    ADD     @%4,%3
1572  010030  006301                4$: ASL     %1
1573  010032  005724                    TST     (%4)+
1574  010034  005200                    INC     %0
1575  010036  022700  000007          CMP     #7,%0
1576  010042  001367                    BNE     6$
1577  010044  060337  006624          ADD     %3,@#MSTA       ;ADD VALUE OF CTR TO MST
1578  010050  000137  010706          JMP     @#CLK2
1579  010054                    CNGSWR:
1580  010054  010246                    MOV     %2,-(6)         ;SAVE R2
1581  010056  010346                    MOV     %3,-(6)         ;SAVE R3
1582  010060                    SETBYT:
1583  010060  005037  006626          CLR     TMPSWR          ;CLEAR TEMP SWR
1584  010064  005003                    CLR     %3              ;CLEAR R3
1585  010066  004737  010240          JSR     PC,CRLF         ;PRINT <CR><LF>
1586  010072  012702  006630          MOV     #BYT1,%2        ;INIT R2 TO 1ST BYTE LOC
1587  010076                    CKCSR:
1588  010076  105777  176446          TSTB    @KCSR           ;IS CHAR TYPED?
1589  010102  100375                    BPL     CKCSR           ;IF NOT,WAIT
1590  010104  017701  176436          MOV     @KDBR,%1        ;ELSE MOVE THE CHAR TO R1
1591  010110                    5$:
1592  010110  105777  176424          TSTB    @PCSR
1593  010114  100375                    BPL     5$
1594  010116  010177  176414          MOV     %1,@PDBR
1595  010122  122701  000225          CMPB    #225,%1         ;IS CHAR ↑U (CONTROL-U)?
1596  010126  001754                    BEQ     SETBYT          ;IF YES,START OVER
1597  010130  122701  000215          CMPB    #215,%1         ;ELSE IS IT <CR>?
1598  010134  001412                    BEQ     SWDONE          ;IF EQUAL,GO TO SWDONE
1599  010136  122701  000212          CMPB    #212,%1         ;IS IT <LF>?
1600  010142  001407                    BEQ     SWDONE          ;IF EQUAL,GO TO SWDONE
1601  010144  005203                    INC     %3              ;INDICATE A CHAR INPUTTED
1602  010146  042701  177770          BIC     #177770,%1      ;LEAVE ONLY BINARY # IN R1
1603  010152  110122                    MOVB    %1,(2)+         ;MOVE # TO PROPER BYTE LOC
```

```
1604  010154  022702  006636            CMP     #BYT7,%2        ;IS R2 PAST BYT6 ADDR?
1605  010160  001346                    BNE     CKCSR           ;IF NOT,GO BACK FOR ANOTHER CHAR
1606  010162                    SWDONE:
1607  010162  005703                    TST     %3              ;WAS A CHAR TYPED?
1608  010164  001420                    BEQ     30$             ;IF NOT,EXIT
1609  010166  012703  006630            MOV     #BYT1,%3        ;INIT R3 TO 1ST BYTE ADDR
1610  010172                    10$:
1611  010172  152337  006626            BISB    (3)+,TMPSWR     ;SET LOW 3 BITS OF TMPSWR
1612  010176  020302                    CMP     %3,%2           ;IS R3 EQUAL BYTE ADDR IN R2?
1613  010200  001407                    BEQ     20$             ;IF YES ,EXIT
1614  010202  006137  006626            ROL     TMPSWR          ;ELSE
1615  010206  006137  006626            ROL     TMPSWR          ;SHIFT
1616  010212  006137  006626            ROL     TMPSWR          ;NEXT 3 BITS UP
1617  010216  000765                    BR      10$             ;AND GO GET ANOTHER #
1618  010220                    20$:
1619  010220  013777  006626  170616    MOV     TMPSWR,@SR      ;SET UP NEW SWR
1620  010226                    30$:
1621  010226  012603                    MOV     (6)+,%3         ;RESTORE R3
1622  010230  012602                    MOV     (6)+,%2         ;RESTORE R2
1623  010232  004737  010240            JSR     PC,CRLF         ;PRINT <CR><LF>
1624  010236  000002                    RTI
1625
1626  010240                    CRLF:
1627  010240  105777  176274            TSTB    @PCSR           ;IS TTY READY?
1628  010244  100375                    BPL     CRLF            ;IF NOT,WAIT
1629  010246  012777  000215  176262    MOV     #215,@PDBR      ;ELSE TYPE <CR>
1630  010254                    10$:
1631  010254  105777  176260            TSTB    @PCSR           ;IS TTY READY?
1632  010260  100375                    BPL     10$             ;IF NOT,WAIT
1633  010262  012777  000212  176246    MOV     #212,@PDBR      ;ELSE TYPE <LF>
1634  010270  000207                    RTS     PC
1635
1636  010272  000510            TABL:   328.                    ;TABLE FOR WORK AREA
1637  010274  000244                    164.
1638  010276  000122                    82.
1639  010300  000051                    41.
1640  010302  000024                    20.
1641  010304  000012                    10.
1642  010306  000005                    5.
1643  010310  000003                    3.
1644
1645  010312  000510            TABL1:  328.                    ;100KHZ TIME TABLE
1646  010314  000244                    164.
1647  010316  000122                    82.
1648  010320  000051                    41.
1649  010322  000024                    20.
1650  010324  000012                    10.
1651  010326  000005                    5.
1652  010330  000003                    3.
1653
1654  010332  000632            TABL2:  410.                    ;10KHZ TIME TABLE
1655  010334  000315                    205.
1656  010336  000146                    102.
1657  010340  000063                    51.
1658  010342  000032                    26.
1659  010344  000015                    13.
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```
1660  010346  000006                          6.
1661  010350  000003                          3.
1662
1663  010352  001025                TABL3:    533.                    ;60HZ TIME TABLE
1664  010354  000413                          267.
1665  010356  000205                          133.
1666  010360  000103                          67.
1667  010362  000041                          33.
1668  010364  000021                          17.
1669  010366  000000                          0.
1670  010370  000000                          0.
1671
1672  010372  000500                TABL4:    320.                    ;50HZ TIME TABLE
1673  010374  000240                          160.
1674  010376  000120                          80.
1675  010400  000050                          40.
1676  010402  000024                          20.
1677  010404  000000                          0.
1678  010406  000000                          0.
1679  010410  000000                          0.
1680
1681                                ;THIS ROUTINE KEEPS THE 24 HOUR
1682                                ;TIME OF DAY
1683
1684  010412  012737  177777  006534  CLKI:   MOV     #-1,@#INTFLG            ;CLOCK INTERRUPT SERVICE ROUTINE
1685  010420  062737  000044  006602  CLK3:   ADD     #36.,@#LST              ;ADD LSB TO LST
1686  010426  022737  000144  006602          CMP     #100.,@#LST             ;DID IT OVER FLOW
1687  010434  003005                          BGT     CLK4
1688  010436  162737  000144  006602          SUB     #100.,@#LST             ;YES
1689  010444  005237  006604                  INC     @#MST                   ;INC MST
1690  010450  062737  001217  006604  CLK4:   ADD     #655.,@#MST.            ;ADD MSB TO MST
1691  010456  022737  001750  006604          CMP     #1000.,@#MST            ;DID IT OVER FLOW
1692  010464  003011                          BGT     2$
1693  010466  162737  001750  006604          SUB     #1000.,@#MST            ;YES
1694  010474  005237  006600                  INC     @#SEC2                  ;INC SECOND
1695  010500  022737  000072  006600          CMP     #72,@#SEC2              ;HAS 10 SECONDS ELAPSED
1696  010506  001401                          BEQ     .+4
1697  010510  000002                  2$:     RTI
1698  010512  012737  000060  006600          MOV     #60,@#SEC2              ;YES
1699  010520  005237  006576                  INC     @#SEC1                  ;INC MSB OF SECOND
1700  010524  022737  000066  006576          CMP     #66,@#SEC1              ;HAS 60 MIN ELAPSED
1701  010532  001401                          BEQ     .+4
1702  010534  000002                          RTI
1703  010536  012737  000060  006576          MOV     #60,@#SEC1              ;YES
1704  010544  005237  006574                  INC     @#MIN2                  ;INC LSB OF MIN
1705  010550  022737  000072  006574          CMP     #72,@#MIN2              ;HAS 10 MIN ELAPSED
1706  010556  001401                          BEQ     .+4
1707  010560  000002                          RTI
1708  010562  012737  000060  006574          MOV     #60,@#MIN2
1709  010570  005237  006572                  INC     @#MIN1                  ;INC MSB OF MIN
1710  010574  022737  000066  006572          CMP     #66,@#MIN1              ;HAS 60 MIN ELAPSED
1711  010602  001401                          BEQ     .+4
1712  010604  000002                          RTI
1713  010606  012737  000060  006572          MOV     #60,@#MIN1
1714  010614  005237  006570                  INC     @#HRS2                  ;INC LSB OF HOURS
1715  010620  022737  000064  006570          CMP     #64,@#HRS2              ;IS LSB A 4
```

```
1716  010626  001014                        BNE     NEWTM
1717  010630  022737  000062  006566        CMP     #62,@#HRS1      ;IF YES, IS MSB A 2
1718  010636  001401                        BEQ     .+4
1719  010640  000002                        RTI
1720  010642  012737  000060  006566        MOV     #60,@#HRS1      ;IF 24 HOURS RESET
1721  010650  012737  000060  006570        MOV     #60,@#HRS2      ;LSB AND MSB OF HOURS
1722  010656  000002                        RTI
1723  010660  022737  000072  006570  NEWTM: CMP     #72,@#HRS2      ;IF NOT 4 IS IT 10 HOURS
1724  010666  001401                        BEQ     .+4
1725  010670  000002                        RTI
1726  010672  005237  006566                INC     @#HRS1          ;YES INC MSB OF HOURS
1727  010676  012737  000060  006570        MOV     #60,@#HRS2
1728  010704  000002                        RTI
1729
1730
1731
1732
1733  010706  022737  001750  006624  CLK2:  CMP     #1000.,@#MSTA   ;THIS ROUTINE IS THE WORK
1734  010714  003011                        BGT     2$
1735  010716  162737  001750  006624        SUB     #1000.,@#MSTA   ;AREA ROUTINE AND IS THE
1736  010724  005237  006620                INC     @#SEC2A         ;SAME AS INTERRUPT HANDLER
1737  010730  022737  000072  006620        CMP     #72,@#SEC2A     ;SERVICE ROUTINE
1738  010736  001401                        BEQ     .+4
1739  010740  000475                  2$:   BR      END1A
1740  010742  012737  000060  006620        MOV     #60,@#SEC2A
1741  010750  005237  006616                INC     @#SEC1A
1742  010754  022737  000066  006616        CMP     #66,@#SEC1A
1743  010762  001401                        BEQ     .+4
1744  010764  000463                        BR      END1A
1745  010766  012737  000060  006616        MOV     #60,@#SEC1A
1746  010774  005237  006614                INC     @#MIN2A
1747  011000  022737  000072  006614        CMP     #72,@#MIN2A
1748  011006  001401                        BEQ     .+4
1749  011010  000451                        BR      END1A
1750  011012  012737  000060  006614        MOV     #60,@#MIN2A
1751  011020  005237  006612                INC     @#MIN1A
1752  011024  022737  000066  006612        CMP     #66,@#MIN1A
1753  011032  001401                        BEQ     .+4
1754  011034  000437                        BR      END1A
1755  011036  012737  000060  006612        MOV     #60,@#MIN1A
1756  011044  005237  006610                INC     HRS2A
1757  011050  022737  000064  006610        CMP     #64,@#HRS2A
1758  011056  001014                        BNE     NEWT
1759  011060  022737  000062  006606        CMP     #62,@#HRS1A
1760  011066  001401                        BEQ     .+4
1761  011070  000421                        BR      END1A
1762  011072  012737  000060  006606        MOV     #60,@#HRS1A
1763  011100  012737  000060  006610        MOV     #60,@#HRS2A
1764  011106  000412                        BR      END1A
1765  011110  022737  000072  006610  NEWT:  CMP     #72,@#HRS2A
1766  011116  001401                        BEQ     .+4
1767  011120  000405                        BR      END1A
1768  011122  005237  006606                INC     @#HRS1A
1769  011126  012737  000060  006610        MOV     #60,@#HRS2A
1770  011134  012777  011202  175400  END1A: MOV     #CR,@PVEC       ;SET UP FOR PRINTER OUTPUT
1771  011142  012737  177776  006562        MOV     #-2,@#CNTB
```

```
1772  011150  012737  006606  006560          MOV     #HRS1A,@#CNT1
1773  011156  012737  177767  006556          MOV     #-11,@#CNT
1774  011164  012777  000000  175344          MOV     #0,@PDBR
1775  011172  012777  000100  175340          MOV     #100,@PCSR
1776  011200  000002                          RTI
1777
1778
1779  011202  012777  011220  175332  CR:     MOV     #LF,@PVEC               ;OUTPUT CR
1780  011210  012777  000215  175320          MOV     #215,@PDBR
1781  011216  000002                          RTI
1782
1783  011220  012777  011236  175314  LF:     MOV     #PINTR,@PVEC            ;OUTPUT LF
1784  011226  012777  000212  175302          MOV     #212,@PDBR
1785  011234  000002                          RTI
1786  011236  005237  006556          PINTR:  INC     @#CNT                   ;PRINT TWO DIGITS FOLLOWED
1787  011242  001414                          BEQ     DONE                    ;BY COLON UNTIL TIME OF
1788  011244  005737  006562                  TST     CNTB                    ;DAY IS PRINTED
1789  011250  001420                          BEQ     COLON
1790  011252  013704  006560                  MOV     @#CNT1,%4
1791  011256  012477  175254                  MOV     (%4)+,@PDBR
1792  011262  010437  006560                  MOV     %4,@#CNT1
1793  011266  005237  006562                  INC     @#CNTB
1794  011272  000002                          RTI
1795  011274  012777  011330  175240  DONE:   MOV     #PER,@PVEC              ;WHEN DONE PRINT "."
1796  011302  012777  000056  175226          MOV     #56,@PDBR
1797  011310  000002                          RTI
1798
1799  011312  012737  177776  006562  COLON:  MOV     #-2,@#CNTB
1800  011320  012777  000072  175210          MOV     #72,@PDBR
1801  011326  000002                          RTI
1802
1803  011330  005037  006562          PER:    CLR     @#CNTB                  ;PRINT MSB OF MILLISEC
1804  011334  000250                          CLN
1805  011336  013737  006624  006560          MOV     @#MSTA,@#CNT1
1806  011344  012737  177767  006556          MOV     #-9.,@#CNT
1807  011352  162737  000144  006560  1$:     SUB     #100.,@#CNT1
1808  011360  100406                          BMI     2$
1809  011362  005237  006562                  INC     @#CNTB
1810  011366  005237  006556                  INC     @#CNT
1811  011372  001367                          BNE     1$
1812  011374  000404                          BR      3$
1813  011376  062737  000144  006560  2$:     ADD     #100.,@#CNT1
1814  011404  000250                          CLN
1815  011406  062737  000060  006562  3$:     ADD     #60,@#CNTB
1816  011414  012777  011432  175120          MOV     #NUM1,@PVEC
1817  011422  013777  006562  175106          MOV     @#CNTB,@PDBR
1818  011430  000002                          RTI
1819
1820  011432  012777  011514  175102  NUM1:   MOV     #NUM2,@PVEC             ;PRINT LSB OF MILLISEC
1821  011440  005037  006562                  CLR     @#CNTB
1822  011444  000250                          CLN
1823  011446  012737  177767  006556          MOV     #-9.,@#CNT
1824  011454  162737  000012  006560  1$:     SUB     #10.,@#CNT1
1825  011462  100405                          BMI     3$
1826  011464  005237  006562                  INC     @#CNTB
1827  011470  005237  006556                  INC     @#CNT
```

```
1828  011474  001367                          BNE     1$
1829  011476  062737  000060  006562  3$:     ADD     #60,@#CNTB
1830  011504  013777  006562  175024          MOV     @#CNTB,@PDBR
1831  011512  000002                          RTI
1832
1833  011514  012777  007504  175030  NUM2:   MOV     #KINTR,@KVEC            ;RESTORE KEYBOARD VECTOR
1834  011522  000002                          RTI
1835
1836
1837
1838
1839
1840
1841  011524  032777  000010  167312  DELADJ: BIT     #10,@SR         ;TEST FOR SR3=1 WHICH INDICATES
1842                                                                  ;11/70 &11/45 WITH MOS
1843  011532  001001                          BNE     1$              ;ADJUST DELAY TIMES
1844  011534  000207                          RTS     %7              ;NO ADJUSTMENTS REQUIRED
1845  011536  012701  001034          1$:     MOV     #ADJ,R1         ;GET START OF REG. FOR ADJUST
1846  011542  012700  001024                  MOV     #DEL1,R0        ;GET START OF REG. TO ADJUST
1847  011546  012702  001032                  MOV     #DEL4,R2        ;GET END TAG OF ADJUSTMENT
1848  011552  062702  000002                  ADD     #2,R2           ;UPDATE END CHECK
1849  011556  012120                  2$:     MOV     (R1)+,(R0)+     ;UPDATE DELAY COUNTS
1850  011560  020200                          CMP     R2,R0           ;ARE WE DONE
1851  011562  001375                          BNE     2$              ;NO CONTINUE UPDATE
1852  011564  000207                          RTS     %7              ;ADJUSTMENT MADE
1853
1854  011566  013746  000004          SWADJ:  MOV     @#4,-(%6)       ;SAVE CONTENT OF TRAP
1855                                                                  ;VECTOR
1856  011572  012737  011612  000004          MOV     #SWADJ1,@#4     ;SET UP NEW TRAP VECTOR
1857  011600  005777  167240                  TST     @SR             ;TEST FOR SWITCH REG.
1858  011604  012637  000004                  MOV     (%6)+,@#4       ;RESTORE STACK NO
1859                                                                  ;TIME OUT ACCONED.
1860  011610  000207                          RTS     %7
1861
1862  011612  022626          SWADJ1: CMP     (%6)+,(%6)+     ;UPDATE STACK
1863  011614  012637  000004                  MOV     (%6)+,@#4       ;RESTORE TRAP VECTOR
1864  011620  012737  000176  001044          MOV     #SOFTSR,SR      ;SET SWITCH REG.(SR) TO
1865                                                                  ;EQUAL SOFTSR
1866  011626  000207                          RTS     %7              ;RETURN TO CALLER
1867
1868
1869
1870          000001                  .END
```

DZKWBG.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
ADJ     001034          473#  1845
BEGIN   001130          451    495#   511   1129  1207  1219  1308
BEGIN1  005170          452   1138#  1174   1191  1203  1209
BEGIN2  001046          450    483#
BUFF  = 000776          448#   483    495    845   860   875   890  1138  1212  1407  1419  1431  1443
                       1462
BYT1    006630         1395#  1586   1609
BYT2    006631         1396#
BYT3    006632         1397#
BYT4    006633         1398#
BYT5    006634         1399#
BYT6    006635         1400#
BYT7    006636         1401#  1604
CACL    004426         1011   1022#  1053   1078
CC    = 177776          444#   624*   825*   848*  863*  879*  1083*  1099*  1282*
CHAR    006060         1247*  1250*  1258*  1259*  1260*  1269#  1272
CKCSR   010076         1587#  1589   1605
CKV     001006          462#   829*   849*   864*  882*  894*   943   947*   970*  1140*  1471*
CKVS    001010          463#   826*   948*  1140   1141*  1472*
CKVS1   006530         1361#  1492*
CKV1    006526         1360#  1491*
CLK     007612         1410*  1422*  1434*  1446*  1525#  1555  1557  1560  1563
CLKFLG  006532         1362#  1477*  1488   1493*  1497*
CLKI    010412         1471   1684#
CLKON   007360         1482   1484#
CLKSER  004220          947    974#
CLKXIT  004224          976#
CLK1    007620         1411*  1423*  1435*  1447*  1526#
CLK2    010706         1578   1733#
CLK3    010420         1415*  1427*  1439*  1451*  1685#
CLK4    010450         1416*  1428*  1440*  1452*  1687  1690#
CNGSWR  010054         1506   1579#
CNT     006556          946*   967*   968   1372#  1516*  1534*  1773*  1786*  1806*  1810*  1823*  1827*
CNTB    006562         1374#  1771*  1788   1793*  1799*  1803*  1809*  1815*  1817   1821*  1826*  1829*  1830
CNT1    006560         1373#  1517*  1529   1533*  1772*  1790   1792*  1805*  1807*  1813*  1824*
COLON   011312         1789   1799#
CR      011202         1770   1779#
CRLF    010240         1585   1623   1626#  1628
CSB     001002          460#   531*   532    544*  553*  563*  577*  638*  646*  655*  667*  680*  693*
                        709*   726*   743*   760*  775*  792*  810*  828*  851*  866*  881*  895*  922*
                        949*   996*  1004*  1038*  1046*  1063*  1071*  1084*  1100*  1145*  1159*  1180*  1193*
                       1480*  1515*  1525*
CSB1    006520         1016*  1357#  1490*  1494*  1501*
CSR     001000          459#   516*   518    552*  562*  566*   567   568*   569   584*   585   588*   589
                        592*   593    596*   597   602*  603   606*  607   612*  613   616*  617   625*
                        626    629*   630    636*  639*  640   644*  647*  648*  649   653*  656*  657*
                        658    666*   669*   679*  682*  692*  694*  696   700*  708*  710*  712   716*
                        725*   727*   729    733*  742*  744*  746   750*  759*  761*  763   767*  774*
                        776*   778    782*   791*  793*  795   799*  809*  811*  813   817*  827*  830*
                        834*   837    844*   850*  852*  856*  859*  865*  867*  871*  873*  880*  883*
                        887*   889*   896*   900*  906*  923*  930*  950*  971*  995*  997*  999  1003*
                       1005*  1007   1037*  1039*  1041  1045*  1047*  1049  1062*  1064*  1066  1070*  1072*
                       1074   1082*  1085*  1089   1091*  1093*  1094  1101*  1105  1107*  1110  1148*  1157*
                       1162*  1171*  1182*  1189*  1195*  1202*  1235  1479*  1514*  1526*
CSRT    001272          515    522#
CSR1    006522         1015*  1017*  1018   1358#  1495*  1500*
```

DZKWBG.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
CTR     001004          461#    536*    537     545     557     572     579     670     683     702     718     735     752
                        769     784     801     820     924     1002    1010    1044    1052    1069    1077    1237    1552
CTRLI = 000211          1375#   1507
CTRLT = 000224          1376#   1509
CTRI    006524          1359#
DELADJ  011524          485     497     1841#
DELY    004376          998     1006    1015#   1040    1048    1065    1073
DEL1    001024          469#    695     762     831     853     868     884     897     1086    1102    1846
DEL2    001026          470#    711     777
DEL3    001030          471#    554     564     728     794
DEL4    001032          472#    745     812     1847
DONE    011274          1787    1795#
END1A   011134          1739    1744    1749    1754    1761    1764    1767    1770#
EOMK    006346          1312*   1313    1330#
HLT   = 104000          443#    520     534     539     547     559     574     581     587     591     595     599     605
                        609     615     619     628     632     642     651     660     672     685     701     704     717
                        720     734     737     751     754     768     771     783     786     800     803     818     822
                        835     840     843     857     874     888     901     928     961     1001    1009    1012    1043
                        1051    1054    1068    1076    1079    1092    1096    1108    1112
HOLD    007700          1539*   1542#
HOLDIT  007670          1539#   1545
HRS1    006566          1378#   1465*   1517    1546    1717    1720*   1726*
HRS1A   006606          1386#   1547    1759    1762*   1768*   1772
HRS2    006570          1379#   1466*   1714*   1715    1721*   1723    1727*
HRS2A   006610          1387#   1756*   1757    1763*   1765    1769*
H50Z    007074          456     1443#
H60Z    007010          455     1431#
ICOUNT  001022          468#    491*    509*    1296
INIT    007174          1417    1429    1441    1453    1461#
INTFLG  006534          1363#   1478*   1544*   1553    1684*
KCSR    006550          1369#   1476*   1588
KDBR    006546          1368#   1504    1524    1530    1539    1590
KIN     007534          1508    1514#
KINI    007630          1520    1529#
KINI2   007600          1523#   1536
KINTR   007504          1473    1504#   1523    1833
KOUT    007702          1491    1510    1544#   1554
KVEC    006552          1370#   1473*   1520*   1523*   1536*   1545*   1833*
KVECS   006554          1371#   1474*
K10HZ   006724          454     1419#
K100HZ  006640          453     1407#
LF      011220          1779    1783#
LINE    005550          1175*   1178*   1180    1193    1204#
LOGICA  005154          442     1125#
LOOP    004132          953#    969
LST     006602          1384#   1463*   1518*   1685*   1686    1688*
LSTA    006622          1392#
MIN1    006572          1380#   1467*   1709*   1710    1713*
MIN1A   006612          1388#   1751*   1752    1755*
MIN2    006574          1381#   1468*   1704*   1705    1708*
MIN2A   006614          1389#   1746*   1747    1750*
MOVE    007160          1414    1426    1438    1450    1455#
MSGPWR  006416          1216    1341#
MSG1    006350          1226    1332#
MSG2    006412          1229    1339#
MST     006604          1385#   1464*   1519*   1689*   1690*   1691    1693*
```

```
MSTA     006624          1393#  1577*  1733   1735*  1805
NEWT     011110          1758   1765#
NEWTM    010660          1716   1723#
NOP    = 000240           445#
NUM1     011432          1816   1820#
NUM2     011514          1820   1833#
OCT      006056          1254*  1264*  1268#
OCTP     006062          1251   1262   1270#
OCTPRT   005746          1234   1236   1238   1240   1247#
OCT1     005766          1249   1251#
OCT2     006004          1255#  1265
PC     =%000007           955*   958*   984*  1585*  1623*  1634*
PCSR     006540          1365#  1592   1627   1631   1775*
PDBR     006536          1364#  1594*  1629*  1633*  1774*  1780*  1784*  1791*  1796*  1800*  1817*  1830*
PER      011330          1795   1803#
PINTR    011236          1783   1786#
PRINT    005630           437   1223#
PRINT1   005744           504*  1227   1231*  1245#
PSW      006564           499*   944*   954*   956*  1377#  1409*  1421*  1433*  1445*
PVEC     006542          1366#  1770*  1779*  1783*  1795*  1816*  1820*
PVECS    006544          1367#  1475*
PWRDWN   005570          1208   1210#
PWRF1    005552           498   1207#  1461
PWRF2    005562          1142   1209#
PWRRTN   005626          1207*  1209*  1218   1219#
PWRUP    005600          1210   1212#
RETURN   006244           503*  1283   1301*  1308#
R0     =%000000           983   1022*  1024   1846*  1849*  1850
R1     =%000001           957*   959   1023*  1024*  1026*  1027   1030   1845*  1849
R2     =%000002          1847*  1848*  1850
R5     =%000005           998*  1006*  1011*  1020*  1029   1031*  1040*  1048*  1053*  1065*  1073*  1078*
SCOPE  = 104400           446#   530    543    551    561    576    583    601    611    623    635    643    652
                          665    678    691    707    722    739    758    773    788    806    824    847    862
                          878    892    917    942    991   1036   1059   1081   1098   1113
SCOPEB   006116          1281#  1287   1299   1307
SCOPEC   006130           439   1286#
SCOPEF   006230           501*  1296   1298*  1300*  1303#
SCOPEG   006216          1295   1297   1300#
SEC1     006576          1382#  1469*  1699*  1700   1703*
SEC1A    006616          1390#  1741*  1742   1745*
SEC2     006600          1383#  1470*  1694*  1695   1698*
SEC2A    006620          1391#  1736*  1737   1740*
SETBYT   010060          1582#  1596
SOFTSR=  000176           447#  1864
SP3      006100          1266   1275#
SP3A     006112          1275   1278#
SR       001044           478#   524    740    807    919    992   1176   1190   1223   1241   1286   1294   1481
                          1484   1486   1498  1619*  1841   1857  1864*
START    007336          1479#
SWADJ    011566           484    496   1139   1408   1420   1432   1444   1854#
SWADJ1   011612          1856   1862#
SWDONE   010162          1598   1600   1606#
TABL     010272          1412   1424   1436   1448   1568   1636#
TABL1    010312          1413   1645#
TABL2    010332          1425   1654#
TABL3    010352          1437   1663#
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TABL4   010372          1449    1672#
TCSR    001014           465#    981    1117    1120    1152    1166    1184    1197    1270    1311*   1318    1322    1325
TDBR    001012           464#    983*   1116*   1119*   1154*   1168*   1186*   1199*   1272*   1320*   1324*   1327*
TEMP    001020           467#    500*    535*    537     542*    544     545     548*    554*    555*    564*    570*    637*
                         638     645*    646     654*    655     668*    670     673*    674     681*    683     686*    687
                         695*    698*    711*    714*    728*    731*    745*    748*    762*    755*    777*    780*    794*
                         797*    812*    815*    831*    832*    837*    838     841     853*    854*    868*    869*    884*
                         885*    897*    898*    927*   1002*   1022    1030*   1044*   1069*   1086*   1087*   1102*   1103*
                        1239
TEMP1   001016           466#    502*    893*    904*   1010*   1023    1052*   1077*
TIKTIK  004226           945*    957     959     975*    979#
TMPSWR  006626          1394#   1583*   1611*   1614*   1615*   1616*   1619
TOP     006246           493    1217    1230    1276    1311#
TOP1    006260          1313#   1321    1329
TOP2    006312          1317    1322#
TRPA    005164          1123    1129#
TSTEND  005114          1116#
TYPE    004230           955     958     981#    982
T0      001234           503     505     514#    525     527
T1      001314           519     521     529#
T10     002206           665#
T10A    002230           669#    675
T11     002264           678#
T11A    002304           682#    688
T12     002340           691#
T12A    002370           696#    699
T12B    002416           697     702#
T13     002426           707#
T13A    002456           712#    715
T13B    002504           713     718#
T14     002514           722#
T14A    002552           729#    732
T14B    002600           730     735#
T15     002610           724     739#
T15A    002650           746#    749
T15B    002676           747     752#
T16     002706           741     758#
T16A    002736           763#    766
T16B    002764           764     769#
T17     002774           773#
T17A    003024           778#    781
T17B    003052           779     784#
T18     003062           788#
T18A    003120           795#    798
T18B    003146           796     801#
T19     003156           790     806#
T19A    003216           813#    816
T19B    003246           814     820#
T20     003256           808     824#
T20A    003346           829     837#
T21     003406           836     847#
T21A    003472           849     859#
T22     003502           858     862#
T22A    003562           864     873#
T23     003576           872     878#
T23A    003662           882     889#
```

```
T23AA   003642            885#    886
T24     003672            892#
T24A    003724            897#    905
T24B    003754            894     903#
T24C    003770            902     917#
T24D    004056            929     942#
T25     004244            921     972     991#
T25A    004462           1013    1036#
T26     004576           1059#
T27     004720            994    1061    1081#
T27A    005020           1098#
T28     005236           1147#   1156
T28A    005250           1149#   1151
T29     005316           1161#   1170
T29A    005330           1163#   1165
T3      001374            544#    549
T3A     001422            551#
T3B     001464            561#
T30     005436           1183#   1188
T31     005516           1196#   1201
T4      001552            576#
T5      001574            583#
T6      001672            601#
T7      001730            611#
T9      001766            623#
T9A     002032            635#
WAITA   007346           1481#   1489    1502
WAITB   007356           1483#   1496
XOR     001210            487     507#
XORA    006234           1291    1305#
XORFLG  006232            490*    510*    723     789    1060    1173    1288    1304#
XORM    006464            492    1349#
.     = 011630            434#    436#    441#    449#    458#    533     538     546     558     573     580     586     590
                          594     598     604     608     614     618     627     631     641     650     659     671     684
                          703     719     736     753     770     785     802     821     839     842     899    1088    1095
                         1104    1111    1118    1121    1153    1167    1177    1185    1198    1215    1224    1228    1242
                         1271    1314    1319    1323    1326    1331#   1338#   1340#   1348#   1402#   1696    1701    1706
                         1711    1718    1724    1738    1743    1748    1753    1760    1766
```

DZKWBG.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

```
ADD      698  714  731  748  765  780  797  815  885  898 1087 1103 1571 1577 1685
        1690 1813 1815 1829 1848
ASL     1558 1559 1565 1572
BEQ      519  533  538  546  558  573  580  586  590  594  598  604  608  614  618
         627  631  659  671  684  703  719  736  753  770  785  802  821  842 1123
        1177 1224 1228 1297 1317 1482 1485 1487 1499 1506 1508 1510 1556 1561 1596
        1598 1600 1608 1613 1696 1701 1706 1711 1718 1724 1738 1743 1748 1753 1760
        1766 1787 1789
BGT     1687 1692 1734
BIC      700  716  733  750  767  782  799  817  834  856  873  887  900 1091 1107
        1157 1171 1189 1202 1259 1531 1602
BICB    1311
BIS      648 1260
BISB    1611
BIT      518  524  640  649  658  740  807  841  919  992 1176 1190 1223 1286 1294
        1481 1484 1486 1498 1841
BLOS     926
BLT     1028
BMI      697  713  724  730  747  764  779  790  796  814  839 1061 1090 1106 1174
        1808 1825
BNE      525  549  556  571  641  650  675  688  699  715  732  741  749  766  781
         798  808  816  833  855  870  886  899  905  920  932  960  969  993 1088
        1104 1151 1156 1165 1170 1188 1191 1201 1215 1265 1287 1295 1314 1458 1489
        1535 1551 1554 1564 1576 1605 1716 1758 1811 1828 1843 1851
BPL      982 1000 1008 1019 1025 1042 1050 1067 1075 1095 1111 1118 1121 1153 1167
        1185 1198 1242 1249 1271 1289 1319 1323 1326 1570 1589 1593 1628 1632
BR       521  527  836  858  872  902  929 1013 1203 1208 1299 1307 1321 1329 1617
        1739 1744 1749 1754 1761 1764 1767 1812
CLN     1804 1814 1822
CLR      499  500  501  502  504  510  542  552  562  596  606  616  629  636  637
         644  645  653  654  666  679  680  692  708  725  742  759  774  791  809
         826  827  844  850  859  865  871  880  889  906  918  930  945  946  956
         971  995 1003 1015 1037 1045 1062 1070 1082 1093 1213 1300 1409 1421 1433
        1445 1463 1464 1477 1478 1479 1480 1490 1497 1500 1501 1514 1515 1518 1519
        1544 1566 1567 1583 1584 1803 1821
CMP      507  522  537  545  557  572  585  589  593  603  613  626  670  674  683
         687  903  925  959  968 1027 1281 1296 1305 1505 1507 1509 1560 1563 1575
        1604 1612 1686 1691 1695 1700 1705 1710 1715 1717 1723 1733 1737 1742 1747
        1752 1757 1759 1765 1850 1862
CMPB    1313 1316 1595 1597 1599
DEC      673
EMT      443
HALT     436  526 1211 1243
INC      548  555  570  686  832  854  869  904  931  967  975 1150 1155 1164 1169
        1187 1200 1214 1231 1264 1298 1328 1457 1534 1550 1574 1601 1689 1694 1699
        1704 1709 1714 1726 1736 1741 1746 1751 1756 1768 1786 1793 1809 1810 1826
        1827
JMP      450  451  452  453  454  455  456  505  511  921  972  994 1129 1218 1283
        1417 1429 1441 1453 1496 1502 1578
JSR      484  485  493  496  497  955  958  998 1006 1011 1040 1048 1053 1065 1073
        1078 1125 1139 1217 1230 1234 1236 1238 1240 1251 1262 1266 1276 1408 1414
        1420 1426 1432 1438 1444 1450 1585 1623
MOV      483  486  487  489  490  491  492  495  498  503  508  509  514  515  516
         523  529  531  535  536  544  553  554  563  564  566  567  568  569  577
         584  588  592  602  612  624  625  638  639  646  647  655  656  657  667
         668  669  681  682  693  694  695  709  710  711  726  727  728  743  744
```

E04


```
        745  760  761  762  775  776  777  792  793  794  810  811  812  825  828
        829  830  831  837  845  848  849  851  852  853  860  863  864  866  867
        968  875  879  881  882  883  884  890  893  894  895  896  897  922  923
        924  927  943  944  947  948  949  950  954  957  970  996  997 1002 1004
       1005 1010 1016 1017 1022 1023 1030 1038 1039 1044 1046 1047 1052 1063 1064
       1069 1071 1072 1077 1083 1084 1085 1086 1099 1100 1101 1102 1116 1119 1122
       1138 1140 1141 1142 1145 1146 1147 1148 1154 1159 1160 1161 1162 1168 1175
       1178 1180 1181 1182 1186 1193 1194 1195 1199 1207 1209 1210 1212 1216 1226
       1229 1232 1235 1237 1239 1247 1250 1254 1258 1272 1275 1282 1290 1291 1293
       1301 1306 1407 1410 1411 1412 1413 1415 1416 1419 1422 1423 1424 1425 1427
       1428 1431 1434 1435 1436 1437 1439 1440 1443 1446 1447 1448 1449 1451 1452
       1455 1456 1461 1462 1465 1466 1467 1468 1469 1470 1471 1472 1473 1474 1475
       1476 1491 1492 1493 1494 1495 1504 1516 1517 1520 1523 1524 1525 1526 1529
       1530 1532 1533 1536 1539 1545 1546 1547 1548 1549 1552 1568 1580 1581 1586
       1590 1594 1609 1619 1621 1622 1629 1633 1684 1698 1703 1708 1713 1720 1721
       1727 1740 1745 1750 1755 1762 1763 1769 1770 1771 1772 1773 1774 1775 1779
       1780 1783 1784 1790 1791 1792 1795 1796 1799 1800 1805 1806 1816 1817 1820
       1823 1830 1833 1845 1846 1847 1849 1854 1856 1858 1863 1864
MOVB    983 1312 1320 1324 1327 1603
NEG    1026
NOP    1126 1127 1128
RESET   517  578  819 1109 1124 1143
ROL    1252 1253 1255 1256 1257 1263 1614 1615 1616
ROR    1261
RTI     977 1141 1225 1244 1302 1511 1521 1527 1537 1540 1624 1697 1702 1707 1712
       1719 1722 1725 1728 1776 1781 1785 1794 1797 1801 1818 1831 1834
RTS     984 1020 1031 1267 1273 1277 1315 1459 1634 1844 1852 1860 1866
SUB    1024 1233 1557 1688 1693 1735 1807 1824
SWAB   1562
TRAP    446
TST     488  532  579  597  607  617  630  702  718  723  735  752  769  784  789
        801  820 1029 1060 1089 1094 1105 1110 1173 1227 1241 1248 1288 1292 1488
       1553 1555 1569 1573 1607 1788 1857
TSTB    696  712  729  746  763  778  795  813  838  981  999 1007 1018 1041 1049
       1066 1074 1117 1120 1152 1166 1184 1197 1270 1318 1322 1325 1588 1592 1627
       1631
WAIT   1149 1163 1183 1196 1483
.ASCII 1278 1332 1339 1341 1349
.BYTE  1330 1395 1396 1397 1398 1399 1400 1401
.ENABL  433
.END   1870
.EVEN  1279 1331 1338 1340 1348 1354 1402
.LIST   436
.NLIST  436
.PAGE  1130 1205
.REPT     1  436
.SBTTL  430 1131 1205
```

ERRORS DETECTED: 0
DEFAULT GLOBALS GENERATED: 0

*DZKWBG,DZKWBG.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DZKWBG.P11
RUN-TIME: 6 12 2 SECONDS

```
.MAIN.  MACY11 27(732)  10-SEP-76  13:04  PAGE 46
DZKWBG.P11      CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

 RUN-TIME RATIO: 50/21=2.3
 CORE USED:  10K  (19 PAGES)
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