

KW11-P

REAL TIME CLOCK TEST
CZKWBJ0

AH-8878J-MC

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JUL 1978

digital

MADE IN USA

TEST 1	TEST 2	TEST 3	TEST 4
TEST 5	TEST 6	TEST 7	TEST 8
TEST 9	TEST 10	TEST 11	TEST 12
TEST 13	TEST 14	TEST 15	TEST 16
TEST 17	TEST 18	TEST 19	TEST 20
TEST 21	TEST 22	TEST 23	TEST 24
TEST 25	TEST 26	TEST 27	TEST 28
TEST 29	TEST 30	TEST 31	TEST 32
TEST 33	TEST 34	TEST 35	TEST 36
TEST 37	TEST 38	TEST 39	TEST 40
TEST 41	TEST 42	TEST 43	TEST 44
TEST 45	TEST 46	TEST 47	TEST 48
TEST 49	TEST 50	TEST 51	TEST 52
TEST 53	TEST 54	TEST 55	TEST 56
TEST 57	TEST 58	TEST 59	TEST 60
TEST 61	TEST 62	TEST 63	TEST 64
TEST 65	TEST 66	TEST 67	TEST 68
TEST 69	TEST 70	TEST 71	TEST 72
TEST 73	TEST 74	TEST 75	TEST 76
TEST 77	TEST 78	TEST 79	TEST 80
TEST 81	TEST 82	TEST 83	TEST 84
TEST 85	TEST 86	TEST 87	TEST 88
TEST 89	TEST 90	TEST 91	TEST 92
TEST 93	TEST 94	TEST 95	TEST 96
TEST 97	TEST 98	TEST 99	TEST 100

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.REPT 0

IDENTIFICATION

PRODUCT CODE: AC-8877J-MC
PRODUCT NAME: CZKWBJO KW11-P RT CLK TST
PRODUCT DATE: 1-MAY-78
MAINTAINER: DIAGNOSTIC ENGINEERING
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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 VECTOR 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 ENABLE 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-PRIMARYLY 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 ENABLE 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 =0 OR DOWN...ADJUSTS DELAYS FOR 11/60, 11/70 OR 11/45 WITH MOS OR BIPOLAR ME
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.

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=0 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 ACCURACY CAN BE MEASURED AGAINST AN ACCURATE EXTERNAL SOURCE.

9.1 BASIC TEST

TEST	DESCRIPTION
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TO THRU T9	TEST THAT CSR, COUNT SET BUFFER AND COUNTER BITS MAY BE SET AND CLEARED.
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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 SE-
COND INTERVALS FOR 1 MINUTE USING 100HZ, FOLLOWED BY 1 MINUTE
AT 10KHZ FOLLOWED BY 1 MINUTE AT LINE FREQ.(60HZ OR 50HZ) AND
(IF SWO=1) 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

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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 SIMILAR
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,

334 RESTART THE TEST.

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336 10.* IF THE ONE MINUTE TEST WAS PASSED, ALLOW THE TEST TO
337 RUN FOR EXACTLY 16 MINUTES MORE. AT THE EXACT END OF THE
338 16TH MINUTE INTERVAL, READ THE CLOCK. IT SHOULD
339 BE WITHIN THREE SECONDS OF THE CORRECT TIME. IF IT IS NOT,
340 THE BOARD IS DEFECTIVE. IN THE EVENT THAT THE DUAL CLOCK
341 REAL TIME TEST IS GOING TO BE PERFORMED, THIS STEP
342 CAN BE OMITTED.
343

344 11. LOAD ADDRESS 220 VIA SWITCH REGISTER,
345 DEPRESS START (10KHZ TEST)
346 REPEAT STEPS 3-10
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348 12. LOAD ADDRESS 224 VIA SWITCH REGISTER,
349 DEPRESS START (224 IF 60HZ, OR 230 IF 50HZ LINE TEST)
350 REPEAT STEPS 3-10
351

352
353 * THE DURATION OF THIS TEST IS ARBITRARY, IT IS NOMINALLY
354 A THOUSAND SECOND TEST. LONGER TESTS ARE PERMISSIBLE.
355 THE RESULTS OF LONG TERM TESTS SHOULD BE WITHIN (PLUS OR MINUS)
356 1 MINUTE FOR A 24 HR TEST.
357

358 NOTE THAT THE TIME CAN BE READ AT ANY POINT WITHIN
359 THE TEST WITHOUT AFFECTING THE TEST.
360

361 9.3.2 DUAL CLOCK REAL TIME CLOCK TEST
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363 THE USE OF A TEMPORARY CLOCK (REFERED AS COW) REDUCES THE TIME
364 REQUIRED FOR THE REAL TIME TEST. THE SECOND CLOCK INTERRUPTS
365 THE FIRST CLOCK EVERY FIVE SECONDS. THE DURATION OF THE COMBINED
366 REAL TIMES TESTS, WHEN THE DUAL CLOCK TEST IS USED IS
367 1 MIN : 50 SEC/FREQ VERSUS 17 MIN/FREQ FOR THE
368 SINGLE CLOCK REAL TIME TEST ALONE.
369

370 THE DUAL CLOCK TEST REQUIRES THAT THE CLOCK BE STARTED AS IN
371 THE SINGLE MODE. RAISING SWITCH#2 CAUSES THE PRINTOUT
372 TO OCCUR AUTOMATICALLY.
373

374 THE COW MODULE SHOULD ONLY BE INSTALLED IN THE SYSTEM WHILE
375 THIS DIAGNOSTIC IS BEING USED.
376

377 TO CONVERT A STANDARD P CLOCK TO A "COW" MODULE:
378

- 379 1. REMOVE JUMPER A4
380 CSR=772560
381 CSB=772562
382 CTR=772564
383
384 2. ADD JUMPER V8
385 VECTOR LOCATION IS 504
386 PSW " " 506
387
388
389

NOTE: THIS VECTOR IS IN FLOATING VECTOR SPACE, CAUTION IS ADVISED
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 000004,
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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429      .TITLE  CZKWBJO KW11-P RT CLK TST
430
431      .SBTTL   BASIC TEST
432      ;COPYRIGHT 1971, 1978 DIGITAL EQUIPMENT CORP., MAYNARD, MASS. 01754
433      ;JOHN RODENHISER/JIM LACEY
434      .ENABL  AMA,ABS
435      .=0
436      ;TRAP  CATCHER 0-200
437      .=30
438      000030 005650      PRINT
439      000032 000340      340
440      000034 006150      SCOPEC
441      000036 000340      340
442      .=46
443      000046 005174      LOGICAL
444      .104000      HLT=EMT
445      .177776      CC=177776
446      .000240      NOP=240
447      .104400      SCOPE=TRAP
448      .000176      SOFTSR=176
449      .000776      BUFF=776
450      .=200
451      000200 000137 001046      JMP      @#BEGIN2      ;START BASIC TEST
452      000204 000137 001150      JMP      @#BEGIN      ;RESTART BASIC TEST
453      000210 000137 005210      JMP      @#BEGIN1      ;START TIMING TEST
454      000214 000137 006714      JMP      @#K100HZ      ;DOUBLE OR SINGAL CLK TEST. 100KHZ.
455      000220 000137 007000      JMP      @#K10HZ      ;DOUBLE OR SINGLE CLK TEST. 10KHZ.
456      000224 000137 007064      JMP      @#H60Z      ;DOUBLE OR SINGLE CLK TEST. 60HZ.
457      000230 000137 007150      JMP      @#H50Z      ;DOUBLE OR SINGLE CLK TEST. 50HZ
458
459      .=1000
460      001000 172540      CSR:      172540      ;CONTROL AND STATUS REGISTER
461      001002 172542      CSB:      172542      ;COUNT SET BUFFER
462      001004 172544      CTR:      172544      ;COUNTER
463      001006 000104      CKV:      104      ;CLOCK VECTOR ADDRESS
464      001010 000106      CKVS:     106
465      001012 177566      TDBR:     177566
466      001014 177564      TCSR:     177564
467      001016 000000      TEMP1:    0
468      001020 000000      TEMP:     0
469      001022 000001      ICOUNT:   1
470      001024 177740      DEL1:     -40
471      001026 177730      DEL2:     -50
472      001030 160000      DEL3:     -20000
473      001032 160000      DEL4:     -20000
474      001034 177700      ADJ:      -100
475
476      .-120
477      001036 177660      .-40000
478      001040 140000      .-40000
479      001042 140000      .-40000
480      001044 177570      SR:      177570
481
482
483
484      001046 012706 000776      BEGIN2: MOV      #BUFF,%6

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;DELAY ADJUSTMENT FOR 11/70
; & 11/45 WITH MOS MEM.


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485 001052 023737 000042 000046    CMP    @#42, @#46    ;UNDER ACT ?
486 001060 001404                BEQ     1$           ;YES-SKIP TITLE PRINT OUT
487 001062 012702 006436                MOV    #MSG3, %2
488 001066 004737 006266                JSR    %7, TOP      ;PRINT TITLE
489 001072 004737 011652    1$:      JSR    %7,SWADJ    ;HAS THIS CPU HAVE A SWITCH REG.?
490 001076 004737 011610                JSR    %7,DELADJ    ;IS ADJUSTMENT IN DELAY REQUIRED
491 001102 013746 000004                MOV    @#4,-(%6)
492 001106 012737 001230 000004                MOV    #XOR,@#4
493 001114 005737 177060                TST    @#177060
494 001120 012637 000004                MOV    (%6)+,@#4
495 001124 012737 177777 006252                MOV    #-1,@#XORFLG
496 001132 012737 000001 001022                MOV    #1,@#ICOUNT
497 001140 012702 006540                MOV    #XORM,%2
498 001144 004737 006266                JSR    %7,TOP
499
500 001150 012706 000776    BEGIN:  MOV    #BUFF,%6    ;SET UP STACK FOR SCOPE LOOPS
501 001154 004737 011652                JSR    %7,SWADJ    ;HAS THIS CPU HAVE A SWITCH REG.?
502 001160 004737 011610                JSR    %7,DELADJ    ;IS ADJUSTMENT IN DELAY REQUIRED
503 001164 012737 005572 000024                MOV    #PWRFL,24    ;INIT POWER FAIL POINTER
504 001172 005077 005442                CLR    @PSW        ;CLEAR PROC. STATUS REG.
505 001176 005037 001020                CLR    TEMP
506 001202 005037 006250                CLR    SCOPEF
507 001206 005037 001016                CLR    TEMP1        ;INIT. SCOPEF TAG
508 001212 012737 001254 006264                MOV    #TO,RETURN    ;SET UP RESTART OF PROGRAM
509 001220 005037 005764                CLR    PRINT1        ;INITIALIZE ERROR PRINTOUT READING
510 001224 000137 001254                JMP     TO
511
512 001230 022626                XOR:    CMP    (%6)+,(%6)+
513 001232 012637 000004                MOV    (%6)+,@#4
514 001236 012737 000005 001022                MOV    #5,@#ICOUNT
515 001244 005037 006252                CLR    @#XORFLG
516 001250 000137 001150                JMP     @#BEGIN
517
518                ;TEST INIT TO CLEAR CONTROL AND STATUS REGISTER
519 001254 013746 000004    TO:      MOV    @#4,-(%6)
520 001260 012737 001312 000004                MOV    #CSRT,@#4
521 001266 012777 100377 177504                MOV    #100377,@CSR
522 001274 000005                RESET
523 001276 032777 100377 177474                BIT    #100377,@CSR
524 001304 001413                BEQ     T1
525 001306 104000                HLT
526 001310 000411                BR     T1        ;ERROR, INIT FAILED TO CLEAR ALL BITS OF CSR.
527 001312 022626    CSRT:  CMP    (%6)+,(%6)+
528 001314 012637 000004                MOV    (%6)+,@#4
529 001320 032777 040000 177516                BIT    #40000,@SR
530 001326 001352                BNE     TO
531 001330 000000                HALT
532 001332 000750                BR     TO        ;NO SSYN FROM DEVICE
533
534 001334 012637 000004    ;TEST COUNT SET BUFFER
535 001340 104400    T1:      MOV    (%6)+,@#4
536 001342 012777 177777 177432                SCOPE
537 001350 005777 177426                MOV    #-1,@CSB
538 001354 001401                TST    @CSB
539 001356 104000                BEQ     .+4
540 001360 012737 177777 001020                HLT
                    MOV    #-1,@TEMP    ;ERR, FAILED TO GIVE ZERO'S FROM WRITE ONLY REG.

```

541	001366	012777	000000	177410		MOV	#0,ACTR	
542	001374	023777	001020	177402		CMP	a#TEMP,ACTR	
543	001402	001401				BEQ	+.4	
544	001404	104000				HLT		
545								;CTR CHANGED WHEN WRITTEN TO
546								;TEST COUNT SET BUFFER TO ACCEPT A COUNT PATTERN
547	001406	005037	001020					;TEST COUNTER TO CONTAIN COUNT SET BUFFER VALUE
548	001412	104400				CLR	TEMP	
549	001414	013777	001020	177360	T3:	MOV	TEMP,ACSB	
550	001422	023777	001020	177354		CMP	TEMP,ACTR	
551	001430	001401				BEQ	+.4	
552	001432	104000				HLT		
553	001434	005237	001020			INC	TEMP	;ERROR, CTR NOT=TEMP
554	001440	001365				BNE	T3	;+1 TO COUNT PATTERN
555								;REPEAT UNTIL COUNT OVERFLOWS
556	001442	104400						;TEST THAT CTR REMAINS CONSTANT IF RUN CLEAR
557	001444	005077	177330		T3A:	SCOPE		
558	001450	012777	177777	177324		CLR	ACSR	
559	001456	013737	001030	001020		MOV	#-1,ACSB	
560	001464	005237	001020			MOV	a#DEL3,a#TEMP	
561	001470	001375			1\$:	INC	a#TEMP	
562	001472	022777	177777	177304		BNE	1\$	
563	001500	001401				CMP	#-1,ACTR	
564	001502	104000				BEQ	+.4	
565						HLT		;CTR CHANGED ALTHOUGH RUN 0
566	001504	104400						;TEST THAT CTR REMAINS CONSTANT WHEN CSR IS REF'D
567	001506	005077	177266		T3B:	SCOPE		
568	001512	012777	177777	177262		CLR	ACSR	
569	001520	013737	001030	001020		MOV	#-1,ACSB	
570						MOV	a#DEL3,a#TEMP	
571	001526	012777	177736	177244	1\$:	MOV	#177736,ACSR	
572	001534	017700	177240			MOV	ACSR,X0	
573	001540	012777	000000	177232		MOV	#0,ACSR	
574	001546	017700	177226			MOV	ACSR,X0	
575	001552	005237	001020			INC	a#TEMP	
576	001556	001363				BNE	1\$	
577	001560	022777	177777	177216		CMP	#-1,ACTR	
578	001566	001401				BEQ	+.4	
579	001570	104000				HLT		;CTR CHANGED BY CSR REF
580								;TEST INIT TO CLEAR COUNT SET BUFFER WHEN IT IS =-1
581	001572	104400			T4:	SCOPE		
582	001574	012777	177777	177200		MOV	#-1,ACSB	
583	001602	000005				RESET		
584	001604	005777	177174			TST	ACTR	
585	001610	001401				BEQ	+.4	
586	001612	104000				HLT		;ERROR, INIT FAILED TO CLEAR CSB
587								;TEST RATE SELECT (BIT,2) MAY BE SET AND CLEARED
588	001614	104400			T5:	SCOPE		
589	001616	012777	000002	177154		MOV	#2,ACSR	
590	001624	022777	000002	177146		CMP	#2,ACSR	
591	001632	001401				BEQ	+.4	
592	001634	104000				HLT		;ERROR, CSR NOT = 2
593	001636	012777	000004	177134		MOV	#4,ACSR	
594	001644	022777	000004	177126		CMP	#4,ACSR	
595	001652	001401				BEQ	+.4	
596	001654	104000				HLT		;ERROR, CSR NOT = 4


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597 001656 012777 000006 177114      MOV      #6,@CSR
598 001664 022777 000006 177106      CMP      #6,@CSR
599 001672 001401                      BEQ      .+4
600 001674 104000                      HLT
601 001676 005077 177076              CLR      @CSR          ;ERROR, CSR NOT = 6
602 001702 005777 177072              TST      @CSR
603 001706 001401                      BEQ      .+4
604 001710 104000                      HLT
605                                ;TEST MODE (BIT 3) CAN BE SET AND CLEARED ;ERROR, CSR NOT = 0
606 001712 104400                      T6:  SCOPE
607 001714 012777 000010 177056      MOV      #10,@CSR
608 001722 022777 000010 177050      CMP      #10,@CSR
609 001730 001401                      BEQ      .+4
610 001732 104000                      HLT
611 001734 005077 177040              CLR      @CSR          ;ERROR, CSR NOT = 10
612 001740 005777 177034              TST      @CSR
613 001744 001401                      BEQ      .+4
614 001746 104000                      HLT
615                                ;TEST UP/DN (BIT 4) CAN BE SET AND CLEARED ;ERROR, CSR NOT = 0
616 001750 104400                      T7:  SCOPE
617 001752 012777 000020 177020      MOV      #20,@CSR
618 001760 022777 000020 177012      CMP      #20,@CSR
619 001766 001401                      BEQ      .+4
620 001770 104000                      HLT
621 001772 005077 177002              CLR      @CSR          ;ERROR, CSR NOT = 20
622 001776 005777 176776              TST      @CSR
623 002002 001401                      BEQ      .+4
624 002004 104000                      HLT
625                                ;ERROR, CSR NOT = 0
626
627                                ;TEST INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
628 002006 104400                      T9:  SCOPE
629 002010 012737 000340 177776      MOV      #340,CC          ;SET PROCESSOR PRIORITY LEVEL 7
630 002016 012777 000100 176754      MOV      #100,@CSR
631 002024 022777 000100 176746      CMP      #100,@CSR
632 002032 001401                      BEQ      .+4
633 002034 104000                      HLT
634 002036 005077 176736              CLR      @CSR          ;ERROR, CSR NOT = 100
635 002042 005777 176732              TST      @CSR
636 002046 001401                      BEQ      .+4
637 002050 104000                      HLT
638                                ;ERROR, CSR NOT = 0
639                                ;TEST RUN (BIT 0) CAN BE SET AND CLEARED
640 002052 104400                      T9A: SCOPE
641 002054 005077 176720              CLR      @CSR
642 002060 005037 001020              CLR      TEMP
643 002064 013777 001020 176710      MOV      TEMP,@CSB
644 002072 012777 000021 176700      MOV      #21,@CSR
645 002100 032777 000001 176672      BIT      #1,@CSR
646 002106 001001                      BNE      .+4
647 002110 104000                      HLT
648 002112 104400                      ;START AT ZERO
649 002114 005077 176660              ;DISABLE INTERRUPT, COUNT UP, SET RUN
650 002120 005037 001020              ;CHECK IF ZERO IS STILL SET
651 002124 013777 001020 176650      SCOPE
652 002132 012777 000020 176640      CLR      @CSR
653                                ;CSR LOST BIT 0 AFTER BIT INSTRUCTION
654                                ;START AT ZERO
655                                ;DISABLE INTERRUPT, COUNT UP, DO NOT SET RUN
```

```
653 002140 052777 000001 176632 BIS #1,@CSR ;SET RUN
654 002146 032777 000001 176624 BIT #1,@CSR ;CHECK IF BIT 0 IS SET
655 002154 001001 BNE .+4
656 002156 104000 HLT ;CSR LOST BIT 0 AFTER A BIS INSTRUCTION
657 002160 104400 SCOPE
658 002162 005077 176612 CLR @CSR
659 002166 005037 001020 CLR TEMP
660 002172 013777 001020 176602 MOV TEMP,@CSB ;START AT ZERO
661 002200 012777 000021 176572 MOV #21,@CSR ;DISABLE INTERRUPT, COUNT UP, SET RUN
662 002206 012777 000020 176564 MOV #20,@CSR ;LEAVE ALL SAME RESET RUN
663 002214 032777 000001 176556 BIT #1,@CSR ;CHECK BIT 0
664 002222 001401 BEQ .+4 ;BRANCH IF NOT SET
665 002224 104000 HLT ;CSR PICKED BIT 0 ON A MOV.
666
667
668 ; TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
669 ; SET UP/DN (BIT 4) =0 TO ENABLE COUNT DOWN
670 002226 104400 T10: SCOPE
671 002230 005077 176544 CLR @CSR
672 002234 012777 177777 176540 MOV #-1,@CSB
673 002242 012737 177776 001020 MOV #-2,TEMP
674 002250 012777 000040 176522 T10A: MOV #40,@CSR
675 002256 023777 001020 176520 CMP TEMP,@CTR
676 002264 001401 BEQ .+4
677 002266 104000 HLT ;ERROR, COUNTER NOT = TEMP, DIDN'T COUNT DOWN
678 002270 005337 001020 DEC TEMP ; -1 TO PATTERN COUNT
679 002274 023727 001020 000000 CMP TEMP,#0 ;DONE ALL COUNTS?
680 002302 001362 BNE T10A ;NO
681 ;TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
682 ;SET UP/DN (BIT 4)=1 TO ENABLE COUNT UP
683 002304 104400 T11: SCOPE
684 002306 005077 176466 CLR @CSR
685 002312 005077 176464 CLR @CSB
686 002316 012737 000001 001020 MOV #1,TEMP
687 002324 012777 000060 176446 T11A: MOV #60,@CSR
688 002332 023777 001020 176444 CMP TEMP,@CTR
689 002340 001401 BEQ .+4
690 002342 104000 HLT ;ERROR, COUNTER NOT = TEMP, FAILED TO COUNT UP.
691 002344 005237 001020 INC TEMP ; +1 TO PATTERN COUNT
692 002350 023727 001020 000000 CMP TEMP,#0 ;DONE ALL COUNTS ?
693 002356 001362 BNE T11A ;NO
694 ;TEST CLOCK TO COUNT DOWN AT ALL FREQUENCIES
695 ;100KHZ
696 002360 104400 T12: SCOPE
697 002362 005077 176412 CLR @CSR
698 002366 012777 000002 176406 MOV #2,@CSB ;COUNT SET BUFFER TO 2
699 002374 012777 000001 176376 MOV #1,@CSR ;DOWN COUNT , 100KHZ, GO
700 002402 013737 001024 001020 MOV @DEL1,@TEMP
701 002410 105777 176364 T12A: TSTB @CSR
702 002414 100410 BMI T12B
703 002416 062737 000001 001020 ADD #1,@TEMP
704 002424 001371 BNE T12A
705 002426 042777 000001 176344 BIC #1,@CSR
706 002434 104000 HLT ;ERROR, P INTR (BIT 7) NOT = 1.
707 002436 005777 176342 T12B: TST @CTR
708 002442 001401 BEQ .+4
```



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709 002444 104000 HLT ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
710
711 ;10KHZ
712 002446 104400 T13: SCOPE
713 002450 005077 176324 CLR @CSR
714 002454 012777 000002 176320 MOV #2,@CSB
715 002462 012777 000003 176310 MOV #3,@CSR
716 002470 013737 001026 001020 MOV @DEL2,@TEMP ;DOWN COUNT, 10KHZ, GO
717 002476 105777 176276 T13A: TSTB @CSR
718 002502 100410 BMI T13B
719 002504 062737 000001 001020 ADD #1,@TEMP
720 002512 001371 BNE T13A
721 002514 042777 000001 176256 BIC #1,@CSR
722 002522 104000 HLT
723 002524 005777 176254 T13B: TST @CTR
724 002530 001401 BEQ .+4
725 002532 104000 HLT ;ERROR, P INTR (BIT 7) NOT = 1.
726 ;LINE FREQ.
727 002534 104400 T14: SCOPE
728 002536 005737 006252 TST @XORFLG
729 002542 100432 BMI T15
730 002544 005077 176230 CLR @CSR
731 002550 012777 000002 176224 MOV #2,@CSB
732 002556 012777 000005 176214 MOV #5,@CSR
733 002564 013737 001030 001020 MOV @DEL3,@TEMP ;DOWN COUNT, LINE FREQ., GO
734 002572 105777 176202 T14A: TSTB @CSR
735 002576 100410 BMI T14B
736 002600 062737 000001 001020 ADD #1,@TEMP
737 002606 001371 BNE T14A
738 002610 042777 000001 176162 BIC #1,@CSR
739 002616 104000 HLT
740 002620 005777 176160 T14B: TST @CTR
741 002624 001401 BEQ .+4
742 002626 104000 HLT ;ERROR, P INTR (BIT 7) NOT=1
743 ;EXT FREQ
744 002630 104400 T15: SCOPE
745 002632 032777 000001 176204 BIT #1,@SR
746 002640 001432 BEQ T16
747 002642 005077 176132 CLR @CSR
748 002646 012777 000002 176126 MOV #2,@CSB
749 002654 012777 000007 176116 MOV #7,@CSR
750 002662 013737 001032 001020 MOV @DEL4,@TEMP ;DOWN COUNT, EXT., GO
751 002670 105777 176104 T15A: TSTB @CSR
752 002674 100410 BMI T15B
753 002676 062737 000001 001020 ADD #1,@TEMP
754 002704 001371 BNE T15A
755 002706 042777 000001 176064 BIC #1,@CSR
756 002714 104000 HLT
757 002716 005777 176062 T15B: TST @CTR
758 002722 001401 BEQ .+4
759 002724 104000 HLT ;ERROR, P INTR (BIT 7) NOT=1
760 ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
761 ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
762 ;100 KHZ
763 002726 104400 T16: SCOPE
764 002730 005077 176044 CLR @CSR
```

```
765 002734 012777 177776 176040      MOV    #-2,@CSB
766 002742 012777 000021 176030      MOV    #21,@CSR
767 002750 013737 001024 001020      MOV    @#DEL1,@#TEMP      ;UP COUNT, 100 KHZ, GO
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
774 003004 005777 175774      T16B:  TST    @CTR      ;ERROR
775 003010 001401      BEQ    .+4
776 003012 104000      HLT      ;ERROR
777
778 003014 104400      ;10 KHZ
779 003016 005077 175756      T17:   SCOPE
780 003022 012777 177776 175752      CLR    @CSR
781 003030 012777 000023 175742      MOV    #-2,@CSB
782 003036 013737 001026 001020      MOV    #23,@CSR
783 003044 105777 175730      T17A:  MOV    @#DEL2,@#TEMP      ;UP COUNT, 10 KHZ, GO
784 003050 100410      TSTB    @CSR
785 003052 062737 000001 001020      BMI    T17B
786 003060 001371      ADD    #1,@#TEMP
787 003062 042777 000001 175710      BNE    T17A
788 003070 104000      BIC    #1,@CSR
789 003072 005777 175706      T17B:  HLT
790 003076 001401      TST    @CTR      ;ERROR
791 003100 104000      BEQ    .+4
792      HLT      ;ERROR
793      ;LINE FREQ.
794 003102 104400      T18:   SCOPE
795 003104 005737 006252      TST    @#XORFLG
796 003110 100432      BMI    T19
797 003112 005077 175662      CLR    @CSR
798 003116 012777 177776 175656      MOV    #-2,@CSB
799 003124 012777 000025 175646      MOV    #25,@CSR
800 003132 013737 001030 001020      MOV    @#DEL3,@#TEMP      ;UP COUNT, LINE, GO
801 003140 105777 175634      T18A:  TSTB    @CSR
802 003144 100410      BMI    T18B
803 003146 062737 000001 001020      ADD    #1,@#TEMP
804 003154 001371      BNE    T18A
805 003156 042777 000001 175614      BIC    #1,@CSR
806 003164 104000      HLT
807 003166 005777 175612      T18B:  TST    @CTR      ;ERROR
808 003172 001401      BEQ    .+4
809 003174 104000      HLT      ;ERROR
810
811      ;EXT FREQ.
812 003176 104400      T19:   SCOPE
813 003200 032777 000001 175636      BIT    #1,@SR
814 003206 001433      BEQ    T20
815 003210 005077 175564      CLR    @CSR
816 003214 012777 177776 175560      MOV    #-2,@CSB
817 003222 012777 000027 175550      MOV    #27,@CSR
818 003230 013737 001032 001020      MOV    @#DEL4,@#TEMP      ;UP COUNT, EXT FREQ, GO
819 003236 105777 175536      T19A:  TSTB    @CSR
820 003242 100411      BMI    T19B
821 003244 062737 000001 001020      ADD    #1,@#TEMP
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821 003252 001371      BNE      T19A
822 003254 042777 000001 175516      BIC      #1,ACSR
823 003262 104000      HLT
824 003264 000005      RESET      ;ERROR,
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,ACSR
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
846 003404 032737 000001 001020      BIT      #1,@TEMP      ;DONE NOT SET ON INT.
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,ACSR
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

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877 003600 000406
878 003602 042777 000001 175170 T22A: BR T23
879 003610 104000 BIC #1,ACSR
880 003612 012706 000776 HLT ;ERROR, INT SHOULDN'T HAVE OCCURRED
881 MOV #BUFF,%6
882 ;TEST SINGLE INTERRUPT (MODE 0) ON OVERFLOW
883 T23: SCOPE
884 MOV #200,CC ;SET PROCESSOR PRIORITY 4
885 CLR ACSR
886 MOV #-2,ACSB
887 MOV #T23A,ACKV ;SET INTERRUPT RETURN
888 MOV #121,ACSR ;INTERRUPT ENABLE, UP COUNT, 100 KHZ, GO
889 MOV @DEL1,@TEMP
890 T23AA: ADD #1,@TEMP ;WASTE TIME
891 BNE T23AA
892 003672 042777 000001 175100 BIC #1,ACSR
893 003700 104000 HLT ;ERROR, INTERRUPT FAILED TO OCCUR.
894 003702 005077 175072 T23A: CLR ACSR ;RETURN HERE AFTER INTERRUPT.
895 003706 012706 000776 MOV #BUFF,%6 ;RESET STACK
896 ;TEST REPEATED INTERRUPT (MODE 1).
897 T24: SCOPE
898 MOV #-100,TEMP1 ;SET UP COUNTER FOR INTER
899 MOV #T24B,ACKV ;SET INTERRUPT RETURN
900 MOV #10,ACSB ;SET UP COUNT SET BUFFER
901 MOV #111,ACSR ;INTERRUPT ENABLE, REPEATED INTERRUPTS, 100 KHZ.
902 T24A: MOV @DEL1,@TEMP
903 ADD #1,@TEMP
904 BNE .-6
905 003762 042777 000001 175010 BIC #1,ACSR
906 003770 104000 HLT ;ERROR, INTERRUPT FAILED TO OCCUR
907 003772 000406 BR T24C
908 003774 022626 T24B: CMP (6)+,(6)+ ;POP STACK
909 003776 005237 001016 INC TEMP1 ;DONE 100 INTERRUPTS?
910 004002 001360 BNE T24A ;NO
911 004004 005077 174770 CLR ACSR ;CLEAR CLOCK
912
913
914
915
916 ;SYNCHRONIZATION TEST
917 ;NO. 1 FOR
918 ;KW11-P BOARDS THAT
919 ;ARE REV F OR GREATER
920
921
922 004010 104400 T24C: SCOPE
923 004012 005003 CLR X3
924 004014 032777 000020 175022 BIT #20,ASR
925 004022 001002 BNE 1$
926 004024 000137 004264 JMP T25
927 004030 012777 010000 174744 1$: MOV #10000,ACSB ;LOAD COUNTER
928 004036 012777 000001 174734 MOV #1,ACSR ;GO COUNT DOWN, 100 KHZ
929 004044 017700 174734 MOV @CTR,X0 ;SAVE CTR
930 004050 020027 010000 CMP X0,#10000 ;DID COUNT INCREASE?
931 004054 101404 BLOS 2$ ;BRANCH IF OK TO 1$
932 004056 010037 001020 MOV X0,@TEMP

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933 004062 104000          HLT          ;SYNC ERROR
934 004064 000404          BR           T24D      ;END TEST
935 004066 005077 174706  2$: CLR        @CSR    ;CLR CSR
936 004072 005203          INC        %3      ;NO OF TIMES THROUGH PROGRAM DETECTS 2(16)
937 004074 001355          BNE        1$      ;2(16) YET, IF NOT GO BACK TO LOOP 1
938
939
940
941          ;SYNCHRONIZATION TEST
942          ;NO. 2 FOR KW11-P
943          ;BOARDS THAT ARE
944          ;REV F OR GREATER
945
946
947 004076 104400          T24D: SCOPE
948 004100 017746 174702  MOV        @CKV,-(%6) ;SAVE CLOCK VECTOR
949 004104 012777 000340 002526 MOV        #340,@PSW ;PS=7 STOPS ALL INTRs
950 004112 005037 004246  CLR        TIKTIK ;CLEAR CLOCK COUNTER
951 004116 005037 006632  CLR        CNT    ;CLEAR ITERATION COUNT
952 004122 012777 004240 174656 MOV        #CLKSER,@CKV ;SETUP INTR SERVICE RTN
953 004130 012777 000300 174652 MOV        #300,@CKVS ;SETUP INTR PSW
954 004136 012777 000010 174636 MOV        #10,@CSB ;KW11 COUNT = 10
955 004144 012777 000111 174626 MOV        #111,@CSR ;SET TO RUN @100KH
956                                     ;INTR ENABLE & COUNT DOWN
957                                     ;AND REPEAT INTR MODE
958
959 004152          LOOP:
960 004152 012777 000340 002460 MOV        #340,@PSW ;PS=7 STOPS ALL INTRs
961 004160 004737 004250  JSR        PC,TYPE ;100MS DELAY @PR7
962 004164 005077 002450  CLR        @PSW   ;PS=0 ALLOWS INTRs
963 004170 013701 004246  MOV        TIKTIK,R1 ;GET CURRENT CLK COUNT
964 004174 004737 004250  JSR        PC,TYPE ;100MS DELAY @PRO
965 004200 023701 004246  CMP        TIKTIK,R1 ;ANY INTRs DURING DELAY?
966 004204 001001          BNE        1$      ;IF YES,GO TO 1$
967 004206 104000          HLT          ;ELSE THERE WAS AN ERROR
968                                     ;CHECK FOR JUMPERS ON THE
969                                     ;KW11-P BOARD NEAR I.C.
970                                     ;LOCATIONS E41 & E51 ON REV F
971                                     ;BOARD & GREATER ONLY
972
973 004210          1$:
974 004210 005237 006632  INC        CNT    ;120 ITERATIONS?
975 004214 022737 000170 006632 CMP        #120,CNT ;IF NOT,GO BACK TO LOOP
976 004222 001353          BNE        LOOP    ;ELSE RESTORE THE VECTOR
977 004224 012677 174556  MOV        (%6)+,@CKV ;CLEAR CONTROL REG
978 004230 005077 174544  CLR        @CSR    ;AND GO TO NEXT TEST
979 004234 000137 004264  JMP        T25
980
981 004240          CLKSER:
982 004240 005237 004246  INC        TIKTIK ;INC CLK COUNTER
983 004244          CLKXIT:
984 004244 000002          RTI          ;ELSE EXIT RTN
985
986 004246 000000          TIKTIK: 0
987
988 004250          TYPE:
989 004254 105777 174540  TSTB       @TCSR ;READY TO SEND
990 004256 100375          BPL        TYPE  ;BR IF NOT
991 004256 110077 174530  MOVB       R0,@TDBR ;SEND THEM A MESSAGE
```

```
989 004262 000207          RTS    PC
990
991
992
993
994
995
996 004264 104400          ;TEST 100 KHZ REPEATABILITY
997 004266 032777 000004 174550 T25:  SCOPE
998 004274 001002          BIT     #4,@SR      ;ARE TWO CLK'S PRESENT
999 004276 000137 004740    BNE     3$        ;BRANCH IF SW#2 IS UP
1000 004302 005077 174472    JMP     T27       ;EXIT IF ONLY ONE CLK
1001 004306 012777 000000 174466 3$:  CLR     @CSR
1002 004314 012777 000021 174456    MOV     #0,@CSB      ;SET CTR
1003 004322 004537 004416    MOV     #21,@CSR     ;COUNT UP 100KHZ GO
1004 004326 105777 174446    JSR     R5,DELY    ;GO TO DELAY SUBROUTINE
1005 004332 100001          TSTB    @CSR      ;TEST DONE BIT SET
1006 004334 104000          BPL     1$
1007 004336 017737 174442 001020 1$:  MOV     @CTR,@#TEMP    ;DONE BIT SET TOO SOON
1008 004344 005077 174430    CLR     @CSR      ;DONE NOT SET SO SAVE CTR
1009 004350 012777 000000 174424    MOV     #0,@CSB
1010 004356 012777 000021 174414    MOV     #21,@CSR
1011 004364 004537 004416    JSR     R5,DELY
1012 004370 105777 174404    TSTB    @CSR
1013 004374 100001          BPL     2$
1014 004376 104000          HLT
1015 004400 017737 174400 001016 2$:  MOV     @CTR,@#TEMP1    ;HERE WE ARE SAVING SEC CNT
1016 004406 004537 004446    JSR     R5,CACL    ;GO DETERMINE ACCURACY OF CNT'S
1017 004412 104000          HLT
1018 004414 000432          BR      T25A
1019
1020 004416 005077 002154          DELY:  CLR     @CSR1      ;DELAY SUBROUTINE
1021 004422 012777 001130 002144    MOV     #1130,@CSB1
1022 004430 012777 000021 002140    MOV     #21,@CSR1
1023 004436 105777 002134 1$:  TSTB    @CSR1      ;WAIT 600 MIL.
1024 004442 100375          BPL     1$
1025 004444 000205          RTS     R5
1026
1027 004446 013700 001020          CACL:  MOV     @#TEMP,R0      ;COMPARE CTR1 WITH CTR2
1028 004452 013701 001016    MOV     @#TEMP1,R1
1029 004456 160001          SUB     R0,R1
1030 004460 100001          BPL     1$
1031 004462 005401          NEG     R1
1032 004464 022701 000005 1$:  CMP     #5,R1      ;DIFFERENCE MUST BE LESS THAN 5
1033 004470 002401          BLT     2$
1034 004472 005725          TST     (R5)+    ;UPDATE RETURN
1035 004474 010137 001020 2$:  MOV     R1,TEMP    ;DEFRENCE FOR PRINT OUT
1036 004500 000205          RTS     R5
1037
1038          ;TEST 10 KHZ REPEATABILITY
1039          ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
1040          ;FOR 10KHZ.
1041 004502 104400          T25A:  SCOPE
1042 004504 005077 174270          CLR     @CSR
1043 004510 012777 000000 174264    MOV     #0,@CSB
1044 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	

;TEST LINE REPEATABILITY
;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
;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	

;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
1089	004754	012777	000002	174020			MOV	#2,@CSB
1090	004762	012777	000111	174010			MOV	#111,@CSR
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	
1098	005024	005077	173750		1\$:		CLR	@CSR
1099	005030	005777	173744				TST	@CSR
1100	005034	100001					BPL	+.4

;SET PROCESSOR PRIORITY 7
;SET COUNTER FOR FAST INTERRUPTS
;INT EN, REPEATED INT, DOWN COUNT, 100 KHZ, GO

;ERROR, ERROR (BIT 15) NOT SET

1101	005036	104000			HLT		
1102					:TEST BIT 15 IS CLEARED BY INIT		;ERR, FAILED TO CLEAR WHEN REF.
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,X2	
1128	005170	001405			BEQ	TRPA	
1129	005172	000005			RESET		
1130	005174	004712			LOGICAL: JSR	X7,(2)	
1131	005176	000240			NOP		
1132	005200	000240			NOP		
1133	005202	000240			NOP		
1134	005204	000137	001150		TRPA: JMP	BEGIN	


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1135
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1143 005210 012706 000776
1144 005214 004737 011652
1145 005220 013777 001010 173560
1146 005226 012777 000002 173554
1147 005234 012737 005602 000024
1148 005242 000005
1149
1150 005244 012777 141520 173530
1151 005252 012700 177772
1152 005256 012701 177754
1153 005262 012777 000111 173510
1154 005270 000001
1155 005272 005201
1156 005274 001375
1157 005276 105777 173512
1158 005302 100375
1159 005304 012777 000207 173500
1160 005312 005200
1161 005314 001360
1162 005316 042777 000101 173454
1163
1164 005324 012777 011610 173450
1165 005332 012700 177772
1166 005336 012701 177754
1167 005342 012777 000113 173430
1168 005350 000001
1169 005352 005201
1170 005354 001375
1171 005356 105777 173432
1172 005362 100375
1173 005364 012777 000207 173420
1174 005372 005200
1175 005374 001360
1176 005376 042777 000101 173374
1177
1178 005404 005737 006252
1179 005410 100677
1180 005412 012737 001130 005570
1181 005420 032777 000002 173416
1182 005426 001403
1183 005430 012737 000764 005570
1184
1185 005436 013777 005570 173336
1186 005444 012700 177772
1187 005450 012777 000115 173322
1188 005456 000001
1189 005460 105777 173330
1190 005464 100375

.SBTTL          TIMING TEST
;RING TELETYPE BELL AT 10 SECOND INTERVALS USING REPEATED INTERRUPT MODE
;1ST MINUTE = 100 KHZ
;2ND MINUTE = 10 KHZ
;3RD MINUTE = LINE
;4TH MINUTE = EXTERNAL

BEGIN1: MOV      #BUFF,%6
        JSR      %7,SWADJ      ;HAS THIS CPU HAVE A SWITCH REG.?
        MOV      CKVS,@CKV
        MOV      #RTI,@CKVS
        MOV      #PWRF2,%24    ;INIT POWER FAIL POINTER
        RESET

;100 KHZ
        MOV      #50000.,@CSB  ;INIT COUNT SET BUFFER FOR .5 SECONDS
        MOV      #-6,%0        ;COUNT 6(10 SECOND) INTERVALS
T28:    MOV      #-20.,%1      ;COUNT 20(.5 SECOND) INTERVALS
        MOV      #111,@CSR     ;100 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
T28A:   WAIT
        INC      %1            ;DONE 10 SECONDS?
        BNE      T28A          ;NO
        TSTB     @TCSR
        BPL      .-4
        MOV      #207,@TDBR
        INC      %0            ;DONE 6 TIMES?
        BNE      T28          ;NO
        BIC      #101,@CSR     ;YES DISABLE INTERRUPTS

;10 KHZ
        MOV      #5000.,@CSB  ;INIT COUNT SET BUFFER FOR .5 SECONDS
        MOV      #-6,%0        ;COUNT 6(10SECOND) INTERVALS
T29:    MOV      #-20.,%1      ;COUNT 20(.5 SECOND) INTERVALS
        MOV      #113,@CSR     ;10 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
T29A:   WAIT
        INC      %1            ;DONE 10 SECONDS?
        BNE      T29A          ;NO
        TSTB     @TCSR        ;YES, RING BELL
        BPL      .-4
        MOV      #207,@TDBR
        INC      %0            ;DONE 6 TIMES?
        BNE      T29          ;NO
        BIC      #101,@CSR     ;YES, DISABLE INTERRUPTS

;SET UP FOR 10 SECONDS AT LINE FREQ.
        TST      @#XORFLG
        BMI      BEGIN1
        MOV      #600.,LINE
        BIT      #2,@SR
        BEQ      .+10
        MOV      #500.,LINE

;LINE
        MOV      LINE,@CSB     ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
        MOV      #-6,%0        ;COUNT 6 (10 SECOND) INTERVALS
        MOV      #115,@CSR     ;LINE, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
T30:    WAIT
        TSTB     @TCSR
        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	001635			BEQ	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 ITERATION 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,#'a	

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 ;/@CZKWBJ KW11-P RT CLK TST@/;	
1347	006444	045102	045430	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	

1378 006620 000066
1379 006622 177562
1380 006624 177560
1381 006626 000060
1382 006630 000062
1383 006632 000000
1384 006634 000000
1385 006636 000000
1386 000211
1387 000224
1388 006640 177776
1389 006642 000000
1390 006644 000000
1391 006646 000000
1392 006650 000000
1393 006652 000000
1394 006654 000000
1395 006656 000000
1396 006660 000000
1397 006662 000000
1398 006664 000000
1399 006666 000000
1400 006670 000000
1401 006672 000000
1402 006674 000000
1403 006676 000000
1404 006700 000000
1405 006702 000000
1406 006704 000
1407 006705 000
1408 006706 000
1409 006707 000
1410 006710 000
1411 006711 000
1412 006712 000
1413 006714
1414
1415
1416
1417

PVECS: 66
KDBR: 177562
KCSR: 177560
KVEC: 60
KVECS: 62
CNT: 0
CNT1: 0
CNTB: 0
CTRL1=211
CTRLT=224
PSW: 177776
HRS1: 0
HRS2: 0
MIN1: 0
MIN2: 0
SEC1: 0
SEC2: 0
LST: 0
MST: 0
HRS1A: 0
HRS2A: 0
MIN1A: 0
MIN2A: 0
SEC1A: 0
SEC2A: 0
LSTA: 0
MSTA: 0
TMPSWR: 0
BYT1: .BYTE 0
BYT2: .BYTE 0
BYT3: .BYTE 0
BYT4: .BYTE 0
BYT5: .BYTE 0
BYT6: .BYTE 0
BYT7: .BYTE 0
.EVEN

;TEMP LOC FOR SOFT-SWR CONTENTS
;LOC FOR 1ST # INPUT VIA TTY
; " " 2ND " " " "
; " " 3RD " " " "
; " " 4TH " " " "
; " " 5TH " " " "
; " " 6TH " " " "
; " " 7TH " " " "

1418 006714 012706 000776
1419 006720 004737 011652
1420 006724 005077 177710
1421 006730 012737 000000 007674
1422 006736 012737 000131 007702
1423 006744 012700 010356
1424 006750 012701 010376
1425 006754 004537 007234
1426 006760 012737 000043 010506
1427 006766 012737 001217 010536
1428 006774 000137 007250
1429
1430 007000 012706 000776
1431 007004 004737 011652
1432 007010 005077 177624
1433 007014 012737 164217 007674

K100HZ: MOV #BUFF,%6
JSR %7,SWADJ ;HAS THIS CPU HAVE A SWITCH REG.?
CLR @PSW ;
MOV #0,CLK+2 ;100KHZ
MOV #131,CLK1+2
MOV #TABL,%0
MOV #TABL1,%1
JSR %5,@#MOVE
MOV #35,CLK3+2 ;LEAST VALUE
MOV #655,CLK4+2 ;MOST VALUE
JMP @#INIT

K10HZ: MOV #BUFF,%6
JSR %7,SWADJ ;HAS THIS CPU HAVE A SWITCH REG.?
CLR @PSW ;
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

CZKWBJO KW11-P RT CLK TST MACY11 30A(1052) 19-APR-78 09:58 ^{D 3} PAGE 29
CZKWBJ.P11 19-APR-78 09:55 SUBROUTINES

SEQ 0029

1439	007052	012737	001130	010536	MOV	#600.,CLK4+2
1440	007060	000137	007250		JMP	@#INIT

CZKWBJO KW11-P RT CLK TST
CZKWBJ.P11 19-APR-78 09:55

MACY11 30A(1052) 19-APR-78 09:58 E 3
SUBROUTINES PAGE 30

SEQ 0030

1441
1442 007064 012706 000776
1443 007070 004737 011652
1444 007074 005077 177540

H60Z: MOV #BUFF,%6
JSR %7,SWADJ
CLR @PSW

;HAS THIS CPU HAVE A SWITCH REG.?
;

CZKWBJO KW11-P RT CLK TST MACY11 30A(1052) 19-APR-78 09:58 F 3
CZKWBJ.P11 19-APR-78 09:55 SUBROUTINES PAGE 31

SEQ 0031

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

CZKWBJO KW11-P RT CLK TST MACY11 30A(1052) 19-APR-78 09:58 ^{G 3} PAGE 32
CZKWBJ.P11 19-APR-78 09:55 SUBROUTINES

SEQ 0032

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	#00,CLK3+2	
1451	007136	012737	001130	010536	MOV	#600.,CLK4+2	
1452	007144	000137	007250		JMP	@#INIT	
1453							
1454	007150	012706	000776		H502: 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,ACKV	
1483	007344	012777	000340	171436	MOV	#340,ACKVS	
1484	007352	012777	007560	177246	MOV	#KINTR,AKVEC	
1485	007360	012777	000200	177242	MOV	#200,AKVECS	
1486	007366	012777	000200	177224	MOV	#200,APVECS	
1487	007374	012777	000100	177222	MOV	#100,AKCSR	
1488	007402	005037	006606		CLR	@#CLKFLG	
1489	007406	005037	006610		CLR	@#INTFLG	
1490	007412	005077	171362		START: CLR	ACSR	
1491	007416	005077	171360		CLR	ACSB	
1492	007422	032777	000002	171414	WAITA: BIT	#2,ASR	;WAIT LOOP, SW 1 CAUSE WAIT
1493	007430	001401			BEQ	CLKON	
1494	007432	000001			WAITB: WAIT		
1495	007434	032777	000001	171402	CLKON: BIT	#1,ASR	;SW 0 TURNS ON CLK2
1496	007442	001032			BNE	3\$	
1497	007444	032777	000004	171372	BIT	#4,ASR	;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	ACSB1	
1502	007466	012777	007762	177106	MOV	#KOUT,ACKV1	


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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$:      JMP      WAITA
1514
1515 007560 017701 177036      KINTR:  MOV      @KDBR,%1          ;KEYBOARD INTERRUPT HANDLER
1516 007564 042701 177600              BIC      #177600,%1          ;STRIP JUNK
1517 007570 022701 000007              CMP      #7,%1          ;IS CHAR A G(CONTROL-G)?
1518 007574 001557              BEQ      CNGSWR          ;IF YES,GO TO CNGSWR
1519 007576 022701 000011              CMP      #11,%1         ;IS IT A CNTRL I ?
1520 007602 001404              BEQ      KIN
1521 007604 022701 000024              CMP      #24,%1         ;IS IT A CNTRL T ?
1522 007610 001464              BEQ      KOUT
1523 007612 000002              RTI
1524
1525
1526 007614 005077 171160      KIN:      CLR      @CSR          ;HANDLER FOR CTRL I
1527 007620 005077 171156              CLR      @CSB          ;SETUP TIME OF DAY
1528 007624 012737 177772 006632      MOV      #-6,@CNT
1529 007632 012737 006642 006634      MOV      #HRS1,@CNT1
1530 007640 005037 006656              CLR      LST          ;INPUT
1531 007644 005037 006660              CLR      MST
1532 007650 012777 007710 176750      MOV      #KINI,@KVEC
1533 007656 000002              RTI
1534
1535 007660 012777 007560 176740  KINI2:  MOV      #KINTR,@KVEC          ;AWAIT A CHAR TO START
1536 007666 017701 176730              MOV      @KDBR,%1
1537 007672 012777 000000 171102  CLK:      MOV      #0,@CSB          ;CLK 1
1538 007700 012777 000131 171072  CLK1:   MOV      #131,@CSR
1539 007706 000002              RTI
1540
1541 007710 013704 006634      KINI:      MOV      @CNT1,%4          ;STORE TIME OF DAY
1542 007714 017701 176702              MOV      @KDBR,%1
1543 007720 042701 000300              BIC      #300,%1
1544 007724 010124              MOV      %1,(%4)+
1545 007726 010437 006634              MOV      %4,@CNT
1546 007732 005237 006632              INC      @CNT
1547 007736 001003              BNE      1$
1548 007740 012777 007660 176660      1$:      MOV      #KINI2,@KVEC
1549 007746 000002              RTI
1550
1551 007750 017737 176646 007760  HOLDIT:  MOV      @KDBR,@HOLD          ;DUMMY INTERRUPT SERVICE ROUTINE
1552 007756 000002              RTI
1553
1554 007760 000000      HOLD:      0
1555
1556 007762 005037 006610      KOUT:      CLR      @INTFLG          ;INPUT HANDLER FOR CTRL T
1557 007766 012777 007750 176632      MOV      #HOLDIT,@KVEC          ;SET DUMMY VECTOR
1558 007774 012700 006642      MOV      #HRS1,%0          ;GET TIME OF DAY INTO
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1559 010000 012703 006662      MOV      #HRS1A,%3      ;WORK AREA
1560 010004 012704 177770      MOV      #-10,%4
1561 010010 012023      1$: 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: MOV      %2,-(6)      ;SAVE R2
1592 010134 010246      MOV      %3,-(6)      ;SAVE R3
1593 010136 010346
1594 010140      SETBYT: CLR      TMPSWR      ;CLEAR TEMP SWR
1595 010140 005037 006702      CLR      %3      ;CLEAR R3
1596 010144 005003      JSR      PC,CRLF      ;PRINT <CR><LF>
1597 010146 004737 010324      MOV      #BYT1,%2      ;INIT R2 TO 1ST BYTE LOC
1598 010152 012702 006704      CKCSR: TSTB      @KCSR      ;IS CHAR TYPED?
1599 010156      BPL      CKCSR      ;IF NOT, WAIT
1600 010156 105777 176442      MOV      @KDBR,%1      ;ELSE MOVE THE CHAR TO R1
1601 010162 100375      BIC      #177600,%1      ;STRIP JUNK
1602 010164 017701 176432      5$: TSTB      @PCSR
1603 010170 042701 177600      BPL      5$
1604 010174      MOV      %1,@PDBR
1605 010174 105777 176414      CMPB      #25,%1      ;IS CHAR U (CONTROL-U)?
1606 010200 100375      BEQ      SETBYT      ;IF YES, START OVER
1607 010202 010177 176404      CMPB      #15,%1      ;ELSE IS IT <CR>?
1608 010206 122701 000025      BEQ      SWDONE      ;IF EQUAL, GO TO SWDONE
1609 010212 001752      CMPB      #12,%1      ;IS IT <LF>?
1610 010214 122701 000015      BEQ      SWDONE      ;IF EQUAL, GO TO SWDONE
1611 010220 001412      BEQ      SWDONE
1612 010222 122701 000012      INC      %3
1613 010226 001407
1614 010230 005203
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1615 010232 042701 177770      BIC      #177770,%1      ;LEAVE ONLY BINARY # IN R1
1616 010236 110122      MOV      %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:      TST      %3      ;WAS A CHAR TYPED?
1620 010246 005703      BEQ      30$      ;IF NOT,EXIT
1621 010250 001420      MOV      #BYT1,%3      ;INIT R3 TO 1ST BYTE ADDR
1622 010252 012703 006704      10$:      BISB      (3)+,TMP$WR      ;SET LOW 3 BITS OF TMP$WR
1623 010256      CMP      %3,%2      ;IS R3 EQUAL BYTE ADDR IN R2?
1624 010256 152337 006702      BEQ      20$      ;IF YES ,EXIT
1625 010262 020302      ROL      TMP$WR      ;ELSE
1626 010264 001407      ROL      TMP$WR      ;SHIFT
1627 010266 006137 006702      ROL      TMP$WR      ;NEXT 3 BITS UP
1628 010272 006137 006702      BR       10$      ;AND GO GET ANOTHER #
1629 010276 006137 006702      20$:      MOV      TMP$WR,@SR      ;SET UP NEW $WR
1630 010302 000765      30$:      MOV      (6)+,%3      ;RESTORE R3
1631 010304      MOV      (6)+,%2      ;RESTORE R2
1632 010304 013777 006702 170532      JSR      PC,CRLF      ;PRINT <CR><LF>
1633 010312      RTI
1634 010312 012603      CRLF:      TSTB      @PCSR      ;IS TTY READY?
1635 010314 012602      BPL      CRLF      ;IF NOT,WAIT
1636 010316 004737 010324      MOV      #215,@PDBR      ;ELSE TYPE <CR>
1637 010322 000002      10$:      TSTB      @PCSR      ;IS TTY READY?
1638      BPL      10$      ;IF NOT,WAIT
1639 010324      MOV      #212,@PDBR      ;ELSE TYPE <LF>
1640 010324 105777 176264      RTS      PC
1641 010330 100375      TABL:      328.      ;TABLE FOR WORK AREA
1642 010332 012777 000215 176252      164.
1643 010340      82.
1644 010340 105777 176250      41.
1645 010344 100375      20.
1646 010346 012777 000212 176236      10.
1647 010354 000207      5.
1648      3.
1649 010356 000510      TABL1:      328.      ;100KHZ TIME TABLE
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      TABL2:      410.      ;10KHZ TIME TABLE
1658 010376 000510      205.
1659 010400 000244      102.
1660 010402 000122      51.
1661 010404 000051
1662 010406 000024
1663 010410 000012
1664 010412 000005
1665 010414 000003
1666
1667 010416 000632
1668 010420 000315
1669 010422 000146
1670 010424 000063
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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					
1695					
1696					
1697	010476	012737	177777	006610	CLKI: MOV #-1, @INTFLG
1698	010504	062737	000044	006656	CLK3: ADD #36, @LST
1699	010512	022737	000144	006656	CMP #100, @LST
1700	010520	003005			BGT CLK4
1701	010522	162737	000144	006656	SUB #100, @LST
1702	010530	005237	006660		INC @MST
1703	010534	062737	001217	006660	CLK4: ADD #655, @MST
1704	010542	022737	001750	006660	CMP #1000, @MST
1705	010550	003011			BGT 2\$
1706	010552	162737	001750	006660	SUB #1000, @MST
1707	010560	005237	006654		INC @SEC2
1708	010564	022737	000072	006654	CMP #72, @SEC2
1709	010572	001401			BEQ .+4
1710	010574	000002			2\$: RTI
1711	010576	012737	000060	006654	MOV #60, @SEC2
1712	010604	005237	006652		INC @SEC1
1713	010610	022737	000066	006652	CMP #66, @SEC1
1714	010616	001401			BEQ .+4
1715	010620	000002			RTI
1716	010622	012737	000060	006652	MOV #60, @SEC1
1717	010630	005237	006650		INC @MIN2
1718	010634	022737	000072	006650	CMP #72, @MIN2
1719	010642	001401			BEQ .+4
1720	010644	000002			RTI
1721	010646	012737	000060	006650	MOV #60, @MIN2
1722	010654	005237	006646		INC @MIN1
1723	010660	022737	000066	006646	CMP #66, @MIN1
1724	010666	001401			BEQ .+4
1725	010670	000002			RTI
1726	010672	012737	000060	006646	MOV #60, @MIN1

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

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1783 011220 012777 011266 175370 END1A: 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$:  ADD      #60,@#CNTB
1843 011570 013777 006636 175014  MOV      @#CNTB,@PDBR
1844 011576 000002              RTI
1845
1846 011600 012777 007560 175020 NUM2: MOV      #KINTR,@KVEC      ;RESTORE KEYBOARD VECTOR
1847 011606 000002              RTI
1848
1849
1850
1851
1852
1853
1854 011610 032777 000010 167226 DELADJ: BIT      #10,@SR      ;TEST FOR SR3=0 WHICH INDICATES
1855                                BEQ      1$      ;11/60, 11/70 & 11/45 WITH MOS
1856 011616 001401              BEQ      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                                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*							

CZKWBJO KW11-P RT CLK TST
CZKWBJ.P11 19-APR-78 09:55

MACY11 30A(1052) 19-APR-78 09:58 E 4
CROSS REFERENCE TABLE -- USER SYMBOLS PAGE 44

SEQ 0043

MST	006660	1396#	1475*	1531*	1702*	1703*	1704	1706*										
MSTA	006700	1404#	1589*	1746	1748*	1818												
NEW	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#															
PWRTN	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*	984#								
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									
TO	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	818#	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#											

CZKWBJO KW11-P RT CLK TST
CZKWBJ.P11 19-APR-78 09:55

MACY11 30A(1052) 19-APR-78 09:58 PAGE 46
CROSS REFERENCE TABLE -- USER SYMBOLS

SEQ 0045

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	006254	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

CZKWBJ.BIN,CZKWBJ.LST/CRF/SOL/NL:TOC=CZKWBJ.P11

RUN-TIME: 2 4 .5 SECONDS

RUN-TIME RATIO: 41/7=5.7

CORE USED: 9K (17 PAGES)