```
>>>>>>         CLOCK FIRMWARE                                                   <<<<<<<<
   3 000000                 *SOURCE KHTIME  -  BINARY KH5
   4 000000                        ENT ONCLK1
   5 000000                        ENT ONCLK2
   6 000000                        ENT ONCLK3
   7 000000                        ENT WAIT.
   8 000000                         ENT TIME0
   9 000000                         ENT TIME.
  10 000000                        ENT STIME.
  11 000000                         ENT ONTIM.
  12 000000                         ENT OFTIM.
  13 000000                 *
  14 000000                 ****************************************
  15 000000                 *THIS ROUTINE ADDS A BASE TIME FROM RAM AND
  16 000000                 *  THE ELAPSED TIME FROM THE SYSTEM CLOCK TO
  17 000000                 *  GIVE ACTUAL TIME(IN SECONDS)
  18 000000                 *
  19 000000                 ****   TIME ATTRIBUTES TABLE  **************
  20 000000 000 055                 OCT 0,55
  21 000002                 ****************************************
  22 000002 155 222         TIME.   CLB 55              ADDRESS TIMER 0
  23 000004 262 001 377             STBD R55,=GINTDS    DISABLE FOR THE MOMENT
  24 000007 316 377 377             JSB =TIMWST
  25 000012 140 223                 CLM 40              CLEAR UPPER 4 BYTES+
  26 000014 316 377 377             JSB =TIMRDY         TIME TO 44-47
  27 000017 144 261 013             LDMD R44,=CLKDAT
  27 000022 377
  28 000023 262 000 377             STBD R44,=GINTEN    RE-ENABLE EVERYONE
  29 000026 136 251 004             LDM 36,=4,0         MS TO SEC
  29 000031 000
  30 000032 231                     BCD
  31 000033 132 222                 CLB 32              SGN IS +
  32 000035 316 377 377             JSB =SHRONF            SHIFT AND PACK
  33 000040 150 261 123             LDMD 50,=TIME       GET BASE TIME
  33 000043 202
  34 000044 140 012 343             POMD 40,-12         GET INITIAL TIME
  35 000047 316 377 377             JSB =ADD10          COMPUTE ACTUAL TIME
  36 000052 236                     RTN
  37 000053                 ****************************************
  38 000053                 *THIS ROUTINE RETURNS THE JULIAN DATE ON THE STACK
  39 000053                 *THIS ROUTINE SETS THE SYSTEM CLOCK TO INTERRUPT
  40 000053                 *  ON THE #SECS FROM NOW UNTIL MIDNIGHT (AT WHICH
  41 000053                 *  POINT THE INTERRUPT ROUTINE WILL INCREMENT
  42 000053                 *  THE DATE IN RAM).  THE LOWER PORTION OF THE ROUTINE
  43 000053                 *  SHIFTS THE USER "SEC" INPUT TO MILLISEC FOR
  44 000053                 *  INPUT TO THE SYSTEM CLOCK
  45 000053                 *
  46 000053                 ***SETTIME ATTRIBUTES TABLE  **************
  47 000053 241                     OCT 241
  48 000054                 ****************************************
  49 000054 316 377 377 STIME.      JSB =ONEI           GET DATE OFF STACK
  50 000057 145 006 345             PUMD R45,+R6         AND SAVE IT
  51 000062 316 377 377             JSB =ONER           REAL TIME
  52 000065 141 220                 TSB  R41           - TIME?
```

```
>> >>>>        CLOCK FIRMWARE                                                       <<<<<<<<
  3 000067 376 007               JRZ  TIMOK.       JIF +
 54 000071 145 006 343           POMD R45,-R6      CLEAN R6
 55 000074 316 377 377 ER89D     JSB  =ERROR+
 56 000077 131                   OCT  89D          BAD PARAMS
 57 000100 140 006 345 TIMOK.   PUMD R40,+R6      SAVE BASE TIME
 58 000103 150 223               CLM  R50          GENERATE 86400
 59 000105 250 004               LDB  R50,=4       EXPONENT
 60 000107 156 251 100           LDM  R56,=100,206
 60 000112 206
 61 000113 231                   BCD
 62 000114 316 377 377           JSB  =SUB10       BUILD TERMINAL COUNT.
 63 000117                       DRP  !40
 64 000117                       ARP  !12
 65 000117 343                   POMD R40,-R12     POP TERM. COUNT
 66 000120 160 006 343           POMD R60,-R6      POP BASE TIME
 67 000123 155 343               POMD R55,-R6      POP DATE
 68 000125 157 204               LLB  R57          DUMP SIGN
 69 000127 206                   LRB  R57
    000130 141 220               TSB  R41          - TERMINAL COUNT?
  1 000132 377 340               JRN  ER89D        JIF YES
 72 000134 160 263 123           STMD R60,=TIME    BASE TIME
 72 000137 202
 73 000140 155 263 133           STMD R55,=DATE    DATE
 73 000143 202
 74 000144 251 032 004           LDM  R55,=32,4,0  STATUS,EXPONENT
 74 000147 000
    000150 316 026 001           JSB  =INTSET      START TIMER
    000153 260 012 377 WT41MS    LDBD R#,=CLKSTS   LET TIMER CLEAR
 77 000156 364 373               JNG  WT41MS       WAIT FOR 1 MS
 78 000160 236                   RTN
 79 000161              ***  COMMENTS:  SETTIME USES ONEI FOR "SECONDS SINCE MID
 80 000161              ***             AND CHECKS FOR VALUES OUTSIDE 0-86399 (R
 81 000161              ***             WHICH WILL RESULT IN AN ERROR .
 82 000161              ***
 83 000161              ***             ON TIMER USES INTSET SO THAT 1-99999999
 84 000161              ***             GIVES THE EXPECTED RESULT WHILE ALL OTHE
 85 000161              ***             ARE FORCED TO 0.  THIS WILL GENERATE AN
    000161              ***             IMMEDIATE INTERRUPT.
    000161              ***             THE NEXT INTERRUPT WOULD THEN
 88 000161              ***             OCCUR 27+ HOURS LATER.
 89 000161              ***
 90 000161              ***             ALSO NOTE THAT ON TIMER IGNORES THE SIGN
```

```
==========================================================================
>>>>>>>        WAIT STATEMENT                                              <<<<<<<<
 92 000161                  ****  WAIT ATTRIBUTES TABLE ********************
 93 000161 241                    OCT 241
 94 000162                  ************************************************
 95 000162 231              WAIT.   BCD
 96 000163 140 223                  CLM 40
 97 000165 210                      ICB 40
 98 000166 142 250 146              LDB 42,=146          GENERATE 16.666666666
 99 000171 043 243                  STM R42,R43          PROPAGATE THEM
100 000173 210                      ICB R42              67
101 000174 147 250 026              LDB R47,=26          MSBYTE
102 000177 140 012 345              PUMD 40,+12          PUSH  TO STACK
103 000202 316 377 377              JSB =DIV2            WAIT N>> N/16
104 000205 316 377 377              JSB =ONEI
105 000210 116 220                  TSB R16
106 000212 362 023                  JOD NOWAIT
107 000214 231                      BCD
108 000215 147 220          CK47    TSB R47              NEGATIVE?
109 000217 375 016                  JLN NOWAIT           JIF YES
110 000221 127 260 162              LDBD R27,=SVCWRD     EXIT ON KEYHIT
110 000224 200
111 000225 362 010                  JOD NOWAIT
112 000227 316 377 377              JSB =RETRA1
113 000232 231                      BCD
114 000233 145 213                  DCM 45               DOWN COUNT
115 000235 366 356                  JNZ CK47
116 000237 236              NOWAIT  RTN
117 000240                  ************************************************
118 000240                  * TIMER 3 INTERRUPT ROUTINE
119 000240                  ****** ON TIMER EXECUTION FROM EXEC**************
120 000240 175 261 350 ONCLK1  LDMD 75,=TIMTAB
120 000243 203
121 000244 230              CLK2EN  BIN
122 000245                          DRP  !75
123 000245 367 043                  JZR  CLKOUT          GET OUT IF NOT STARTED
124 000247 323 006 200              ADMD R75,=FWCURR     MAKE IT ABSOLUTE
125 000252 116 220                  TSB R16
126 000254 362 034                  JOD CLKOUT           JIF CALC MODE
127 000256 367 032                  JZR CLKOUT           JIF IDLE
128 000260 310 006                  CMB R16,=6           DONT ALLOW 6 EITHER
129 000262 367 026                  JZR CLKOUT
130 000264 165 261 065              LDMD R65,=ONFLAG     ALREADY SOME BODY ?
130 000267 200
131 000270 366 020                  JNZ CLKOUT
132 000272 261 310 377              LDMD R65,=PTR1       SAVE RETURN ADDR
133 000275 263 065 200              STMD 65,=ONFLAG      STORE RETURN
134 000300 175 263 310              STMD R75,=PTR1       ON TIMER ADDR
134 000303 377
135 000304 316 377 377              JSB =SETTR1          SET TRACE & "FROM"
136 000307 116 250 007              LDB R16,=7           RUN MODE ENTER IN MIDDLE
137 000312 235              CLKOUT  CLE
138 000313 236                      RTN
139 000314 175 261 353 ONCLK2  LDMD 75,=TIMTB2
139 000317 203
```

```
>>>>>>         WAIT STATEMENT                                        <<<<<<<<
  0 000320 760 322                  JMP CLK2EN
141 000322 175 261 756 ONCLK3  LDMD 75,=TIMTB3
141 000325 203
142 000326 760 314                  JMP CLK2EN
143 000330             **
144 000330
```

```
>>>>>>>     ON TIMER,OF TIMER                                          <<<<<<<<<
000330                        ****  TIMEOUT ATTRIBUTES TABLE  ******************
000330 241                          OCT 241
000331                        **************************************************
000331 316 377 377 ONTIM,     JSB =ONER
000334 140 020 243            STM R40,20           SAVE TIMEOUT AMT.
000337 316 377 377            JSB =ONEB            WHICH TIMER?
000342 116 220                TSB R16
000344 362 142                JOD NONTIM           JIF ODD
000346                        *  NOTE IF R16 IS ODD, COMPARE IS ODD
000346 146 055 242            STB 46,55
000351 213                    DCM 46               1-3 > 0-2
000352 036 243                STM 46,36
000354 140 020 241            LDM 40,20            TIMEOUT TO 40
000357 136 311 003            CMM 36,=3,0
000362 000
000363 372 004                JNC TIMOK
000365 316 377 377 BADPAR     JSB =ERROR+
000370 131                    OCT 89D              BAD PARAMS
000371             TIMOK      BSS  0
000371                        DRP  !36
000371 020 243                STM  R36,R20         COPY ORIGINAL
000373 205                    LLM  R36             DOUBLED
000374 303                    ADM  R36,R20         TRIPLED FOR INDEXING
000375 175 261 310            LDMD R75,=PTR1       GET PC ADDR
000400 377
000401 325 006 200            SBMD R75,=FWCURR     MAKE IT RELATIVE
000404 036 267 350            STMD R75,X36,TIMTAB
000407 203
000410 316 377 377            JSB  =LEGDUN         SKIP GOTO/GOSUB TOKEN
000413 155 220                TSB R55              CLEAR CARRY
000415 202                    ERB R55              SHIFT RIGHT
000416 202                    ERB R55                2 PLACES
000417 202                    ERB R55                (+1 FOR CARRY)
000420 312 072                ADB 55,=72           TIMER#,GO,CLR,ENABLE
000422 156 251 007            LDM 56,=7,0
000425 000
000426 231         INTSET     BCD
000427 316 377 377            JSB =SEP10           SEPARATE EXPONENT
000432 156 036 301            CMM R56,R36          EXP OUT OF RANGE
000435 373 002                JCY SHFTCK           JIF NO
000437 140 223                CLM R40              FORCE A 0
000441 136 056 301 SHFTCK     CMM R36,R56          EXP 4 OR MORE?
000444 373 021                JCY SETEN            JIF YES
000446 147 207                LRM R47              NO, SHIFT TERM COUNT
000450 367 015                JZR SETEN            EXIT WITH 0
000452 136 211                ICM R36              INCR. EXPONENT
000454 360 363                JMP SHFTCK           LOOP
000456                        *******
000456                        ***POWER ON ROUTINE FOR SYSTEM CLOCK
000456 155 250 032 TIME0      LDB R55,=32          CLEAR,GO,ENABLE
000461 144 223                CLM R44              GENERATE 86400
000463 146 251 100            LDM R46,=100,206
000466 206
```

```
>>>>>>        ON TIMER,OF TIMER                                          <<<<<<<<
 000467 262 001 377 SETEN   STBD R#,=GINTDS     DISABLE INTERRUPTS
 000472 316 377 377         JSB =TIMRDY         SEND STATUS
 000475 155 262 012         STBD R55,=CLKSTS
 000500 377
 000501             *** MUST NOT USE TIMWST HERE FOR LACK OF CYCLES
 000501 144 263 013         STMD R44,=CLKDAT    STORE TERM. COUNT
 000504 377
 000505 262 000 377         STBD R44,=GINTEN    ENABLE INTERRUPTS
 000510 236         NONTIM  RTN
 000511
 000511             ******** OF TIMER# ATTRIBUTES TABLE*************
 000511 241                 OCT 241
 000512             ************************************************
 000512 316 377 377 OFTIM.  JSB =ONEB           GET TIMER#
 000515 146 311 004         CMM 46,=4,0         (ONEB LEAVES BIN)
 000520 000
 000521 373 242             JCY BADPAR
 000523 055 242             STB R46,R55         SAVE FOR WRSTATUS
 000525 213                 DCM R46             FOR INDEX
 000526 036 243             STM R46,R36
 000530 205                 LLM R46             DOUBLE
 000531 303                 ADM R46,R36         TRIPLE
 000532 175 223             CLM R75
 000534 046 267 350         STMD R75,XR46,TIMTAB CLEAR TABLE ENTRY
 000537 203
 000540             *CARRY IS ALREADY 0, SO SHIFT MOVES IN A ZERO
 000540 155 202             ERB R55             SHIFT RIGHT
 000542 202                 ERB R55               2 PLACES
 000543 202                 ERB R55               (+1 FOR CARRY)
 000544 312 045             ADB R55,=45         ADD STOP,DISABLE,CLR SVC F/F
 000546 316 377 377         JSB =TIMWST         SEND THE STATUS
 000551 236                 RTN
 000552             *       UNIL EXTERNALS
 000552                     EXT ADD10
 000552                     EXT CONINT
 000552                     EXT DIV2
 000552                     EXT ERROR+
 000552                     EXT LEGDUN
 000552                     EXT ONEB
 000552                     EXT ONEI
 000552                     EXT ONER
 000552                     EXT RETRA1
 000552                     EXT SEP10
 000552                     EXT SETTR1
 000552                     EXT SHRONF
 000552                     EXT SUB10
 000552                     EXT TIMRDY
 000552                     EXT TIMWST
 000552             *       UNL FOR FIN
 000552                     FIN
```

```
ADD10   177777    EXT    1
BA  AR  000365    LCL    1
CL  7   000215    LCL    1
CLK2EN  000244    LCL    2
CLKDAT  177413  G DAD    2
CLKOUT  000312    LCL    5
CLKSTS  177412  G DAD    2
CONINT  177777    EXT    0   <--- NOT REFERENCED??
DATE    101133  G DAD    1
DIV2    177777    EXT    1
ER89D   000074    LCL    1
ERROR+  177777    EXT    2
FWCURR  100006  G DAD    2
GINTDS  177401  G DAD    2
GINTEN  177400  G DAD    2
INTSET  000426    LCL    1
LEGDUN  177777    EXT    1
NONTIM  000510    LCL    1
NOWAIT  000237    LCL    3
OFTIM.  000512    ENT    1
ON  K1  000240    ENT    1
OF  K2  000314    ENT    1
ONCLK3  000322    ENT    1
ONEB    177777    EXT    2
ONEI    177777    EXT    2
ONER    177777    EXT    2
ONFLAG  100065  G DAD    2
ONTIM.  000331    ENT    1
PTR1    177710  G DAD    3
RETRA1  177777    EXT    1
SEP10   177777    EXT    1
SETEN   000467    LCL    2
SETTR1  177777    EXT    1
SHFTCK  000441    LCL    2
SHRONF  177777    EXT    1
STIME.  000054    ENT    1
SUB10   177777    EXT    1
SVCWRD  100162  G DAD    1
TIME    101123  G DAD    2
TI  .   000002    ENT    1
TI  0   000456    ENT    1
TIMCK   000371    LCL    1
TIMOK.  000100    LCL    1
TIMRDY  177777    EXT    2
TIMTAB  101750  G DAD    3
TIMTB2  101753  G DAD    1
TIMTB3  101756  G DAD    1
TIMWST  177777    EXT    2
WAIT.   000162    ENT    1
WT41MS  000153    LCL    1
```

CCKHTI HAD 0 ERRORS 0 WARNINGS 50 LABELS LAST ERROR AT 0