KW11-P

REAL TIME CLOCK TEST
CZKWBIO

AH-8878I-MC

FICHE 1 OF 1

APR 1978
digital
MADE IN USA

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IDENTIFICATION

PRODUCT CODE:	AC-8877I-MC
PRODUCT NAME:	CZKWB1C KW11-P RT CLK TST
PRODUCT DATE:	02-FEBRUARY-1978
MAINTAINER:	DIAGNOSTIC ENGINEERING
AUTHOR:	JOHN RODENHISER/JIM LACEY
REVISED BY:	W.F.KELLICKER AUG 30,1974 A.J.COSSETTE NOV.21,1975 M. SOARES NOV.21,1975 B. SUSSMAN JAN.02,1978 W. SCHLITZKUS FEB.02,1978

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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 11636.

                        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 11/60, 11/70 OR 11/45 WITH MOS OR BIPOLAR MEMO
                                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 FREQUENCY INPUT. THIS PROGRAM USES THE INTERNAL 60HZ FOR ITS SOURCE. TO DO THIS IT IS REQUIRED THAT A JUMPER WIRE BE CONNECTED 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,

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 F 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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                                .TITLE  CZKWBH0 KW11-P RT CLK TST

                                .SBTTL          BASIC TEST
                                ;COPYRIGHT 1971, 1978 DIGITAL EQUIPMENT CORP., MAYNARD, MASS. 01754
                                ;JOHN RODENHISER/JIM LACEY
                                        .ENABL AMA,ABS
000000                                  .=0
                                ;TRAP CATCHER 0-200
000030                                  .=30
000030  005650                          PRINT
000032  000340                          340
000034  006150                          SCOPEC
000036  000340                          340
000046                                  .=46
000046  005174                          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  001150                  JMP     @#BEGIN         ;RESTART BASIC TEST
000210  000137  005210                  JMP     @#BEGIN1        ;START TIMING TEST
000214  000137  006714                  JMP     @#K100HZ        ;DOUBLE OR SINGAL CLK TEST. 100KHZ.
000220  000137  007000                  JMP     @#K10HZ         ;DOUBLE OR SINGLE CLK TEST. 10KHZ.
000224  000137  007064                  JMP     @#H60Z          ;DOUBLE OR SINGLE CLK TEST. 60HZ.
000230  000137  007150                  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
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                                                CMP     @#42,   @#46    ;UNDER ACT ?
                                                BEQ     1$              ;YES-SKIP TITLE PRINT OUT
                                                MOV     #MSG3,  %2
                                                JSR     %7,     TOP     ;PRINT TITLE
                                        1$:     JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
                                                JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
                                                MOV     @#4,-(%6)
                                                MOV     #XOR,@#4
                                                TST     @#177060
                                                MOV     (%6)+,@#4
                                                MOV     #-1,@#XORFLG
                                                MOV     #1,@#ICOUNT
                                                MOV     #XORM,%2
                                                JSR     %7,TOP

                                        BEGIN:  MOV     #BUFF,%6                ;SET UP STACK FOR SCOPE LOOPS
                                                JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
                                                JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
                                                MOV     #PWRF1,24               ;INIT POWER FAIL POINTER
                                                CLR     @PSW                    ;CLEAR PROC. STATUS REG.
                                                CLR     TEMP
                                                CLR     SCOPEF                  ;INIT. SCOPEF TAG
                                                CLR     TEMP1
                                                MOV     #TO,RETURN              ;SET UP RESTART OF PROGRAM
                                                CLR     PRINT1                  ;INITIALIZE ERROR PRINTOUT READING
                                                JMP     TO

                                        XOR:    CMP     (%6)+,(%6)+
                                                MOV     (%6)+,@#4
                                                MOV     #5,@#ICOUNT
                                                CLR     @#XORFLG
                                                JMP     @#BEGIN
                                        ;TEST INIT TO CLEAR CONTROL AND STATUS REGISTER

                                        TO:     MOV     @#4,-(%6)
                                                MOV     #CSRT,@#4
                                                MOV     #100377,@CSR
                                                RESET
                                                BIT     #100377,@CSR
                                                BEQ     T1
                                                HLT                             ;ERROR, INIT FAILED TO CLEAR ALL BITS OF CSR.
                                                BR      T1
                                        CSRT:   CMP     (%6)+,(%6)+
                                                MOV     (%6)+,@#4
                                                BIT     #40000,@SR
                                                BNE     TO
                                                HALT                    ;NO SSYN FROM DEVICE
                                                BR      TO
                                        ;TEST COUNT SET BUFFER
                                        T1:     MOV     (%6)+,@#4
                                                SCOPE
                                                MOV     #-1,@CSB
                                                TST     @CSB
                                                BEQ     .+4
                                                HLT                             ;ERR, FAILED TO GIVE ZERO'S FROM WRITE ONLY REG.
                                                MOV     #-1,@#TEMP
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                                ;TEST COUNT SET BUFFER TO ACCEPT A COUNT PATTERN
                                ;TEST COUNTER TO CONTAIN COUNT SET BUFFER VALUE
001406  005037  001020          T3:     CLR     TEMP
001412  104400                          SCOPE
001414  013777  001020  177360          MOV     TEMP,@CSB
001422  023777  001020  177354          CMP     TEMP,@CTR
001430  001401                          BEQ     .+4
001432  104000                          HLT                             ;ERROR, CTR NOT=TEMP
001434  005237  001020                  INC     TEMP                    ;+1 TO COUNT PATTERN
001440  001365                          BNE     T3                      ;REPEAT UNTIL COUNT OVERFLOWS
                                ;TEST THAT CTR REMAINS CONSTANT IF RUN CLEAR
001442  104400                  T3A:    SCOPE
001444  005077  177330                  CLR     @CSR
001450  012777  177777  177324          MOV     #-1,@CSB
001456  013737  001030  001020          MOV     @#DEL3,@#TEMP
001464  005237  001020          1$:     INC     @#TEMP
001470  001375                          BNE     1$
001472  022777  177777  177304          CMP     #-1,@CTR
001500  001401                          BEQ     .+4
001502  104000                          HLT                             ;CTR CHANGED ALTHOUGH RUN 0
                                ;TEST THAT CTR REMAINS CONSTANT WHEN CSR IS REF'D
001504  104400                  T3B:    SCOPE
001506  005077  177266                  CLR     @CSR
001512  012777  177777  177262          MOV     #-1,@CSB
001520  013737  001030  001020          MOV     @#DEL3,@#TEMP

001526  012777  177736  177244  1$:     MOV     #177736,@CSR
001534  017700  177240                  MOV     @CSR,%0
001540  012777  000000  177232          MOV     #0,@CSR
001546  017700  177226                  MOV     @CSR,%0
001552  005237  001020                  INC     @#TEMP
001556  001363                          BNE     1$
001560  022777  177777  177216          CMP     #-1,@CTR
001566  001401                          BEQ     .+4
001570  104000                          HLT                             ;CTR CHANGED BY CSR REF

                                ;TEST INIT TO CLEAR COUNT SET BUFFER WHEN IT IS =-1
001572  104400                  T4:     SCOPE
001574  012777  177777  177200          MOV     #-1,@CSB
001602  000005                          RESET
001604  005777  177174                  TST     @CTR
001610  001401                          BEQ     .+4
001612  104000                          HLT                             ;ERROR, INIT FAILED TO CLEAR CSB

                                ;TEST RATE SELECT (BIT,2) MAY BE SET AND CLEARED
001614  104400                  T5:     SCOPE
001616  012777  000002  177154          MOV     #2,@CSR
001624  022777  000002  177146          CMP     #2,@CSR
001632  001401                          BEQ     .+4
001634  104000                          HLT                             ;ERROR, CSR NOT = 2
001636  012777  000004  177134          MOV     #4,@CSR
001644  022777  000004  177126          CMP     #4,@CSR
001652  001401                          BEQ     .+4
001654  104000                          HLT                             ;ERROR, CSR NOT = 4
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                                                    MOV     #6,@CSR
                                                    CMP     #6,@CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 6
                                                    CLR     @CSR
                                                    TST     @CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 0
                                        ;TEST MODE (BIT 3) CAN BE SET AND CLEARED
                                        T6:         SCOPE
                                                    MOV     #10,@CSR
                                                    CMP     #10,@CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 10
                                                    CLR     @CSR
                                                    TST     @CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 0
                                        ;TEST UP/DN (BIT 4) CAN BE SET AND CLEARED
                                        T7:         SCOPE
                                                    MOV     #20,@CSR
                                                    CMP     #20,@CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 20
                                                    CLR     @CSR
                                                    TST     @CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 0


                                        ;TEST INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
                                        T9:         SCOPE
                                                    MOV     #340,CC                 ;SET PROCESSOR PRIORITY LEVEL 7
                                                    MOV     #100,@CSR
                                                    CMP     #100,@CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 100
                                                    CLR     @CSR
                                                    TST     @CSR
                                                    BEQ     .+4
                                                    HLT                             ;ERROR, CSR NOT = 0
                                        ;TEST RUN (BIT 0) CAN BE SET AND CLEARED

                                        T9A:        SCOPE
                                                    CLR     @CSR
                                                    CLR     TEMP
                                                    MOV     TEMP,@CSB               ;START AT ZERO
                                                    MOV     #21,@CSR                ;DISABLE INTERRUPT, COUNT UP, SET RUN
                                                    BIT     #1,@CSR                 ;CHECK IF ZERO IS STILL SET
                                                    BNE     .+4
                                                    HLT                             ;CSR LOST BIT 0 AFTER BIT INSTRUCTION
                                                    SCOPE
                                                    CLR     @CSR
                                                    CLR     TEMP
                                                    MOV     TEMP,@CSB               ;START AT ZERO
                                                    MOV     #20,@CSR                ;DISABLE INTERRUPT, COUNT UP, DO NOT SET RUN
```

```
                                        BIS     #1,@CSR                 ;SET RUN
                                        BIT     #1,@CSR                 ;CHECK IF BIT 0 IS SET
                                        BNE     .+4
                                        HLT                             ;CSR LOST BIT 0 AFTER A BIS INSTRUCTION
                                        SCOPE
                                        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
                                                MOV     #3,@CSR                 ;DOWN COUNT, 10KHZ, GO
                                                MOV     @#DEL2,@#TEMP
                                        T13A:   TSTB    @CSR
                                                BMI     T13B
                                                ADD     #1,@#TEMP
                                                BNE     T13A
                                                BIC     #1,@CSR
                                                HLT                             ;ERROR, P INTR (BIT 7) NOT = 1.
                                        T13B:   TST     @CTR
                                                BEQ     .+4
                                                HLT                             ;ERROR, COUNTER DID NOT COUNTDOWN TO 0
                                        ;LINE FREQ.
                                        T14:    SCOPE
                                                TST     @#XORFLG
                                                BMI     T15
                                                CLR     @CSR
                                                MOV     #2,@CSB
                                                MOV     #5,@CSR                 ;DOWN COUNT, LINE FREQ., GO
                                                MOV     @#DEL3,@#TEMP
                                        T14A:   TSTB    @CSR
                                                BMI     T14B
                                                ADD     #1,@#TEMP
                                                BNE     T14A
                                                BIC     #1,@CSR
                                                HLT                             ;ERROR, P INTR (BIT 7) NOT=1
                                        T14B:   TST     @CTR
                                                BEQ     .+4
                                                HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
                                        ;EXT FREQ
                                        T15:    SCOPE
                                                BIT     #1,@SR                  ;
                                                BNE     T16                     ;
                                                CLR     @CSR
                                                MOV     #2,@CSB
                                                MOV     #7,@CSR                 ;DOWN COUNT, EXT., GO
                                                MOV     @#DEL4,@#TEMP
                                        T15A:   TSTB    @CSR
                                                BMI     T15B
                                                ADD     #1,@#TEMP
                                                BNE     T15A
                                                BIC     #1,@CSR
                                                HLT                             ;ERROR, P INTR (BIT 7) NOT=1
                                        T15B:   TST     @CTR
                                                BEQ     .+4
                                                HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0

                                        ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
                                        ;100 KHZ
                                        T16:    SCOPE
                                                CLR     @CSR
```

```
765  002734  012777  177776  176040          MOV     #-2,@CSB
766  002742  012777  000021  176030          MOV     #21,@CSR        ;UP COUNT, 100 KHZ, GO
767  002750  013737  001024  001020          MOV     @#DEL1,@#TEMP
768  002756  105777  176016          T16A:   TSTB    @CSR
769  002762  100410                          BMI     T16B
770  002764  062737  000001  001020          ADD     #1,@#TEMP
771  002772  001371                          BNE     T16A
772  002774  042777  000001  175776          BIC     #1,@CSR
773  003002  104000                          HLT                     ;ERROR
774  003004  005777  175774          T16B:   TST     @CTR
775  003010  001401                          BEQ     .+4
776  003012  104000                          HLT                     ;ERROR
777                                ;10 KHZ
778  003014  104400                T17:      SCOPE
779  003016  005077  175756                  CLR     @CSR
780  003022  012777  177776  175752          MOV     #-2,@CSB
781  003030  012777  000023  175742          MOV     #23,@CSR        ;UP COUNT, 10 KHZ, GO
782  003036  013737  001026  001020          MOV     @#DEL2,@#TEMP
783  003044  105777  175730          T17A:   TSTB    @CSR
784  003050  100410                          BMI     T17B
785  003052  062737  000001  001020          ADD     #1,@#TEMP
786  003060  001371                          BNE     T17A
787  003062  042777  000001  175710          BIC     #1,@CSR
788  003070  104000                          HLT                     ;ERROR
789  003072  005777  175706          T17B:   TST     @CTR
790  003076  001401                          BEQ     .+4
791  003100  104000                          HLT                     ;ERROR
792                                ;LINE FREQ.
793  003102  104400                T18:      SCOPE
794  003104  005737  006252                  TST     @#XORFLG
795  003110  100432                          BMI     T19
796  003112  005077  175662                  CLR     @CSR
797  003116  012777  177776  175656          MOV     #-2,@CSB
798  003124  012777  000025  175646          MOV     #25,@CSR        ;UP COUNT, LINE, GO
799  003132  013737  001030  001020          MOV     @#DEL3,@#TEMP
800  003140  105777  175634          T18A:   TSTB    @CSR
801  003144  100410                          BMI     T18B
802  003146  062737  000001  001020          ADD     #1,@#TEMP
803  003154  001371                          BNE     T18A
804  003156  042777  000001  175614          BIC     #1,@CSR
805  003164  104000                          HLT                     ;ERROR
806  003166  005777  175612          T18B:   TST     @CTR
807  003172  001401                          BEQ     .+4
808  003174  104000                          HLT                     ;ERROR
809
810                                ;EXT FREQ.
811  003176  104400                T19:      SCOPE
812  003200  032777  000001  175636          BIT     #1,@SR          ;
813  003206  001033                          BNE     T20             ;
814  003210  005077  175564                  CLR     @CSR
815  003214  012777  177776  175560          MOV     #-2,@CSB
816  003222  012777  000027  175550          MOV     #27,@CSR        ;UP COUNT, EXT FREQ, GO
817  003230  013737  001032  001020          MOV     @#DEL4,@#TEMP
818  003236  105777  175536          T19A:   TSTB    @CSR
819  003242  100411                          BMI     T19B
820  003244  062737  000001  001020          ADD     #1,@#TEMP
```

```
821  003252  001371                    BNE     T19A
822  003254  042777  000001  175516    BIC     #1,@CSR
823  003262  104000                    HLT                             ;ERROR.
824  003264  000005                    RESET
825  003266  005777  175512  T19B:     TST     @CTR
826  003272  001401                    BEQ     .+4
827  003274  104000                    HLT                             ;ERROR.
828                          ;TEST THAT INTERRUPT OCCURS TO PROPER VECTOR WITH PROCESSOR PRIORITY 4
829  003276  104400          T20:      SCOPE
830  003300  012737  000200  177776    MOV     #200,CC                 ;SET PROCESSOR PRIORITY 4
831  003306  005077  175476            CLR     @CKVS                   ;CLEAR INTERRUPT RETURN STATUS
832  003312  005077  175462            CLR     @CSR
833  003316  012777  000002  175456    MOV     #2,@CSB
834  003324  012777  003366  175454    MOV     #T20A,@CKV              ;SET UP INTERRUPT RETURN VECTOR
835  003332  012777  000101  175440    MOV     #101,@CSR               ;ENABLE INTERRUPT
836  003340  013737  001024  001020    MOV     @#DEL1,@#TEMP
837  003346  005237  001020  1$:       INC     @#TEMP
838  003352  001375                    BNE     1$
839  003354  042777  000001  175416    BIC     #1,@CSR
840  003362  104000                    HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR.
841  003364  000420                    BR      T21
842  003366  017737  175406  001020  T20A:     MOV     @CSR,@#TEMP
843  003374  105737  001020            TSTB    @#TEMP
844  003400  100401                    BMI     .+4
845  003402  104000                    HLT                             ;DONE NOT SET ON INT.
846  003404  032737  000001  001020    BIT     #1,@#TEMP
847  003412  001401                    BEQ     .+4
848  003414  104000                    HLT                             ;RUN NOT CLEARED
849  003416  005077  175356            CLR     @CSR
850  003422  012706  000776            MOV     #BUFF,%6
851                          ;TEST THAT INTERRUPT OCCURS WITH PROCESSOR PRIORITY 5
852  003426  104400          T21:      SCOPE
853  003430  012737  000240  177776    MOV     #240,CC                 ;SET PROCESSOR PRIORITY 5
854  003436  012777  003512  175342    MOV     #T21A,@CKV              ;SET UP INTERRUPT RETURN STATUS
855  003444  005077  175330            CLR     @CSR
856  003450  012777  000002  175324    MOV     #2,@CSB
857  003456  012777  000101  175314    MOV     #101,@CSR               ;ENABLE INTERRUPT
858  003464  013737  001024  001020    MOV     @#DEL1,@#TEMP
859  003472  005237  001020  1$:       INC     @#TEMP
860  003476  001375                    BNE     1$
861  003500  042777  000001  175272    BIC     #1,@CSR
862  003506  104000                    HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR
863  003510  000404                    BR      T22
864  003512  005077  175262  T21A:     CLR     @CSR                    ;RETURN HERE AFTER INTERRUPT
865  003516  012706  000776            MOV     #BUFF,%6
866                          ;TEST THAT INTERRUPT IS INHIBITED WITH PROCESSOR PRIORITY 6
867  003522  104400          T22:      SCOPE
868  003524  012737  000300  177776    MOV     #300,CC                 ;SET PROCESSOR PRIORITY 6
869  003532  012777  003602  175246    MOV     #T22A,@CKV              ;SET UP INTERRUPT RETURN
870  003540  005077  175234            CLR     @CSR
871  003544  012777  000002  175230    MOV     #2,@CSB
872  003552  012777  000101  175220    MOV     #101,@CSR               ;INTERRUPT ENABLE
873  003560  013737  001024  001020    MOV     @#DEL1,@#TEMP
874  003566  005237  001020  1$:       INC     @#TEMP
875  003572  001375                    BNE     1$
876  003574  005077  175200            CLR     @CSR
```

```
                        BR      T23
003602 042777 000001 175170 T22A:   BIC     #1,@CSR
003610 104000                       HLT                     ;ERROR, INT SHOULDN'T HAVE OCCURRED
003612 012706 000776                MOV     #BUFF,%6

                    ;TEST SINGLE INTERRUPT (MODE 0) ON OVERFLOW
003616 104400       T23:    SCOPE
003620 012737 000200 177776         MOV     #200,CC             ;SET PROCESSOR PRIORITY 4
003626 005077 175146                CLR     @CSR
003632 012777 177776 175142         MOV     #-2,@CSB
003640 012777 003702 175140         MOV     #T23A,@CKV          ;SET INTERRUPT RETURN
003646 012777 000121 175124         MOV     #121,@CSR           ;INTERRUPT ENABLE, UP COUNT, 100 KHZ, GO
003654 013737 001024 001020         MOV     @#DEL1,@#TEMP
003662 062737 000001 001020 T23AA:  ADD     #1,@#TEMP                   ;WASTE TIME
003670 001374                       BNE     T23AA
003672 042777 000001 175100         BIC     #1,@CSR
003700 104000                       HLT                         ;ERROR, INTERRUPT FAILED TO OCCUR.
003702 005077 175072        T23A:   CLR     @CSR                ;RETURN HERE AFTER INTERRUPT.
003706 012706 000776                MOV     #BUFF,%6            ;RESET STACK

                    ;TEST REPEATED INTERRUPT (MODE 1).
003712 104400       T24:    SCOPE
003714 012737 177700 001016         MOV     #-100,TEMP1         ;SET UP COUNTER FOR INTER
003722 012777 003774 175056         MOV     #T24B,@CKV          ;SET INTERRUPT RETURN
003730 012777 000010 175044         MOV     #10,@CSB            ;SET UP COUNT SET BUFFER
003736 012777 000111 175034         MOV     #111,@CSR           ;INTERRUPT ENABLE, REPEATED INTERRUPTS, 100 KHZ.
003744 013737 001024 001020 T24A:   MOV     @#DEL1,@#TEMP
003752 062737 000001 001020         ADD     #1,@#TEMP
003760 001374                       BNE     .-6
003762 042777 000001 175010         BIC     #1,@CSR
003770 104000                       HLT                         ;ERROR, INTERRUPT FAILED TO OCCUR
003772 000406                       BR      T24C
003774 022626               T24B:   CMP     (6)+,(6)+           ;POP STACK
003776 005237 001016                INC     TEMP1               ;DONE 100 INTERRUPTS?
004002 001360                       BNE     T24A                ;NO
004004 005077 174770                CLR     @CSR                ;CLEAR CLOCK


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

004010 104400       T24C:   SCOPE
004012 005003               CLR     %3                  ;
004014 032777 000020 175022         BIT     #20,@SR
004022 001002                       BNE     1$          ;
004024 000137 004264                JMP     T25         ;
004030 012777 010000 174744 1$:     MOV     #10000,@CSB ;LOAD COUNTER
004036 012777 000001 174734         MOV     #1,@CSR     ;GO COUNT DOWN, 100 KHZ
004044 017700 174734                MOV     @CTR,%0     ;SAVE CTR
004050 020027 010000                CMP     %0,#10000   ;DID COUNT INCREASE?
004054 101404                       BLOS    2$          ;BRANCH IF OK TO 1$
004056 010037 001020                MOV     %0,@#TEMP           ;
```

```
                                        HLT                     ;SYNC ERROR
                                        BR      T24D            ;END TEST
004066  005077  174706          2$:     CLR     @CSR            ;CLR CSR
004072  005203                          INC     %3              ;NO OF TIMES THROUGH PROGRAM DETECTS 2(16)
004074  001355                          BNE     1$              ;2(16) YET, IF NOT GO BACK TO LOOP 1


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


004076  104400                  T24D:   SCOPE
004100  017746  174702                  MOV     @CKV,-(%6)      ;SAVE CLOCK VECTOR
004104  012777  000340  002526          MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
004112  005037  004246                  CLR     TIKTIK          ;CLEAR CLOCK COUNTER
004116  005037  006632                  CLR     CNT             ;CLEAR ITERATION COUNT
004122  012777  004240  174656          MOV     #CLKSER,@CKV    ;SETUP INTR SERVICE RTN
004130  012777  000300  174652          MOV     #300,@CKVS      ;SETUP INTR PSW
004136  012777  000010  174636          MOV     #10,@CSB        ;KW11 COUNT = 10
004144  012777  000111  174626          MOV     #111,@CSR       ;SET TO RUN @100KH
                                                                ;INTR ENABLE & COUNT DOWN
                                                                ;AND REPEAT INTR MODE
004152                          LOOP:
004152  012777  000340  002460          MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
004160  004737  004250                  JSR     PC,TYPE         ;100MS DELAY @PR7
004164  005077  002450                  CLR     @PSW            ;PS=0 ALLOWS INTRS
004170  013701  004246                  MOV     TIKTIK,R1       ;GET CURRENT CLK COUNT
004174  004737  004250                  JSR     PC,TYPE         ;100MS DELAY @PR0
004200  023701  004246                  CMP     TIKTIK,R1       ;ANY INTRS DURING DELAY?
004204  001001                          BNE     1$              ;IF YES,GO TO 1$
004206  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
004210                          1$:
004210  005237  006632                  INC     CNT
004214  022737  000170  006632          CMP     #120.,CNT       ;120 ITERATIONS?
004222  001353                          BNE     LOOP            ;IF NOT,GO BACK TO LOOP
004224  012677  174556                  MOV     (%6)+,@CKV      ;ELSE RESTORE THE VECTOR
004230  005077  174544                  CLR     @CSR            ;CLEAR CONTROL REG
004234  000137  004264                  JMP     T25             ;AND GO TO NEXT TEST

004240                          CLKSER:
004240  005237  004246                  INC     TIKTIK          ;INC CLK COUNTER
004244                          CLKXIT:
004244  000002                          RTI                     ;ELSE EXIT RTN

004246  000000                  TIKTIK: 0

004250  105777  174540          TYPE:   TSTB    @TCSR           ;READY TO SEND
004254  100375                          BPL     TYPE            ;BR IF NOT
004256  110077  174530                  MOVB    R0,@TDBR        ;SEND THEM A MESSAGE
```

```
                                                RTS     PC
                                        ;TEST 100 KHZ REPEATABILITY
                                        T25:    SCOPE
004264  104400
004266  032777  000004  174550                  BIT     #4,@SR          ;ARE TWO CLK'S PRESENT
004274  001002                                  BNE     3$              ;BRANCH IF SW#2 IS UP
004276  000137  004740                          JMP     T27             ;EXIT IF ONLY ONE CLK
004302  005077  174472                  3$:     CLR     @CSR
004306  012777  000000  174466                  MOV     #0,@CSB         ;SET CTR
004314  012777  000021  174456                  MOV     #21,@CSR        ;COUNT UP 100KHZ GO
004322  004537  004416                          JSR     R5,DELY         ;GO TO DELAY SUBROUTINE
004326  105777  174446                          TSTB    @CSR            ;TEST DONE BIT SET
004332  100001                                  BPL     1$
004334  104000                                  HLT                     ;DONE BIT SET TOO SOON
004336  017737  174442  001020          1$:     MOV     @CTR,@#TEMP     ;DONE NOT SET SO SAVE CTR
004344  005077  174430                          CLR     @CSR
004350  012777  000000  174424                  MOV     #0,@CSB
004356  012777  000021  174414                  MOV     #21,@CSR
004364  004537  004416                          JSR     R5,DELY
004370  105777  174404                          TSTB    @CSR
004374  100001                                  BPL     2$
004376  104000                                  HLT
004400  017737  174400  001016          2$:     MOV     @CTR,@#TEMP1    ;HERE WE ARE SAVING SEC CNT
004406  004537  004446                          JSR     R5,CACL         ;GO DETERMINE ACCURACY OF CNT'S
004412  104000                                  HLT
004414  000432                                  BR      T25A

004416  005077  002154                  DELY:   CLR     @CSR1           ;DELAY SUBROUTINE
004422  012777  001130  002144                  MOV     #1130,@CSB1
004430  012777  000021  002140                  MOV     #21,@CSR1
004436  105777  002134                  1$:     TSTB    @CSR1           ;WAIT 600 MIL.
004442  100375                                  BPL     1$
004444  000205                                  RTS     R5

004446  013700  001020                  CACL:   MOV     @#TEMP,R0       ;COMPARE CTR1 WITH CTR2
004452  013701  001016                          MOV     @#TEMP1,R1
004456  160001                                  SUB     R0,R1
004460  100001                                  BPL     1$
004462  005401                                  NEG     R1
004464  022701  000005                  1$:     CMP     #5,R1           ;DIFFERENCE MUST BE LESS THAN 5
004470  002401                                  BLT     2$
004472  005725                                  TST     (R5)+           ;UPDATE RETURN
004474  010137  001020                  2$:     MOV     R1,TEMP         ;DEFRENCE FOR PRINT OUT
004500  000205                                  RTS     R5

                                        ;TEST 10 KHZ REPEATABILITY
                                        ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
                                        ;FOR 10KHZ.
004502  104400                          T25A:   SCOPE
004504  005077  174270                          CLR     @CSR
004510  012777  000000  174264                  MOV     #0,@CSB
004516  012777  000023  174254                  MOV     #23,@CSR
```

```
1045  004524  004537  004416                    JSR     R5,DELY
1046  004530  105777  174244                    TSTB    @CSR
1047  004534  100001                            BPL     1$
1048  004536  104000                            HLT
1049  004540  017737  174240  001020  1$:       MOV     @CTR,@#TEMP
1050  004546  005077  174226                    CLR     @CSR
1051  004552  012777  000000  174222            MOV     #0,@CSB
1052  004560  012777  000023  174212            MOV     #23,@CSR
1053  004566  004537  004416                    JSR     R5,DELY
1054  004572  105777  174202                    TSTB    @CSR
1055  004576  100001                            BPL     2$
1056  004600  104000                            HLT
1057  004602  017737  174176  001016  2$:       MOV     @CTR,@#TEMP1
1058  004610  004537  004446                    JSR     R5,CACL
1059  004614  104000                            HLT
1060
1061                                    ;TEST LINE REPEATABILITY
1062                                    ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
1063                                    ;FOR LINE FREQ.
1064  004616  104400                    T26:    SCOPE
1065  004620  005737  006252                    TST     @#XORFLG
1066  004624  100445                            BMI     T27
1067  004626  005077  174146                    CLR     @CSR
1068  004632  012777  000000  174142            MOV     #0,@CSB
1069  004640  012777  000025  174132            MOV     #25,@CSR
1070  004646  004537  004416                    JSR     R5,DELY
1071  004652  105777  174122                    TSTB    @CSR
1072  004656  100001                            BPL     1$
1073  004660  104000                            HLT
1074  004662  017737  174116  001020  1$:       MOV     @CTR,@#TEMP
1075  004670  005077  174104                    CLR     @CSR
1076  004674  012777  000000  174100            MOV     #0,@CSB
1077  004702  012777  000025  174070            MOV     #25,@CSR
1078  004710  004537  004416                    JSR     R5,DELY
1079  004714  105777  174060                    TSTB    @CSR
1080  004720  100001                            BPL     2$
1081  004722  104000                            HLT
1082  004724  017737  174054  001016  2$:       MOV     @CTR,@#TEMP1
1083  004732  004537  004446                    JSR     R5,CACL
1084  004736  104000                            HLT
1085                                    ;TEST ERROR (BIT 15) TO SET WHEN INTERRUPT IS NOT SERVICED IN REPEAT MODE
1086  004740  104400                    T27:    SCOPE
1087  004742  005077  174032                    CLR     @CSR
1088  004746  012737  000340  177776            MOV     #340,CC                 ;SET PROCESSOR PRIORITY 7
1089  004754  012777  000002  174020            MOV     #2,@CSB                 ;SET COUNTER FOR FAST INTERRUPTS
1090  004762  012777  000111  174010            MOV     #111,@CSR               ;INT EN, REPEATED INT, DOWN COUNT, 100 KHZ. GO
1091  004770  013737  001024  001020            MOV     @#DEL1,@#TEMP
1092  004776  062737  000001  001020            ADD     #1,@#TEMP
1093  005004  001374                            BNE     .-6
1094  005006  005777  173766                    TST     @CSR
1095  005012  100404                            BMI     1$
1096  005014  042777  000001  173756            BIC     #1,@CSR
1097  005022  104000                            HLT                             ;ERROR, ERROR (BIT 15) NOT SET
1098  005024  005077  173750          1$:       CLR     @CSR
1099  005030  005777  173744                    TST     @CSR
1100  005034  100001                            BPL     .+4
```

```
1101   005036  104000                          HLT                     ;ERR, FAILED TO CLEAR WHEN REF.
1102                                   ;TEST BIT 15 IS CLEARED BY INIT
1103   005040  104400                 T27A:   SCOPE
1104   005042  012737  000340  177776          MOV     #340,@CC
1105   005050  012777  000002  173724          MOV     #2,@CSB
1106   005056  012777  000111  173714          MOV     #111,@CSR
1107   005064  013737  001024  001020          MOV     @#DEL1,@#TEMP
1108   005072  062737  000001  001020          ADD     #1,@#TEMP
1109   005100  001374                          BNE     .-6
1110   005102  005777  173672                  TST     @CSR
1111   005106  100404                          BMI     1$
1112   005110  042777  000001  173662          BIC     #1,@CSR
1113   005116  104000                          HLT                     ;BIT 15 NOT SET
1114   005120  000005                  1$:     RESET
1115   005122  005777  173652                  TST     @CSR
1116   005126  100001                          BPL     .+4
1117   005130  104000                          HLT                     ;BIT 15 NOT CLEARED BY RESET
1118   005132  104400                          SCOPE
1119
1120                                   ;BELL ON PASS COMPLETE
1121   005134  012777  000207  173650 TSTEND: MOV     #207,@TDBR
1122   005142  105777  173646                  TSTB    @TCSR
1123   005146  100375                          BPL     .-4
1124   005150  012777  000000  173634          MOV     #0,@TDBR        ;SEND A NULL CHAR.
1125   005156  105777  173632                  TSTB    @TCSR
1126   005162  100375                          BPL     .-4
1127   005164  013702  000042                  MOV     @#42,%2
1128   005170  001405                          BEQ     TRPA
1129   005172  000005                          RESET
1130   005174  004712                  LOGICAL:        JSR     %7,(2)
1131   005176  000240                          NOP
1132   005200  000240                          NOP
1133   005202  000240                          NOP
1134   005204  000137  001150          TRPA:   JMP     BEGIN
```

```
1135
1136                                    .SBTTL          TIMING TEST
1137                                    ;RING TELETYPE BELL AT 10 SECOND INTERVALS USING REPEATED INTERRUPT MODE
1138                                    ;1ST MINUTE = 100 KHZ
1139                                    ;2ND MINUTE = 10 KHZ
1140                                    ;3RD MINUTE = LINE
1141                                    ;4TH MINUTE = EXTERNAL
1142
1143  005210  012706  000776           BEGIN1: MOV     #BUFF,%6
1144  005214  004737  011652                   JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1145  005220  013777  001010  173560           MOV     CKVS,@CKV
1146  005226  012777  000002  173554           MOV     #RTI,@CKVS
1147  005234  012737  005602  000024           MOV     #PWRF2,24       ;INIT POWER FAIL POINTER
1148  005242  000005                           RESET
1149                                    ;100 KHZ
1150  005244  012777  141520  173530           MOV     #50000.,@CSB    ;INIT COUNT SET BUFFER FOR .5 SECONDS
1151  005252  012700  177772                   MOV     #-6,%0          ;COUNT 6(10 SECOND) INTERVALS
1152  005256  012701  177754           T28:    MOV     #-20.,%1        ;COUNT 20(.5 SECOND) INTERVALS
1153  005262  012777  000111  173510           MOV     #111,@CSR       ;100 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1154  005270  000001                   T28A:   WAIT
1155  005272  005201                           INC     %1              ;DONE 10 SECONDS?
1156  005274  001375                           BNE     T28A            ;NO
1157  005276  105777  173512                   TSTB    @TCSR
1158  005302  100375                           BPL     .-4
1159  005304  012777  000207  173500           MOV     #207,@TDBR
1160  005312  005200                           INC     %0              ;DONE 6 TIMES?
1161  005314  001360                           BNE     T28             ;NO
1162  005316  042777  000101  173454           BIC     #101,@CSR       ;YES DISABLE INTERRUPTS
1163                                    ;10 KHZ
1164  005324  012777  011610  173450           MOV     #5000.,@CSB     ;INIT COUNT SET BUFFER FOR .5 SECONDS
1165  005332  012700  177772                   MOV     #-6,%0          ;COUNT 6(10SECOND) INTERVALS
1166  005336  012701  177754           T29:     MOV     #-20.,%1        ;COUNT 20(.5 SECOND) INTERVALS
1167  005342  012777  000113  173430           MOV     #113,@CSR       ;10 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1168  005350  000001                   T29A:   WAIT
1169  005352  005201                           INC     %1              ;DONE 10 SECONDS?
1170  005354  001375                           BNE     T29A            ;NO
1171  005356  105777  173432                   TSTB    @TCSR           ;YES, RING BELL
1172  005362  100375                           BPL     .-4
1173  005364  012777  000207  173420           MOV     #207,@TDBR
1174  005372  005200                           INC     %0              ;DONE 6 TIMES?
1175  005374  001360                           BNE     T29             ;NO
1176  005376  042777  000101  173374           BIC     #101,@CSR       ;YES, DISABLE INTERRUPTS
1177                                    ;SET UP FOR 10 SECONDS AT LINE FREQ.
1178  005404  005737  006252                   TST     @#XORFLG
1179  005410  100677                           BMI     BEGIN1
1180  005412  012737  001130  005570           MOV     #600.,LINE
1181  005420  032777  000002  173416           BIT     #2,@SR
1182  005426  001403                           BEQ     .+10
1183  005430  012737  000764  005570           MOV     #500.,LINE
1184                                    ;LINE
1185  005436  013777  005570  173336           MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
1186  005444  012700  177772                   MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
1187  005450  012777  000115  173322           MOV     #115,@CSR       ;LINE, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
1188  005456  000001                   T30:    WAIT
1189  005460  105777  173330                   TSTB    @TCSR
1190  005464  100375                           BPL     .-4
```

```
 1191   005466   012777   000207   173316          MOV     #207,@TDBR      ;RING BELL
 1192   005474   005200                           INC     %0              ;DONE 6 TIMES
 1193   005476   001367                           BNE     T30             ;NO
 1194   005500   042777   000101   173272          BIC     #101,@CSR       ;YES--DISABLE INTERRUPTS
 1195   005506   032777   000001   173330          BIT     #1,@SR          ;
 1196   005514   001235                           BNE     BEGIN1          ;
 1197                                    ;EXTERNAL (LINE FOR MAINTENANCE)
 1198   005516   013777   005570   173256          MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
 1199   005524   012700   177772                   MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
 1200   005530   012777   000117   173242          MOV     #117,@CSR       ;EXT FREQ, REPEATED INTERRUPTS, INTERRUPT ENABLE , GO
 1201   005536   000001                   T31:    WAIT
 1202   005540   105777   173250                   TSTB    @TCSR
 1203   005544   100375                           BPL     .-4
 1204   005546   012777   000207   173236          MOV     #207,@TDBR      ;RING BELL
 1205   005554   005200                           INC     %0              ;DONE 6 TIMES
 1206   005556   001367                           BNE     T31             ;NO
 1207   005560   042777   000100   173212          BIC     #100,@CSR       ;YES, DISABLE INTERRUPTS
 1208   005566   000610                           BR      BEGIN1          ;REPEAT
 1209   005570   001130                   LINE:   600.
```

```
1210                                        .SBTTL      SUBROUTINES
1211                                        ;POWER FAIL HANDLERS
1212  005572  012737  001150  005646  PWRF1:  MOV     #BEGIN,PWRRTN
1213  005600  000403                        BR      PWRDWN
1214  005602  012737  005210  005646  PWRF2:  MOV     #BEGIN1,PWRRTN
1215  005610  012737  005620  000024  PWRDWN: MOV     #PWRUP,24
1216  005616  000000                        HALT
1217  005620  012706  000776          PWRUP:  MOV     #BUFF,%6
1218  005624  005000                        CLR     %0
1219  005626  005200                        INC     %0
1220  005630  001376                        BNE     .-2
1221  005632  012702  006472                MOV     #MSGPWR,%2
1222  005636  004737  006266                JSR     %7,TOP
1223  005642  000177  000000                JMP     @PWRRTN
1224  005646  001150          PWRRTN: BEGIN
1225
1226                                        ;ENTERED WITH SYSTEM TRAP CALL (HLT)
1227                                        ;PRINT PC, STATUS REGISTER, COMAND REGISTER, BYTE COUNT, CURRENT ADDRESS,  DATA
1228  005650  037727  173170  020000  PRINT:  BIT     @SR,#20000          ;TEST FOR INHIBIT PRINT OUT
1229  005656  001401                        BEQ     .+4                 ;BRANCH TO PRINT
1230  005660  000002                        RTI                         ;INHIBIT, RETURN TO MAIN STREAM
1231  005662  012702  006370                MOV     #MSG1,%2
1232  005666  005737  005764                TST     PRINT1
1233  005672  001402                        BEQ     .+6
1234  005674  012702  006432                MOV     #MSG2,%2
1235  005700  004737  006266                JSR     %7,TOP              ;PRINT ERROR HEADING
1236  005704  005237  005764                INC     PRINT1
1237  005710  011602                        MOV     (6),%2
1238  005712  162702  000002                SUB     #2,%2
1239  005716  004737  005766                JSR     %7,OCTPRT           ;PRINT PC
1240  005722  017702  173052                MOV     @CSR,%2
1241  005726  004737  005766                JSR     %7,OCTPRT           ;PRINT STATUS REGISTER
1242  005732  017702  173046                MOV     @CTR,%2
1243  005736  004737  005766                JSR     %7,OCTPRT           ;PRINT COUNTER
1244  005742  013702  001020                MOV     TEMP,%2
1245  005746  004737  005766                JSR     %7,OCTPRT           ;PRINT TEMP
1246  005752  005777  173066                TST     @SR                 ;CHECK SR FOR HALT SWITCH
1247  005756  100001                        BPL     .+4
1248  005760  000000                        HALT                        ;HALT ON ERROR UP
1249  005762  000002                        RTI                         ;RETURN TO MAINLINE
1250  005764  000000          PRINT1: 0
1251                                        ;PRINT OCTAL VALUE IN REGISTER2
1252  005766  012737  000060  006100  OCTPRT: MOV     #'0,CHAR            ;INITIALIZE 1ST NUMBER AS 0
1253  005774  005702                        TST     %2                  ;IS VALUE POSITIVE
1254  005776  100003                        BPL     OCT1                ;YES PRINT 0
1255  006000  012737  000061  006100        MOV     #'1,CHAR            ;NO PRINT 1
1256  006006  004737  006102          OCT1:   JSR     %7,OCTP
1257  006012  006102                        ROL     %2
1258  006014  006102                        ROL     %2
1259  006016  012737  177773  006076        MOV     #-5,OCT             ;COUNT 5 DIGITS
1260  006024  006102          OCT2:   ROL     %2
1261  006026  006102                        ROL     %2
1262  006030  006102                        ROL     %2
1263  006032  010237  006100                MOV     %2,CHAR             ;SAVE DIGIT
1264  006036  042737  177770  006100        BIC     #177770,CHAR        ;CLEAR OTHER BITS
1265  006044  052737  000060  006100        BIS     #60,CHAR            ;MAKE ASCII DIGIT
```

```
1266  006052  006002                        ROR     %2
1267  006054  004737  006102                JSR     %7,OCTP                 ;PRINT
1268  006060  006102                        ROL     %2
1269  006062  005237  006076                INC     OCT                     ;+1 TO DIGIT COUNT
1270  006066  001356                        BNE     OCT2                    ;NOT DONE
1271  006070  004737  006120                JSR     %7,SP3
1272  006074  000207                        RTS     %7                      ;EXIT
1273  006076  000000              OCT:      0
1274  006100  000000              CHAR:     0
1275  006102  105777  172706      OCTP:     TSTB    @TCSR
1276  006106  100375                        BPL     .-4                     ;WAIT FOR READY
1277  006110  013777  006100  172674        MOV     CHAR,@TDBR              ;PRINT
1278  006116  000207                        RTS     %7
1279                              ;TYPE 3 SPACES
1280  006120  012702  006132      SP3:      MOV     #SP3A,%2
1281  006124  004737  006266                JSR     %7,TOP
1282  006130  000207                        RTS     %7
1283  006132  020057  027440      SP3A:     .ASCII  ;/  /;
1284                                        .EVEN
1285
1286  006136  022606              SCOPEB:   CMP     (6)+,%6                 ;REPOSITION THE STACK
1287  006140  012637  177776                MOV     (6)+,CC
1288  006144  000177  000114                JMP     @RETURN                 ;SCOPE RETURN
1289
1290                              ;SCOPE OR/AND ITERATION LOOP FOR EACH TEST
1291  006150  032777  040000  172666  SCOPEC:  BIT     #40000,@SR              ;TEST SR FOR SCOPE
1292  006156  001367                        BNE     SCOPEB                  ;YES SCOPE
1293  006160  005737  006252                TST     @#XORFLG
1294  006164  100011                        BPL     1$
1295  006166  013746  000004                MOV     @#4,-(%6)
1296  006172  012737  006254  000004        MOV     #XORA,@#4
1297  006200  005737  177060                TST     @#177060
1298  006204  012637  000004                MOV     (%6)+,@#4               ;RESTORE STACK
1299  006210  032777  004000  172626  1$:    BIT     #4000,@SR               ;NO - TEST FOR ITERATION
1300  006216  001007                        BNE     SCOPEG                  ;INHIBIT ITERATION
1301  006220  023737  006250  001022        CMP     SCOPEF,ICOUNT
1302  006226  001403                        BEQ     SCOPEG                  ;EXIT - DONE
1303  006230  005237  006250                INC     SCOPEF                  ;INCREMENT COUNT
1304  006234  000740                        BR      SCOPEB                  ;LOOP SOME MORE
1305  006236  005037  006250      SCOPEG:   CLR     SCOPEF                  ;CLEAR COUNT
1306  006242  011637  006264                MOV     @%6,RETURN              ;SAVE SCOPE RETURN POINTER
1307  006246  000002                        RTI                             ;RETURN INLINE-NEXT TEST
1308  006250  000000              SCOPEF:   0                               ;COUNT LOCATION FOR INTERATION LOOP
1309  006252  000000              XORFLG:   0
1310  006254  022626              XORA:     CMP     (%6)+,(%6)+
1311  006256  012637  000004                MOV     (%6)+,@#4
1312  006262  000725                        BR      SCOPEB
1313  006264  001150              RETURN:   BEGIN                           ;ADDRESS OF LAST TEST
1314                              ;MOV ADDRESS OF MESSAGE TO REGISTER 2
1315                              ;THEN JSR %7,TOP
1316  006266  142777  000177  172520  TOP:  .  BICB    #177,@TCSR              ;CLR INT FLAG
1317  006274  112237  006366                MOVB    (2)+,EOMK               ;MOVE IN EOM MARKER
1318  006300  121237  006366      TOP1:     CMPB    @%2,EOMK                ;COMPARE FOR EOM
1319  006304  001001                        BNE     .+4                     ;NO
1320  006306  000207                        RTS     %7                      ;YES, EXIT
1321  006310  121227  000100                CMPB    @%2,#'@
```

```
1322  006314  001406                        BEQ     TOP2
1323  006316  105777  172472                TSTB    @TCSR                   ;CK TTY
1324  006322  100375                        BPL     .-4                     ;WAIT FOR DONE
1325  006324  112277  172462                MOVB    (2)+,@TDBR              ;MOVE CHARACTER
1326  006330  000763                        BR      TOP1                    ;BRANCH BACK
1327  006332  105777  172456          TOP2: TSTB    @TCSR
1328  006336  100375                        BPL     .-4
1329  006340  112777  000215  172444        MOVB    #215,@TDBR              ;SEND CARRIAGE RETURN
1330  006346  105777  172442                TSTB    @TCSR
1331  006352  100375                        BPL     .-4
1332  006354  112777  000212  172430        MOVB    #212,@TDBR              ;SEND LINE FEED
1333  006362  005202                        INC     %2                      ;INCRMTN R2
1334  006364  000745                        BR      TOP1                    ;NO EOM, SO LOOP
1335  006366     000                  EOMK: .BYTE   0
1336             006370                     .EVEN
1337  006370  040057  020040  041520  MSG1: .ASCII  ;/@  PC    STATUS  COUNTER  TEMP@/;
1338  006376  020040  020040  052123
1339  006404  052101  051525  020040
1340  006412  047503  047125  042524
1341  006420  020122  052040  046505
1342  006426  040120     057
1343             006432                     .EVEN
1344  006432  040057     057          MSG2: .ASCII  ;/@/;
1345             006436                     .EVEN
1346  006436  040057  055103  053513  MSG3: .ASCII  ;/@CZKWBI KW11-P RT CLK TST@/;
1347  006444  044502  045440  030527
1348  006452  026461  020120  052122
1349  006460  041440  045514  052040
1350  006466  052123  027500
1351                                        .EVEN
1352  006472  040057  042522  052123  MSGPWR: .ASCII  ;/@RESTARTING AFTER A POWER FAILURE@@/;
1353  006500  051101  044524  043516
1354  006506  040440  052106  051105
1355  006514  040440  050040  053517
1356  006522  051105  043040  044501
1357  006530  052514  042522  040100
1358  006536     057
1359             006540                     .EVEN
1360  006540  040057  047531  020125  XORM:  .ASCII  ;/@YOU ARE ON AN XOR TESTER@/;
1361  006546  051101  020105  047117
1362  006554  040440  020116  047530
1363  006562  020122  042524  052123
1364  006570  051105  027500
1365                                        .EVEN
1366                                  ;TIMER FOR KW11-P CLOCK
1367                                  ;
1368  006574  172562                  CSB1:   172562
1369  006576  172560                  CSR1:   172560
1370  006600  172564                  CTR1:   172564
1371  006602  000504                  CKV1:   504
1372  006604  000506                  CKVS1:  506
1373  006606  000000                  CLKFLG: 0
1374  006610  000000                  INTFLG: 0
1375  006612  177566                  PDBR:   177566
1376  006614  177564                  PCSR:   177564
1377  006616  000064                  PVEC:   64
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```
1378  006620  000066                PVECS:  66
1379  006622  177562                KDBR:   177562
1380  006624  177560                KCSR:   177560
1381  006626  000060                KVEC:   60
1382  006630  000062                KVECS:  62
1383  006632  000000                CNT:    0
1384  006634  000000                CNT1:   0
1385  006636  000000                CNTB:   0
1386          000211                CTRLI=211
1387          000224                CTRLT=224
1388  006640  177776                PSW:    177776
1389  006642  000000                HRS1:   0
1390  006644  000000                HRS2:   0
1391  006646  000000                MIN1:   0
1392  006650  000000                MIN2:   0
1393  006652  000000                SEC1:   0
1394  006654  000000                SEC2:   0
1395  006656  000000                LST:    0
1396  006660  000000                MST:    0
1397  006662  000000                HRS1A:  0
1398  006664  000000                HRS2A:  0
1399  006666  000000                MIN1A:  0
1400  006670  000000                MIN2A:  0
1401  006672  000000                SEC1A:  0
1402  006674  000000                SEC2A:  0
1403  006676  000000                LSTA:   0
1404  006700  000000                MSTA:   0
1405  006702  000000                TMPSWR: 0               ;TEMP LOC FOR SOFT-SWR CONTENTS
1406  006704     000                BYT1:   .BYTE 0         ;LOC FOR 1ST # INPUT VIA TTY
1407  006705     000                BYT2:   .BYTE 0         ;  "   "  2ND  "   "   "   "
1408  006706     000                BYT3:   .BYTE 0         ;  "   "  3RD  "   "   "   "
1409  006707     000                BYT4:   .BYTE 0         ;  "   "  4TH  "   "   "   "
1410  006710     000                BYT5:   .BYTE 0         ;  "   "  5TH  "   "   "   "
1411  006711     000                BYT6:   .BYTE 0         ;  "   "  6TH  "   "   "   "
1412  006712     000                BYT7:   .BYTE 0         ;  "   "  7TH  "   "   "   "
1413          006714                .EVEN
1414
1415
1416
1417
1418  006714  012706  000776        K100HZ: MOV     #BUFF,%6
1419  006720  004737  011652                JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1420  006724  005077  177710                CLR     @PSW
1421  006730  012737  000000  007674        MOV     #0,CLK+2                ;100KHZ
1422  006736  012737  000131  007702        MOV     #131,CLK1+2
1423  006744  012700  010356                MOV     #TABL,%0
1424  006750  012701  010376                MOV     #TABL1,%1
1425  006754  004537  007234                JSR     %5,@#MOVE
1426  006760  012737  000043  010506        MOV     #35.,CLK3+2             ;LEAST VALUE
1427  006766  012737  001217  010536        MOV     #655.,CLK4+2            ;MOST VALUE
1428  006774  000137  007250                JMP     @#INIT
1429
1430  007000  012706  000776        K10HZ:  MOV     #BUFF,%6
1431  007004  004737  011652                JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1432  007010  005077  177624                CLR     @PSW
1433  007014  012737  164217  007674        MOV     #-13561,CLK+2           ;10KHZ
```

```
1434  007022  012737  000133  007702          MOV     #133,CLK1+2
1435  007030  012700  010356                  MOV     #TABL,%0
1436  007034  012701  010416                  MOV     #TABL2,%1
1437  007040  004537  007234                  JSR     %5,@#MOVE
1438  007044  012737  000000  010506          MOV     #0.,CLK3+2
```

```
 1439  007052  012737  001130  010536          MOV     #600.,CLK+2
 1440  007060  000137  007250                  JMP     @#INIT
```

```
 1441
 1442  007064  012706  000776          H60Z:   MOV     #BUFF,%6        ;
 1443  007070  004737  011652                  JSR     %7,SWAD         ;HAS THIS CPU HAVE A SWITCH REG.?
 1444  007074  005077  177540                  CLR     @PSW            ;
```

```
  1445  007100  012737  177733  007674          MOV     #-45,CLK+2              ;60HZ
```

```
 1446  007106  012737  000135  007702          MOV     #135,CLK1+2
```

```
1447  007114  012700  010356              MOV     #TABL,%0
1448  007120  012701  010436              MOV     #TABL3,%1
1449  007124  004537  007234              JSR     %5,@#MOVE
1450  007130  012737  000000  010506      MOV     #0O,CLK3+2
1451  007136  012737  001130  010536      MOV     #600.,CLK4+2
1452  007144  000137  007250              JMP     @#INIT
1453
1454  007150  012706  000776        H50Z: MOV     #BUFF,%6
1455  007154  004737  011652              JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1456  007160  005077  177454              CLR     @PSW            ;
1457  007164  012737  177742  007674      MOV     #-36.,CLK+2     ;50HZ
1458  007172  012737  000135  007702      MOV     #135,CLK1+2
1459  007200  012700  010356              MOV     #TABL,%0
1460  007204  012701  010456              MOV     #TABL4,%1
1461  007210  004537  007234              JSR     %5,@#MOVE
1462  007214  012737  000000  010506      MOV     #0.,CLK3+2
1463  007222  012737  001104  010536      MOV     #580.,CLK4+2
1464  007230  000137  007250              JMP     @#INIT
1465
1466  007234  012702  177771        MOVE: MOV     #-7,%2
1467  007240  012120              1$:     MOV     (%1)+,(%0)+
1468  007242  005202                      INC     %2
1469  007244  001375                      BNE     1$
1470  007246  000205                      RTS     %5
1471
1472  007250  013737  005572  000024 INIT: MOV     PWRF1,24        ;
1473  007256  012706  000776              MOV     #BUFF,%6        ;INITIALIZE
1474  007262  005037  006656              CLR     @#LST
1475  007266  005037  006660              CLR     @#MST
1476  007272  012737  000060  006642      MOV     #60,@#HRS1
1477  007300  012737  000060  006644      MOV     #60,@#HRS2
1478  007306  012737  000060  006646      MOV     #60,@#MIN1
1479  007314  012737  000060  006650      MOV     #60,@#MIN2
1480  007322  012737  000060  006652      MOV     #60,@#SEC1
1481  007330  012737  000060  006654      MOV     #60,@#SEC2
1482  007336  012777  010476  171442      MOV     #CLKI,@CKV
1483  007344  012777  000340  171436      MOV     #340,@CKVS
1484  007352  012777  007560  177246      MOV     #KINTR,@KVEC
1485  007360  012777  000200  177242      MOV     #200,@KVECS
1486  007366  012777  000200  177224      MOV     #200,@PVECS
1487  007374  012777  000100  177222      MOV     #100,@KCSR
1488  007402  005037  006606              CLR     @#CLKFLG
1489  007406  005037  006610              CLR     @#INTFLG
1490  007412  005077  171362        START: CLR     @CSR
1491  007416  005077  171360              CLR     @CSB
1492  007422  032777  000002  171414 WAITA: BIT     #2,@SR          ;WAIT LOOP, SW 1 CAUSE WAIT
1493  007430  001401                      BEQ     CLKON
1494  007432  000001              WAITB:  WAIT
1495  007434  032777  000001  171402 CLKON: BIT     #1,@SR          ;SW 0 TURNS ON CLK2
1496  007442  001432                      BEQ     3$
1497  007444  032777  000004  171372      BIT     #4,@SR          ;SW 2 DETERMINES PRESENCE OF CLOCK 2
1498  007452  001426                      BEQ     3$
1499  007454  005737  006606              TST     @#CLKFLG        ;CLKFLG ALLOW CLK 2 TO BE TURNED ON
1500  007460  001360                      BNE     WAITA           ;ONLY ONCE
1501  007462  005077  177106              CLR     @CSB1
1502  007466  012777  007762  177106      MOV     #KOUT,@CKV1
```

```
1503  007474  012777  000200  177102          MOV     #200,@CKVS1
1504  007502  012737  177777  006606          MOV     #-1,@#CLKFLG
1505  007510  012777  141521  177056          MOV     #141521,@CSB1
1506  007516  012777  000113  177052          MOV     #113,@CSR1              ;TURN ON CLK 2
1507  007524  000137  007432                  JMP     WAITB
1508  007530  005037  006606          3$:     CLR     @#CLKFLG                ;CLEAR CLK 2 IF PRESENT
1509  007534  032777  000004  171302          BIT     #4,@SR
1510  007542  001404                          BEQ     4$
1511  007544  005077  177026                  CLR     @CSR1
1512  007550  005077  177020                  CLR     @CSB1
1513  007554  000137  007422          4$:     JMP     WAITA
1514
1515  007560  017701  177036          KINTR:  MOV     @KDBR,%1                ;KEYBOARD INTERRUPT HANDLER
1516  007564  042701  177600                  BIC     #177600,%1              ;STRIP JUNK
1517  007570  022701  000007                  CMP     #7,%1           ;IS CHAR A ↑G(CONTROL-G)?
1518  007574  001557                          BEQ     CNGSWR          ;IF YES,GO TO CNGSWR
1519  007576  022701  000011                  CMP     #11,%1          ;IS IT A CNTRL I ?
1520  007602  001404                          BEQ     KIN
1521  007604  022701  000024                  CMP     #24,%1          ;IS IT A CNTRL T ?
1522  007610  001464                          BEQ     KOUT
1523  007612  000002                          RTI
1524
1525
1526  007614  005077  171160          KIN:    CLR     @CSR                    ;HANDLER FOR CTRL I
1527  007620  005077  171156                  CLR     @CSB                    ;SETUP TIME OF DAY
1528  007624  012737  177772  006632          MOV     #-6,@#CNT
1529  007632  012737  006642  006634          MOV     #HRS1,@#CNT1            ;INPUT
1530  007640  005037  006656                  CLR     LST
1531  007644  005037  006660                  CLR     MST
1532  007650  012777  007710  176750          MOV     #KINI,@KVEC
1533  007656  000002                          RTI
1534
1535  007660  012777  007560  176740  KINI2:  MOV     #KINTR,@KVEC            ;AWAIT A CHAR TO START
1536  007666  017701  176730                  MOV     @KDBR,%1
1537  007672  012777  000000  171102  CLK:    MOV     #0,@CSB                 ;CLK 1
1538  007700  012777  000131  171072  CLK1:   MOV     #131,@CSR
1539  007706  000002                          RTI
1540
1541  007710  013704  006634          KINI:   MOV     @#CNT1,%4               ;STORE TIME OF DAY
1542  007714  017701  176702                  MOV     @KDBR,%1
1543  007720  042701  000300                  BIC     #300,%1
1544  007724  010124                          MOV     %1,(%4)+
1545  007726  010437  006634                  MOV     %4,@#CNT1
1546  007732  005237  006632                  INC     @#CNT
1547  007736  001003                          BNE     1$
1548  007740  012777  007660  176660          MOV     #KINI2,@KVEC
1549  007746  000002                  1$:     RTI
1550
1551  007750  017737  176646  007760  HOLDIT: MOV     @KDBR,@#HOLD            ;DUMMY INTERRUPT SERVICE ROUTINE
1552  007756  000002                          RTI
1553
1554  007760  000000                  HOLD:   0
1555
1556  007762  005037  006610          KOUT:   CLR     @#INTFLG                ;INPUT HANDLER FOR CTRL T
1557  007766  012777  007750  176632          MOV     #HOLDIT,@KVEC           ;SET DUMMY VECTOR
1558  007774  012700  006642                  MOV     #HRS1,%0                ;GET TIME OF DAY INTO
```

```
1559  010000  012703  006662            MOV     #HRS1A,%3               ;WORK AREA
1560  010004  012704  177770            MOV     #-10,%4
1561  010010  012023            1$:     MOV     (%0)+,(%3)+
1562  010012  005204                    INC     %4
1563  010014  001375                    BNE     1$
1564  010016  017701  170762            MOV     @CTR,%1
1565  010022  005737  006610            TST     @#INTFLG                ;SEE IF CLK HAS INTERRUPTED IN THIS TIME
1566  010026  001355                    BNE     KOUT                    ;CALC VALUE OF CTR
1567  010030  005737  007674            TST     @#CLK+2                 ;IS CLOCK RUNNING AT 100KHZ ?
1568  010034  001416                    BEQ     2$
1569  010036  163701  007674            SUB     @#CLK+2,%1              ;SUB INIT VALUE
1570  010042  006301                    ASL     %1
1571  010044  006301                    ASL     %1
1572  010046  023727  007674  164217    CMP     @#CLK+2,#-13561         ;IS CLOCK RUNNING AT 10KHZ ?
1573  010054  001405                    BEQ     3$
1574  010056  000301            10$:    SWAB    %1
1575  010060  023727  007674  177742    CMP     @#CLK+2,#-36            ;IS CLOCK RUNNING AT 50HZ ?
1576  010066  001001                    BNE     2$
1577  010070  006301            3$:     ASL     %1
1578  010072  005000            2$:     CLR     %0
1579  010074  005003                    CLR     %3
1580  010076  012704  010356    5$:     MOV     #TABL,%4
1581  010102  005701            6$:     TST     %1
1582  010104  100001                    BPL     4$
1583  010106  061403                    ADD     @%4,%3
1584  010110  006301            4$:     ASL     %1
1585  010112  005724                    TST     (%4)+
1586  010114  005200                    INC     %0
1587  010116  022700  000007            CMP     #7,%0
1588  010122  001367                    BNE     6$
1589  010124  060337  006700            ADD     %3,@#MSTA               ;ADD VALUE OF CTR TO MST
1590  010130  000137  010772            JMP     @#CLK2
1591  010134            CNGSWR:
1592  010134  010246                    MOV     %2,-(6)                 ;SAVE R2
1593  010136  010346                    MOV     %3,-(6)                 ;SAVE R3
1594  010140            SETBYT:
1595  010140  005037  006702            CLR     TMPSWR                  ;CLEAR TEMP SWR
1596  010144  005003                    CLR     %3                      ;CLEAR R3
1597  010146  004737  010324            JSR     PC,CRLF                 ;PRINT <CR><LF>
1598  010152  012702  006704            MOV     #BYT1,%2                ;INIT R2 TO 1ST BYTE LOC
1599  010156            CKCSR:
1600  010156  105777  176442            TSTB    @KCSR                   ;IS CHAR TYPED?
1601  010162  100375                    BPL     CKCSR                   ;IF NOT,WAIT
1602  010164  017701  176432            MOV     @KDBR,%1                ;ELSE MOVE THE CHAR TO R1
1603  010170  042701  177600            BIC     #177600,%1              ;STRIP JUNK
1604  010174            5$:
1605  010174  105777  176414            TSTB    @PCSR
1606  010200  100375                    BPL     5$
1607  010202  010177  176404            MOV     %1,@PDBR
1608  010206  122701  000025            CMPB    #25,%1                  ;IS CHAR ↑U (CONTROL-U)?
1609  010212  001752                    BEQ     SETBYT                  ;IF YES,START OVER
1610  010214  122701  000015            CMPB    #15,%1                  ;ELSE IS IT <CR>?
1611  010220  001412                    BEQ     SWDONE                  ;IF EQUAL,GO TO SWDONE
1612  010222  122701  000012            CMPB    #12,%1                  ;IS IT <LF>?
1613  010226  001407                    BEQ     SWDONE                  ;IF EQUAL,GO TO SWDONE
1614  010230  005203                    INC     %3                      ;INDICATE A CHAR INPUTTED
```

```
1615  010232  042701  177770            BIC     #177770,%1      ;LEAVE ONLY BINARY # IN R1
1616  010236  110122                    MOVB    %1,(2)+         ;MOVE # TO PROPER BYTE LOC
1617  010240  022702  006712            CMP     #BYT7,%2        ;IS R2 PAST BYT6 ADDR?
1618  010244  001344                    BNE     CKCSR           ;IF NOT,GO BACK FOR ANOTHER CHAR
1619  010246                    SWDONE:
1620  010246  005703                    TST     %3              ;WAS A CHAR TYPED?
1621  010250  001420                    BEQ     30$             ;IF NOT,EXIT
1622  010252  012703  006704            MOV     #BYT1,%3        ;INIT R3 TO 1ST BYTE ADDR
1623  010256                    10$:
1624  010256  152337  006702            BISB    (3)+,TMPSWR     ;SET LOW 3 BITS OF TMPSWR
1625  010262  020302                    CMP     %3,%2           ;IS R3 EQUAL BYTE ADDR IN R2?
1626  010264  001407                    BEQ     20$             ;IF YES ,EXIT
1627  010266  006137  006702            ROL     TMPSWR          ;ELSE
1628  010272  006137  006702            ROL     TMPSWR          ;SHIFT
1629  010276  006137  006702            ROL     TMPSWR          ;NEXT 3 BITS UP
1630  010302  000765                    BR      10$             ;AND GO GET ANOTHER #
1631  010304                    20$:
1632  010304  013777  006702  170532    MOV     TMPSWR,@SR      ;SET UP NEW SWR
1633  010312                    30$:
1634  010312  012603                    MOV     (6)+,%3         ;RESTORE R3
1635  010314  012602                    MOV     (6)+,%2         ;RESTORE R2
1636  010316  004737  010324            JSR     PC,CRLF         ;PRINT <CR><LF>
1637  010322  000002                    RTI
1638
1639  010324                    CRLF:
1640  010324  105777  176264            TSTB    @PCSR           ;IS TTY READY?
1641  010330  100375                    BPL     CRLF            ;IF NOT,WAIT
1642  010332  012777  000215  176252    MOV     #215,@PDBR      ;ELSE TYPE <CR>
1643  010340                    10$:
1644  010340  105777  176250            TSTB    @PCSR           ;IS TTY READY?
1645  010344  100375                    BPL     10$             ;IF NOT,WAIT
1646  010346  012777  000212  176236    MOV     #212,@PDBR      ;ELSE TYPE <LF>
1647  010354  000207                    RTS     PC
1648
1649  010356  000510            TABL:   328.                    ;TABLE FOR WORK AREA
1650  010360  000244                    164.
1651  010362  000122                    82.
1652  010364  000051                    41.
1653  010366  000024                    20.
1654  010370  000012                    10.
1655  010372  000005                    5.
1656  010374  000003                    3.
1657
1658  010376  000510            TABL1:  328.                    ;100KHZ TIME TABLE
1659  010400  000244                    164.
1660  010402  000122                    82.
1661  010404  000051                    41.
1662  010406  000024                    20.
1663  010410  000012                    10.
1664  010412  000005                    5.
1665  010414  000003                    3.
1666
1667  010416  000632            TABL2:  410.                    ;10KHZ TIME TABLE
1668  010420  000315                    205.
1669  010422  000146                    102.
1670  010424  000063                    51.
```

```
1671  010426  000032                        26.
1672  010430  000015                        13.
1673  010432  000006                        6.
1674  010434  000003                        3.
1675
1676  010436  001025              TABL3:    533.                    ;60HZ TIME TABLE
1677  010440  000413                        267.
1678  010442  000205                        133.
1679  010444  000103                        67.
1680  010446  000041                        33.
1681  010450  000021                        17.
1682  010452  000000                        0.
1683  010454  000000                        0.
1684
1685  010456  000500              TABL4:    320.                    ;50HZ TIME TABLE
1686  010460  000240                        160.
1687  010462  000120                        80.
1688  010464  000050                        40.
1689  010466  000024                        20.
1690  010470  000000                        0.
1691  010472  000000                        0.
1692  010474  000000                        0.
1693
1694                              ;THIS ROUTINE KEEPS THE 24 HOUR
1695                              ;TIME OF DAY
1696
1697  010476  012737  177777  006610  CLKI:   MOV     #-1,@#INTFLG            ;CLOCK INTERRUPT SERVICE ROUTINE
1698  010504  062737  000044  006656  CLK3:   ADD     #36.,@#LST              ;ADD LSB TO LST
1699  010512  022737  000144  006656          CMP     #100.,@#LST             ;DID IT OVER FLOW
1700  010520  003005                   BGT     CLK4
1701  010522  162737  000144  006656          SUB     #100.,@#LST             ;YES
1702  010530  005237  006660                   INC     @#MST                   ;INC MST
1703  010534  062737  001217  006660  CLK4:   ADD     #655.,@#MST             ;ADD MSB TO MST
1704  010542  022737  001750  006660          CMP     #1000.,@#MST            ;DID IT OVER FLOW
1705  010550  003011                   BGT     2$
1706  010552  162737  001750  006660          SUB     #1000.,@#MST            ;YES
1707  010560  005237  006654                   INC     @#SEC2                  ;INC SECOND
1708  010564  022737  000072  006654          CMP     #72,@#SEC2              ;HAS 10 SECONDS ELAPSED
1709  010572  001401                   BEQ     .+4
1710  010574  000002                   RTI
1711  010576  012737  000060  006654  2$:     MOV     #60,@#SEC2              ;YES
1712  010604  005237  006652                   INC     @#SEC1                  ;INC MSB OF SECOND
1713  010610  022737  000066  006652          CMP     #66,@#SEC1              ;HAS 60 MIN ELAPSED
1714  010616  001401                   BEQ     .+4
1715  010620  000002                   RTI
1716  010622  012737  000060  006652          MOV     #60,@#SEC1              ;YES
1717  010630  005237  006650                   INC     @#MIN2                  ;INC LSB OF MIN
1718  010634  022737  000072  006650          CMP     #72,@#MIN2              ;HAS 10 MIN ELAPSED
1719  010642  001401                   BEQ     .+4
1720  010644  000002                   RTI
1721  010646  012737  000060  006650          MOV     #60,@#MIN2
1722  010654  005237  006646                   INC     @#MIN1                  ;INC MSB OF MIN
1723  010660  022737  000066  006646          CMP     #66,@#MIN1              ;HAS 60 MIN ELAPSED
1724  010666  001401                   BEQ     .+4
1725  010670  000002                   RTI
1726  010672  012737  000060  006646          MOV     #60,@#MIN1
```

```
1727  010700  005237  006644          INC     @#HRS2          ;INC LSB OF HOURS
1728  010704  022737  000064  006644  CMP     #64,@#HRS2      ;IS LSB A 4
1729  010712  001014                  BNE     NEWTM
1730  010714  022737  000062  006642  CMP     #62,@#HRS1      ;IF YES, IS MSB A 2
1731  010722  001401                  BEQ     .+4
1732  010724  000002                  RTI
1733  010726  012737  000060  006642  MOV     #60,@#HRS1      ;IF 24 HOURS RESET
1734  010734  012737  000060  006644  MOV     #60,@#HRS2      ;LSB AND MSB OF HOURS
1735  010742  000002                  RTI
1736  010744  022737  000072  006644  NEWTM:  CMP     #72,@#HRS2      ;IF NOT 4 IS IT 10 HOURS
1737  010752  001401                  BEQ     .+4
1738  010754  000002                  RTI
1739  010756  005237  006642          INC     @#HRS1          ;YES INC MSB OF HOURS
1740  010762  012737  000060  006644  MOV     #60,@#HRS2
1741  010770  000002                  RTI
1742
1743
1744
1745
1746  010772  022737  001750  006700  CLK2:   CMP     #1000.,@#MSTA   ;THIS ROUTINE IS THE WORK
1747  011000  003011                  BGT     2$
1748  011002  162737  001750  006700          SUB     #1000.,@#MSTA   ;AREA ROUTINE AND IS THE
1749  011010  005237  006674          INC     @#SEC2A         ;SAME AS INTERRUPT HANDLER
1750  011014  022737  000072  006674          CMP     #72,@#SEC2A     ;SERVICE ROUTINE
1751  011022  001401                  BEQ     .+4
1752  011024  000475                  2$:     BR      END1A
1753  011026  012737  000060  006674          MOV     #60,@#SEC2A
1754  011034  005237  006672          INC     @#SEC1A
1755  011040  022737  000066  006672          CMP     #66,@#SEC1A
1756  011046  001401                  BEQ     .+4
1757  011050  000463                  BR      END1A
1758  011052  012737  000060  006672          MOV     #60,@#SEC1A
1759  011060  005237  006670          INC     @#MIN2A
1760  011064  022737  000072  006670          CMP     #72,@#MIN2A
1761  011072  001401                  BEQ     .+4
1762  011074  000451                  BR      END1A
1763  011076  012737  000060  006670          MOV     #60,@#MIN2A
1764  011104  005237  006666          INC     @#MIN1A
1765  011110  022737  000066  006666          CMP     #66,@#MIN1A
1766  011116  001401                  BEQ     .+4
1767  011120  000437                  BR      END1A
1768  011122  012737  000060  006666          MOV     #60,@#MIN1A
1769  011130  005237  006664          INC     HRS2A
1770  011134  022737  000064  006664          CMP     #64,@#HRS2A
1771  011142  001014                  BNE     NEWT
1772  011144  022737  000062  006662          CMP     #62,@#HRS1A
1773  011152  001401                  BEQ     .+4
1774  011154  000421                  BR      END1A
1775  011156  012737  000060  006662          MOV     #60,@#HRS1A
1776  011164  012737  000060  006664          MOV     #60,@#HRS2A
1777  011172  000412                  BR      END1A
1778  011174  022737  000072  006664  NEWT:   CMP     #72,@#HRS2A
1779  011202  001401                  BEQ     .+4
1780  011204  000405                  BR      END1A
1781  011206  005237  006662          INC     @#HRS1A
1782  011212  012737  000060  006664          MOV     #60,@#HRS2A
```

```
1783  011220  012777  011266  175370  ENDIA:  MOV   #CR,@PVEC          ;SET UP FOR PRINTER OUTPUT
1784  011226  012737  177776  006636          MOV   #-2,@#CNTB
1785  011234  012737  006662  006634          MOV   #HRS1A,@#CNT1
1786  011242  012737  177767  006632          MOV   #-11,@#CNT
1787  011250  012777  000000  175334          MOV   #0,@PDBR
1788  011256  012777  000100  175330          MOV   #100,@PCSR
1789  011264  000002                          RTI
1790
1791
1792  011266  012777  011304  175322  CR:     MOV   #LF,@PVEC           ;OUTPUT CR
1793  011274  012777  000215  175310          MOV   #215,@PDBR
1794  011302  000002                          RTI
1795
1796  011304  012777  011322  175304  LF:     MOV   #PINTR,@PVEC        ;OUTPUT LF
1797  011312  012777  000212  175272          MOV   #212,@PDBR
1798  011320  000002                          RTI
1799  011322  005237  006632          PINTR:  INC   @#CNT               ;PRINT TWO DIGITS FOLLOWED
1800  011326  001414                          BEQ   DONE                ;BY COLON UNTIL TIME OF
1801  011330  005737  006636                  TST   CNTB                ;DAY IS PRINTED
1802  011334  001420                          BEQ   COLON
1803  011336  013704  006634                  MOV   @#CNT1,%4
1804  011342  012477  175244                  MOV   (%4)+,@PDBR
1805  011346  010437  006634                  MOV   %4,@#CNT1
1806  011352  005237  006636                  INC   @#CNTB
1807  011356  000002                          RTI
1808  011360  012777  011414  175230  DONE:   MOV   #PER,@PVEC          ;WHEN DONE PRINT "."
1809  011366  012777  000056  175216          MOV   #56,@PDBR
1810  011374  000002                          RTI
1811
1812  011376  012737  177776  006636  COLON:  MOV   #-2,@#CNTB
1813  011404  012777  000072  175200          MOV   #72,@PDBR
1814  011412  000002                          RTI
1815
1816  011414  005037  006636          PER:    CLR   @#CNTB              ;PRINT MSB OF MILLISEC
1817  011420  000250                          CLN
1818  011422  013737  006700  006634          MOV   @#MSTA,@#CNT1
1819  011430  012737  177767  006632          MOV   #-9.,@#CNT
1820  011436  162737  000144  006634  1$:     SUB   #100.,@#CNT1
1821  011444  100406                          BMI   2$
1822  011446  005237  006636                  INC   @#CNTB
1823  011452  005237  006632                  INC   @#CNT
1824  011456  001367                          BNE   1$
1825  011460  000404                          BR    3$
1826  011462  062737  000144  006634  2$:     ADD   #100.,@#CNT1
1827  011470  000250                          CLN
1828  011472  062737  000060  006636  3$:     ADD   #60,@#CNTB
1829  011500  012777  011516  175110          MOV   #NUM1,@PVEC
1830  011506  013777  006636  175076          MOV   @#CNTB,@PDBR
1831  011514  000002                          RTI
1832
1833  011516  012777  011600  175072  NUM1:   MOV   #NUM2,@PVEC         ;PRINT LSB OF MILLISEC
1834  011524  005037  006636                  CLR   @#CNTB
1835  011530  000250                          CLN
1836  011532  012737  177767  006632          MOV   #-9.,@#CNT
1837  011540  162737  000012  006634  1$:     SUB   #10.,@#CNT1
1838  011546  100405                          BMI   3$
```

```
1839  011550  005237  006636                INC     @#CNTB
1840  011554  005237  006632                INC     @#CNT
1841  011560  001367                        BNE     1$
1842  011562  062737  000060  006636  3$:   ADD     #60,@#CNTB
1843  011570  013777  006636  175014        MOV     @#CNTB,@PDBR
1844  011576  000002                        RTI
1845
1846  011600  012777  007560  175020  NUM2: MOV     #KINTR,@KVEC            ;RESTORE KEYBOARD VECTOR
1847  011606  000002                        RTI
1848
1849
1850
1851
1852
1853
1854  011610  032777  000010  167226  DELADJ: BIT   #10,@SR                 ;TEST FOR SR3=1 WHICH INDICATES
1855                                                                        ;11/60, 11/70 &11/45 WITH MOS
1856  011616  001001                        BNE     1$                      ;ADJUST DELAY TIMES
1857  011620  000207                        RTS     %7                      ;NO ADJUSTMENTS REQUIRED
1858  011622  012701  001034          1$:   MOV     #ADJ,R1                 ;GET START OF REG. FOR ADJUST
1859  011626  012700  001024                MOV     #DEL1,R0                ;GET START OF REG. TO ADJUST
1860  011632  012702  001032                MOV     #DEL4,R2                ;GET END TAG OF ADJUSTMENT
1861  011636  062702  000002                ADD     #2,R2                   ;UPDATE END CHECK
1862  011642  012120                  2$:   MOV     (R1)+,(R0)+             ;UPDATE DELAY COUNTS
1863  011644  020200                        CMP     R2,R0                   ;ARE WE DONE
1864  011646  001375                        BNE     2$                      ;NO CONTINUE UPDATE
1865  011650  000207                        RTS     %7                      ;ADJUSTMENT MADE
1866
1867  011652  013746  000004          SWADJ:  MOV     @#4,-(%6)               ;SAVE CONTENT OF TRAP
1868                                                                        ;VECTOR
1869  011656  012737  011676  000004        MOV     #SWADJ1,@#4             ;SET UP NEW TRAP VECTOR
1870  011664  005777  167154                TST     @SR                     ;TEST FOR SWITCH REG.
1871  011670  012637  000004                MOV     (%6)+,@#4               ;RESTORE STACK NO
1872                                                                        ;TIME OUT ACCONED.
1873  011674  000207                        RTS     %7
1874
1875  011676  022626                SWADJ1: CMP     (%6)+,(%6)+             ;UPDATE STACK
1876  011700  012637  000004                MOV     (%6)+,@#4               ;RESTORE TRAP VECTOR
1877  011704  012737  000176  001044        MOV     #SOFTSR,SR              ;SET SWITCH REG.(SR) TO
1878                                                                        ;EQUAL SOFTSR
1879  011712  000207                        RTS     %7                      ;RETURN TO CALLER
1880
1881
1882
1883          000001                .END
```

```
ADJ     001034          474# 1858
BEGIN   001150          452   500# 516  1134 1212 1224 1313
BEGIN1  005210          453  1143# 1179 1196 1208 1214
BEGIN2  001046          451   484#
BUFF  = 000776          449#  484  500  850  865  880  895 1143 1217 1418 1430 1442 1454
                       1473
BYT1    006704         1406# 1598 1622
BYT2    006705         1407#
BYT3    006706         1408#
BYT4    006707         1409#
BYT5    006710         1410#
BYT6    006711         1411#
BYT7    006712         1412# 1617
CACL    004446         1016  1027# 1058 1083
CC    = 177776          445#  629#  830#  853#  868#  884# 1088# 1104# 1287#
CHAR    006100         1252# 1255# 1263# 1264# 1265# 1274# 1277
CKCSR   010156         1599# 1601  1618
CKV     001006          463#  834#  854#  869#  887#  899#  948  952#  975# 1145# 1482#
CKVS    001010          464#  831#  953# 1145 1146# 1483#
CKVS1   006604         1372# 1503#
CKV1    006602         1371# 1502#
CLK     007672         1421# 1433# 1445# 1457# 1537# 1567 1569 1572 1575
CLKFLG  006606         1373# 1488# 1499 1504# 1508#
CLKI    010476         1482  1697#
CLKON   007434         1493  1495#
CLKSER  004240          952   979#
CLKXIT  004244          981#
CLK1    007700         1422# 1434# 1446# 1458# 1538#
CLK2    010772         1590  1746#
CLK3    010504         1426# 1438# 1450# 1462# 1698#
CLK4    010534         1427# 1439# 1451# 1463# 1700  1703#
CNGSWR  010134         1518  1591#
CNT     006632          951#  972#  973 1383# 1528# 1546# 1786# 1799# 1819# 1823# 1836# 1840#
CNTB    006636         1385# 1784# 1801 1806# 1812# 1816# 1822# 1828# 1830  1834# 1839# 1842# 1843
CNT1    006634         1384# 1529# 1541 1545# 1785# 1803 1805# 1818# 1820# 1826# 1837#
COLON   011376         1802  1812#
CR      011266         1783  1792#
CRLF    010324         1597  1636  1639# 1641
CSB     001002          461#  536#  537   549#  558#  568#  582#  643#  651#  660#  672#  685#  698#
                        714#  731#  748#  765#  780#  797#  815#  833#  856#  871#  886#  900#  927#
                        954# 1001# 1009# 1043# 1051# 1068# 1076# 1089# 1105# 1150# 1164# 1185# 1198#
                       1491# 1527# 1537#
CSB1    006574         1021# 1368# 1501# 1505# 1512#
CSR     001000          460#  521#  523   557#  567#  571#  572  573#  574  589#  590  593#  594
                        597#  598  601#  602  607#  608  611#  612  617#  618  621#  622  630#
                        631   634#  635   641#  644#  645  649#  652#  653#  654  658#  661#  662#
                        663   671#  674#  684#  687#  697#  699#  701  705#  713#  715#  717  721#
                        730#  732#  734   738#  747#  749#  751  755#  764#  766#  768  772#  779#
                        781#  783  787#  796#  798#  800  804#  814#  816#  818  822#  832#  835#
                        839#  842  849#  855#  857#  861#  864#  870#  872#  876#  878#  885#  888#
                        892#  894# 901#  905#  911#  928#  935#  955#  976# 1000# 1002# 1004 1008#
                       1010# 1012 1042# 1044# 1046 1050# 1052# 1054 1067# 1069# 1071 1075# 1077#
                       1079 1087# 1090# 1094 1096# 1098# 1099 1106# 1110 1112# 1115 1153# 1162#
                       1167# 1176# 1187# 1194# 1200# 1207# 1240 1490# 1526# 1538#
CSRT    001312          520   527#
CSR1    006576         1020# 1022# 1023 1369# 1506# 1511#
```

```
CTR     001004          462# 541* 542  550  562  577  584  675  688  707  723  740  757
                        774  789  806  825  929  1007 1015 1049 1057 1074 1082 1242 1564
CTRLI = 000211          1386#
CTRLT = 000224          1387#
CTRI    006600          1370#
DELADJ  011610          490  502  1854#
DELY    004416          1003 1011 1020# 1045 1053 1070 1078
DEL1    001024          470# 700  767  836  858  873  889  902  1091 1107 1859
DEL2    001026          471# 716  782
DEL3    001030          472# 559  569  733  799
DEL4    001032          473# 750  817  1860
DONE    011360          1800 1808#
ENDIA   011220          1752 1757 1762 1767 1774 1777 1780 1783#
EOMK    006366          1317* 1318 1335#
HLT   = 104000          444# 525  539  544  552  564  579  586  592  596  600  604  610
                        614  620  624  633  637  647  656  665  677  690  706  709  722
                        725  739  742  756  759  773  776  788  791  805  808  823  827
                        840  845  848  862  879  893  906  933  966  1006 1014 1017 1048
                        1056 1059 1073 1081 1084 1097 1101 1113 1117
HOLD    007760          1551* 1551#
HOLDIT  007750          1551# 1557
HRS1    006642          1389# 1476* 1529 1558 1730 1733* 1739*
HRS1A   006662          1397# 1559  1772 1775* 1781* 1785
HRS2    006644          1390# 1477* 1727* 1728 1734* 1736 1740*
HRS2A   006664          1398# 1769* 1770 1776* 1778 1782*
H50Z    007150          457  1454#
H60Z    007064          456  1442#
ICOUNT  001022          469# 496*  514*  1301
INIT    007250          1428 1440  1452  1464 1472#
INTFLG  006610          1374# 1489* 1556* 1565 1697*
KCSR    006624          1380# 1487* 1600
KDBR    006622          1379# 1515  1536  1542 1551 1602
KIN     007614          1520 1526#
KINI    007710          1532 1541#
KINI2   007660          1535# 1548
KINTR   007560          1484 1515# 1535  1846
KOUT    007762          1502 1522  1556# 1566
KVEC    006626          1381# 1484* 1532* 1535* 1548* 1557* 1846*
KVECS   006630          1382# 1485*
K10HZ   007000          455  1430#
K100HZ  006714          454  1418#
LF      011304          1792 1796#
LINE    005570          1180* 1183* 1185  1198 1209#
LOGICA  005174          443  1130#
LOOP    004152          958#  974
LST     006656          1395# 1474* 1530* 1698* 1699 1701*
LSTA    006676          1403#
MIN1    006646          1391# 1478* 1722* 1723 1726*
MIN1A   006666          1399# 1764* 1765  1768*
MIN2    006650          1392# 1479* 1717* 1718 1721*
MIN2A   006670          1400# 1759* 1760  1763*
MOVE    007234          1425 1437  1449  1461 1466#
MSGPWR  006472          1221 1352#
MSG1    006370          1231 1337#
MSG2    006432          1234 1344#
MSG3    006436          487  1346#
```

```
MST     006660          1396#  1475*  1531*  1702*  1703*  1704   1706*
MSTA    006700          1404#  1589*  1746   1748*  1818
NEWT    011174          1771   1778#
NEWTM   010744          1729   1736#
NOP   = 000240           446#
NUM1    011516          1829   1833#
NUM2    011600          1833   1846#
OCT     006076          1259*  1269*  1273#
OCTP    006102          1256   1267   1275#
OCTPRT  005766          1239   1241   1243   1245   1252#
OCT1    006006          1254   1256#
OCT2    006024          1260#  1270
PCSR    006614          1376#  1605   1640   1644   1788#
PDBR    006612          1375#  1607*  1642*  1646*  1787*  1793*  1797*  1804*  1809*  1813*  1830*  1843*
PER     011414          1808   1816#
PINTR   011322          1796   1799#
PRINT   005650           438   1228#
PRINT1  005764           509*  1232   1236*  1250#
PSW     006640           504*   949*   959*   961*  1388#  1420*  1432*  1444*  1456*
PVEC    006616          1377#  1783*  1792*  1796*  1808*  1829*  1833*
PVECS   006620          1378#  1486*
PWRDWN  005610          1213   1215#
PWRF1   005572           503   1212#  1472
PWRF2   005602          1147   1214#
PWRRTN  005646          1212*  1214*  1223   1224#
PWRUP   005620          1215   1217#
RETURN  006264           508*  1288   1306*  1313#
SCOPE = 104400           447#   535    548    556    566    581    588    606    616    628    640    648    657
                         670    683    696    712    727    744    763    778    793    811    829    852    867
                         883    897    922    947    996   1041   1064   1086   1103   1118
SCOPEB  006136          1286#  1292   1304   1312
SCOPEC  006150           440   1291#
SCOPEF  006250           506*  1301   1303*  1305*  1308#
SCOPEG  006236          1300   1302   1305#
SEC1    006652          1393#  1480*  1712*  1713   1716*
SEC1A   006672          1401#  1754*  1755   1758*
SEC2    006654          1394#  1481*  1707*  1708   1711*
SEC2A   006674          1402#  1749*  1750   1753*
SETBYT  010140          1594#  1609
SOFTSR= 000176           448#  1877
SP3     006120          1271   1280#
SP3A    006132          1280   1283#
SR      001044           479#   529    745    812    924    997   1181   1195   1228   1246   1291   1299   1492
                        1495   1497   1509  1632*  1854   1870  1877*
START   007412          1490#
SWADJ   011652           489    501   1144   1419   1431   1443   1455  1867#
SWADJ1  011676          1869   1875#
SWDONE  010246          1611   1613   1619#
TABL    010356          1423   1435   1447   1459   1580   1649#
TABL1   010376          1424   1658#
TABL2   010416          1436   1667#
TABL3   010436          1448   1676#
TABL4   010456          1460   1685#
TCSR    001014           466#   986   1122   1125   1157   1171   1189   1202   1275   1316*  1323   1327   1330
TDBR    001012           465#   988*  1121*  1124*  1159*  1173*  1191*  1204*  1277*  1325*  1329*  1332*
TEMP    001020           468#   505*   540*   542    547*   549    550    553*   559*   560*   569*   575*   642*
```

		643	650*	651	659*	660	673*	675	678*	679	686*	688	691*	692
		700*	703*	716*	719*	733*	736*	750*	753*	767*	770*	782*	785*	799*
		802*	817*	820*	836*	837*	842*	843	846	858*	859*	873*	874*	889*
		890*	902*	903*	932*	1007*	1027	1035*	1049*	1074*	1091*	1092*	1107*	1108*
		1244												
TEMP1	001016	467#	507*	898*	909*	1015*	1028	1057*	1082*					
TIKTIK	004246	950*	962	964	980*	964#								
TMPSWR	006702	1405#	1595*	1624*	1627*	1628*	1629*	1632						
TOP	006266	488	498	1222	1235	1281	1316#							
TOP1	006300	1318#	1326	1334										
TOP2	006332	1322	1327#											
TRPA	005204	1128	1134#											
TSTEND	005134	1121#												
TYPE	004250	960	963	986#	987									
T0	001254	508	510	519#	530	532								
T1	001334	524	526	534#										
T10	002226	670#												
T10A	002250	674#	680											
T11	002304	683#												
T11A	002324	687#	693											
T12	002360	696#												
T12A	002410	701#	704											
T12B	002436	702	707#											
T13	002446	712#												
T13A	002476	717#	720											
T13B	002524	718	723#											
T14	002534	727#												
T14A	002572	734#	737											
T14B	002620	735	740#											
T15	002630	729	744#											
T15A	002670	751#	754											
T15B	002716	752	757#											
T16	002726	746	763#											
T16A	002756	768#	771											
T16B	003004	769	774#											
T17	003014	778#												
T17A	003044	783#	786											
T17B	003072	784	789#											
T18	003102	793#												
T18A	003140	800#	803											
T18B	003166	801	806#											
T19	003176	795	811#											
T19A	003236	813#	821											
T19B	003266	819	825#											
T20	003276	813	829#											
T20A	003366	834	842#											
T21	003426	841	852#											
T21A	003512	854	864#											
T22	003522	863	867#											
T22A	003602	869	878#											
T23	003616	877	883#											
T23A	003702	887	894#											
T23AA	003662	890#	891											
T24	003712	897#												
T24A	003744	902#	910											
T24B	003774	899	908#											

```
T24C    004010            907     922#
T24D    004076            934     947#
T25     004264            926     977     996#
T25A    004502           1018    1041#
T26     004616           1064#
T27     004740            999    1066    1086#
T27A    005040           1103#
T28     005256           1152#   1161
T28A    005270           1154#   1156
T29     005336           1166#   1175
T29A    005350           1168#   1170
T3      001414            549#    554
T3A     001442            556#
T3B     001504            566#
T30     005456           1188#   1193
T31     005536           1201#   1206
T4      001572            581#
T5      001614            588#
T6      001712            606#
T7      001750            616#
T9      002006            628#
T9A     002052            640#
WAITA   007422           1492#   1500    1513
WAITB   007432           1494#   1507
XOR     001230            492     512#
XORA    001254           1296    1310#
XORFLG  006252            495*    515*    728     794    1065    1178    1293    1309#
XORM    006540            497    1360#
.     = 011714            435#    437#    442#    450#    459#     538     543     551     563     578     585     591     595
                          599     603     609     613     619     623     632     636     646     655     664     676     689
                          708     724     741     758     775     790     807     826     844     847     904    1093    1100
                         1109    1116    1123    1126    1158    1172    1182    1190    1203    1220    1229    1233    1247
                         1276    1319    1324    1328    1331    1336#   1343#   1345#   1359#   1413#   1709    1714    1719
                         1724    1731    1737    1751    1756    1761    1766    1773    1779

. ABS.  011714      000

 ERRORS DETECTED:  0

 CZKWBI.BIN,CZKWBI.LST/CRF/SOL/NL:TOC=CZKWBI.P11
 RUN-TIME:  2 4 .6 SECONDS
 RUN-TIME RATIO: 210/7=27.6
 CORE USED:  9K  (17 PAGES)
```

H04