

**REAL TIME
CLOCK
OWNER'S MANUAL**

SciTronics Inc.

RTC-100 Real-Time Clock

USER'S MANUAL

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SciTronics RTC-100 Real-Time Clock

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-- Note --

All clocks have an on-board, fully charged lithium battery. Serious damage to the battery may result if the circuit board is placed on a conducting surface.

INTRODUCTION

The SciTronics Inc. S-100 Real Time Clock offers computer enthusiasts an extremely accurate time piece for their system. It employs the latest microprocessor clock chip available and is crystal-controlled to assure .002% accuracy. A lithium battery provides clock power in the event that system power is removed. The RTC-100 may be used to generate interrupts while operating in the background, providing time resolutions as fine as every second. The clock provides year, month, date, day of week, hour, minute, and second data. The RTC-100 is made to be fully compatible with the SciTronics Remote Controller for real-time control of a-c operated appliances. Interactive software packages written in BASIC provide the user with easy-to-use programs to set and read the RTC-100. There are two programs required to use your clock, RTCSET, to set the clock, and RTCREAD to read and display the clock data. In addition to Basic versions of each of these programs, an assembly language program is supplied as an example of how to use the clock in a non-Basic interrupt-driven environment.

Before the clock is installed in your system, you will have to set the base port address and, if you plan to use program interrupt, the interrupt restart address.

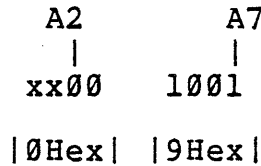
SELECTING THE BASE PORT ADDRESS

The S-100 clock uses four port addresses; one base address, and three additional consecutive addresses. These four ports are used to read and write various data registers within the Peripheral Interface Adaptor chip. In order to select your base address, you must set or reset the six port-select switches located on the circuit board. These switches are part of the 8-position dip switch, PORT, shown in Figure 1. The general form of the base port address is:

A0 A1 A2 A3 A4 A5 A6 A7, where A2 through A7 are user defined address bits. Putting any switch into the "ON" ("OFF") position causes that address bit to be valid when high (low).

Scitronics RTC-100 Real-Time Clock

As an example, to set the base address to 144 decimal (220 octal/90 hexadecimal), the PORT switches should be set as follows:



Note that address bits A1 and A0 do not get set because they are used internally to select among the clock functions. It is important that you set the switches with reference to the markings on the circuit board and the diagram of Figure 1, below. Do not use the switch markings as a guide to the identification of the address bits as they may vary from one production run to another. The only valid base addresses are those which are multiples of 4, such as: 0, 4, 8, 12, 16, 20, 244, 248, 252. Table I is a listing of valid port addresses in binary and decimal. Since the Basic clock software will ask you for your base port address in decimal, choose one that does not conflict with any I/O ports already assigned in your system and note it here.

Base Port Address = 96 (decimal)
~~60~~

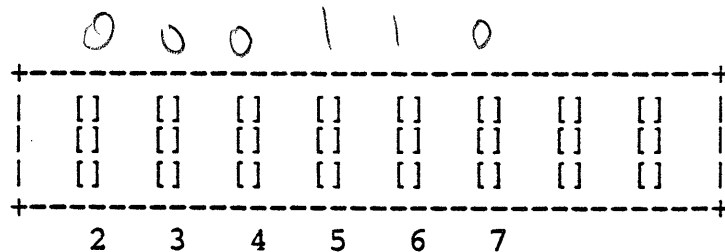


Figure 1. - Base Port Address Switch

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Table I. Valid Base Port Addresses

<u>Decimal</u>	<u>Binary</u>	<u>Decimal</u>	<u>Binary</u>	<u>Decimal</u>	<u>Binary</u>
00	000000	88	011010	172	110101
04	100000	92	111010	176	001101
08	010000	96	000110	180	101101
12	110000	100	100110	184	011101
16	001000	104	010110	188	111101
20	101000	108	110110	192	000011
24	011000	112	001110	196	100011
28	111000	116	101110	200	010011
32	000100	120	011110	204	110011
36	100100	124	111110	208	001011
40	010100	128	000001	212	101011
44	110100	132	100001	216	011011
48	001100	136	010001	220	111011
52	101100	140	110001	224	000111
56	011100	144	001001	228	100111
60	111100	148	101001	232	010111
64	000010	152	011001	236	110111
68	100010	156	111001	240	001111
72	010010	160	000101	244	101111
76	110010	164	100101	248	011111
80	001010	168	010101	252	111111
84	101010				

Note: the binary digits are listed in the same order as they would be set into the PORT switch with the S-100 connector towards you.

READING THE CLOCK

Your Scitronics Real-Time clock keeps time continuously; powered by your system when it is on, and by its onboard lithium battery when your system is off. You may read the clock at any time when your system is running; an example of a Basic program to read and display the clock data is given in the Appendix. This program, RTCREAD, reads and displays the clock data on a continuous basis. The program elements, and, in particular, the clock read subroutine, may be incorporated as part of your own software.

SEQUENCE TO ENABLE CLOCK READ no interrupts active:

port # = dec = hex = 76 543 2 10 - binary bit order

port 1 = 240 = F0H = 11 110 0 00 - to PIA 'A' ctrl port
CA2 = low = hold high =
start of stop clock pulse

port 0 = 15 = 0FH = 0000 1111 - to PIA 'DIR' data input register
|||| |||| direction information to be used
|||| |||| later by F4H instruction
|||| ++++--> sets b0-b3 to output
++++-----> sets b4-b7 to input

150us delay

port 1 = 244 = F4H = 11 110 1 00 - to PIA 'A' ctrl port
sets CA2 low & port direction
CA2 = low = hold high =
clock stopped

port 3 = ~~248~~²⁵² = ~~F8H~~^{FCH} = 11 111 0 00 - to PIA 'B' ctrl port
sets CB2 high
CB2 = high = start of read pulse

SEQUENCE TO READ CLOCK (repeat as needed):

digit address out to PIA port 'A'

6us delay

read PIA port 'A'

clear lower four bits

rotate upper four bits into lower four bits

save result

do next digit

AND 3 to ^{days} month tens digit - eliminate leap year indicator

AND 3 to hours tens digit - eliminate AM/PM indicator

SEQUENCE TO RETURN CLOCK TO RUN MODE:

port 3 = 240 = F0H = 11 110 0 00 - to PIA 'B' ctrl port
sets CB2 low
CB2 = low = read pulse off

port 1 = 248 = F8H = 11 111 0 00 - to PIA 'A' ctrl port
sets CA2 high
CA2 = high = hold low =
end of clock stop pulse =
clock run mode active

port 0 = 15 = 0FH

port 3 = 248 = F8H see pg 34

SETTING THE CLOCK

Once you have installed your clock and are able to read it, you will want to set it to correspond to your local time zone. A Basic program, RTCSET, is provided for this purpose. You must tell the program your base port address (in decimal), and the current date and time. You will be asked to set the clock to the next full minute because the clock automatically resets its seconds to zero when it is set. You will be asked for the last two digits of the year, the one or two digits of the month, the date, the day of the week (Sunday = 0, etc.) and the time on a 24-hour basis. The clock is capable of handling Leap Year, although that feature is not included in the program as released.

SEQUENCE TO ENABLE CLOCK SETTING no interrupts active:

port # = dec = hex = 76 543 2 10 - binary bit order

port 0 = 255 = FFH = 1111 1111 - to PIA 'A' data input register
 port 2 = 255 = FFH = 1111 1111 - to PIA 'B' data input register
 data to preset both PIA ports
 to output

port 1 = 244 = F4H = 11 110 1 00 - to PIA 'A' ctrl port
 sets CA2 to low & DIR of port
 CA2 = low = hold high
 start of stop clock pulse

port 3 = 244 = F4H = 11 110 1 00 - to PIA 'B' ctrl port
 sets CB2 to low & DIR of port
 CB2 = low = read off

150us delay

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SEQUENCE TO SET CLOCK (repeat as needed):

```

port 0 = xxx = xxH =   xxxx xxxx - digit address & data to PIA port 'A'
                        |||||  |||||
                        |||||  |||+--> b0 = a0 = clock digit
                        |||||  ||+---> b1 = a1   select address
                        |||||  |+----> b2 = a2   bits
                        |||||  +-----> b3 = a3
                        |||||
                        |||+-----> b4 = d0 = data to clock
                        ||+-----> b5 = d1   bits
                        |+-----> b6 = d2
                        +-----> b7 = d3

```

```

port 2 =  0 = 00H =   0000 0000 - to PIA 'B' data input register
                                turns write pulse on

```

```

port 2 =  1 = 01H =   0000 0001 - to PIA 'B' data input register
                                turns write pulse off

```

do next digit

SEQUENCE TO RETURN CLOCK TO RUN MODE:

```

port 1 = 248 = F8H = 11 111 0 00 - to PIA 'A' ctrl port
                                sets CA2 high end of stop pulse
                                CA2 = high = hold low = run

```


The three bits xxx allow control to be transferred to any one of eight fixed locations; namely, 0, 8, 16, 24, 32, 40, 48, and 56. To give the user maximum flexibility in selecting any one of these eight locations, a 4-position dip switch, INT, is provided as shown in Figure 2. Please note the markings on the diagram. Also note that the switch is negative logic, that is, ON for 0 and OFF for 1. It is recommended that you avoid having all switches on (RST 0) or all switches off (RST 7) as, frequently, these addresses are used by other devices. Table II lists legal interrupt codes and their decimal equivalents.

Note your INT code here = _____ (decimal)

Table II. - Valid Interrupt Addresses

<u>Interrupt Code</u>	<u>Switch Setting</u>	<u>Decimal Equivalent</u>
B0 xxx B7		
111 000 11	ON ON ON	0
111 100 11	OFF ON ON	8
111 010 11	ON OFF ON	16
111 110 11	OFF OFF ON	24
111 001 11	ON ON OFF	32
111 101 11	OFF ON OFF	40
111 011 11	ON OFF OFF	48
111 111 11	OFF OFF OFF	56

SOFTWARE DESCRIPTION

The two Basic programs, RTCREAD and RTCSET, have been described previously in brief. This section will discuss the format of the clock data as read by RTCREAD and as used by RTCSET to set the clock. This format is also used by the Scitronics a-c controller software to schedule and control a-c appliances and lights.

The clock data block consists of a 13-byte area, each byte of which contains a single clock digit in its least significant 4 bits. The clock digits are in the order: year tens, year units, month tens (Leap Year flag is included with this digit), month units, day-of-week digit, hour tens (24-hour flag is included with this digit), hour units, minute tens, minute units, second tens, and second units. The read subroutine in RTCREAD places the clock board in read mode with Digit Hold on (so the digits will not change while you read them) and fills the clock data block.

Days tens, Days units

The actual clock read operation requires transmitting a digit code to the clock (0=seconds units, 1= seconds tens, etc.), and then reading the clock port. At the conclusion of the read cycle, the clock is released from Hold. RTCREAD does not enable clock interrupts because it does not operate under interrupt, but reads the clock continuously. Because it cycles through the read and display portions of the program continuously, and because the speed of the various Basic programs vary considerably, the program may display the time more or less often than once per second on your system.

RTCSET uses a similar clock data block to set the clock; however, the format of the data actually used for setting the clock is somewhat different. The first part of RTCSET asks the user for the clock base port address and the clock setting information. Next the information is formatted with the data in the high order 4 bits and the digit code in the low order four bits. The digit code is the same as that used in reading the clock, that is 0=seconds units, 1=second tens, etc. The clock is set by the sequence of port operations shown in the program which transmit the data-digit/code-digit bytes to the clock and then place the clock back into normal mode. Once again, the clock interrupt is not enabled in the Basic programs.

The Appendix also contains a listing of a program demonstrating interrupt-driven use of the RTC100. This program is divided into two major sections: first, a section which is user-dependent; and second, the clock routines to set, read, start, and stop the clock. These routines, SETTER, INTR, STARTS, and STOPS should form part of any interrupt-driven software.

SETTER expects to find the clock data in the low four bits of the bytes in the clock area. It shifts each to the high four bits, inserts the proper code digit and sends the digits to the clock. SETTER must be run with interrupt off to avoid having INTR affect the data being set up; also, it does not enable interrupt mode after the clock is set. It is important to realize that the clock chip keeps time even when interrupt is off.

INTR is the interrupt service routine which is invoked automatically each second to read the clock data into the data array, CLOCK. The data is placed as individual digits into the array; the Leap Year and 24-hour flags are stripped off prior to storage. As shown in the first part of the demonstration program, the clock data may be printed from the data array by adding ASCII zero to each digit and sending them to an ASCII printer. INTR restores interrupt mode when it has finished reading the clock data.

Once the clock has been set, it will keep time and may be read; however, it will not be enabled to interrupt back ground programs until the program STARTS is run. This program enables the seconds 'tick' from the clock chip through the PIA chip to cause a program interrupt request. You must have set the INT switch on your RTC100 board to a suitable address and that address must be used for the program constant, RSTART. STARTS will set up the interrupt vector at RSTART to point to the interrupt service routine, INTR, before enabling interrupt.

You must have an interrupt vector at RSTART and the service routine INTR active in memory whenever the clock is generating interrupts. If not, your computer will get 'lost' and crash whatever program you are running. The program, STOPS, is provided to disable the clock interrupts so you may use your computer in the normal manner. STOPS disables the clock interrupts in two ways; first, it disables ALL interrupts by the command, DI, and second, it programs the PIA chip to not pass on the clock 'ticks'. If you are running other interrupt-driven devices besides the RTC100, you may wish to remove the DI command from the beginning of STOPS. Once again, STOPS stops the interrupts, not the time-keeping!

SOFTWARE

APPENDIX

I. RTCREAD.BAS

```

10      REM **READ SCITRONICS REAL-TIME CLOCK**
20      REM **COPYRIGHT 1980 - SCITRONICS, INC.**
30      DIM TIME(13),W$(7)
40      DATA SUN,MON,TUE,WED,THU,FRI,SAT
50      FOR X=1 TO 7 : READ W$(X) : NEXT X
60      PRINT
70      PRINT "PROGRAM TO DISPLAY CLOCK DATA"
80      PRINT "SCITRONICS, INC., BETHLEHEM, PA"
90      PRINT
100     REM THIS IS THE NON INTERRUPT-DRIVEN VERSION
110     PRINT "ENTER CLOCK BASE PORT ADDRESS"
120     PRINT "IN DECIMAL INTEGER FORM - 0,4,8,12,16,20,ETC"
130     PRINT "MAXIMUM VALUE = 252"
140     INPUT P
150     REM CHECK FOR PROPER VALUE AND RANGE
160     IF P>=256 THEN 60
170     M=INT(P/4)
180     IF (4*M-P)<>0 THEN 60
190     P1=P+1
200     P2=P+2
210     P3=P+3
220     REM DISPLAY LOOP STARTS HERE
230     GOSUB 1000
240     Y=TIME(1)*10+TIME(2)
250     MO=TIME(3)*10+TIME(4)
260     D=TIME(5)*10+TIME(6)
270     W=TIME(7)+1
280     H=TIME(8)*10+TIME(9)
290     MI=TIME(10)*10+TIME(11)
300     S=TIME(12)*10+TIME(13)
310     PRINT Y;" ":"MO;" ":";D;" ";
320     PRINT W$(W);". ";
330     PRINT H;" ":"MI;" ":";S;" "
340     PRINT
350     GOTO 230
360     REM

```

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```

1000 REM *****
1010 REM THIS READS THE CLOCK DATA *
1020 REM *****
1030 OUT P1,240 - F0 ✓
1040 OUT P,15 - 0F ✓
1050 OUT P3,252 - FC ✓
1060 OUT P1,244 - F4 ✓
1070 FOR X=1 TO 13
1080 OUT P,13-X
1090 TIME(X)=INP(P) : NEXT X
1100 REM PUT CLOCK BACK INTO RUNNING MODE
1110 OUT P1,248 - F8 ✓
1120 OUT P,15 - 0F ✓
1130 OUT P3,248 - F8 ✓
1140 OUT P1,252 - FC ✓
1150 OUT P,15 - 0F ✓
1160 FOR X=1 TO 13
1170 TIME(X)=INT(TIME(X)/16) : NEXT X
1180 REM THERE ARE SPECIAL MARKS ON HOURS AND DAYS MONTH
1190 REM STRIP THEM OFF
1200 TIME(X)=TIME(X) AND 3
1210 TIME(8)=TIME(8) AND 3
1220 RETURN
1230 REM **LATEST REVISION - 801107**

```


Scitronics RTC-100 Real-Time Clock

II. RTCSET.BAS

```

10 REM PROGRAM TO SET SCITRONICS CLOCK - 801030
20 REM **COPYRIGHT 1980 - SCITRONICS, INC**
30 DIM TIME(13)
40 PRINT "PROGRAM TO SET THE SCITRONICS CLOCK"
50 PRINT "SCITRONICS, INC., BETHLEHEM, PA 18015"
60 PRINT
70 PRINT "ENTER CLOCK BASE PORT ADDRESS"
80 PRINT "IN DECIMAL INTEGER FORM - 0,4,8,12,16,20,ETC"
90 PRINT "MAXIMUM VALUE = 252"
100 INPUT P
110 REM CHECK FOR PROPER VALUE AND RANGE
120 IF P>=256 THEN 60
130 M=INT(P/4)
140 IF(4*M-P)<>0 THEN 60
150 P1=P+1
160 P2=P+2
170 P3=P+3
180 REM GET THE TIME DATA
190 PRINT
200 PRINT "ENTER DATE IN THE FORM: YR,MO,DA "
210 PRINT "ONLY LAST 2 DIGITS FOR YR!"
220 INPUT YR,MO,DA
230 PRINT
240 PRINT "ENTER DAY-OF-THE-WEEK - 0=SUNDAY "
250 INPUT W
260 PRINT
270 PRINT "ENTER TIME ON 24HR CLOCK IN THE"
280 PRINT "FORM: HR,MIN"
290 PRINT "CLOCK ALWAYS STARTS ON 00 SECONDS, SO"
300 PRINT "BE SURE TO ENTER THE NEXT MINUTE."
310 INPUT HR,MIN
320 REM PREPARE THE DATA FOR ENTRY
330 TIME(1)=16*INT(YR/10)+12
340 TIME(2)=16*(YR-10*INT(YR/10))+11
350 TIME(3)=16*INT(MO/10)+10
360 TIME(4)=16*(MO-10*INT(MO/10))+9
370 TIME(5)=16*INT(DA/10)+8
380 TIME(6)=16*(DA-10*INT(DA/10))+7
390 TIME(7)=16*W+6
400 TIME(8)=16*INT(HR/10)+5-128 24h time
410 TIME(9)=16*(HR-10*INT(HR/10))+4
420 TIME(10)=16*INT(MIN/10)+3
430 TIME(11)=16*(MIN-10*INT(MIN/10))+2
440 TIME(12)=1
450 TIME(13)=0

```

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```

460     REM DATA IS READY, ASK FOR
470     REM START SIGNAL FROM USER
480     PRINT
490     PRINT "ENTER 1 AND CARRIAGE RETURN TO SET CLOCK"
500     PRINT "PUSH CR ON THE ZERO SECOND"
510     INPUT J
-----
520     REM THIS IS THE SETTING SEQUENCE
530     OUT P3,244  F4
540     ② OUT P2,255  FF
550     OUT P3,240  F0
560     OUT P2,255  FF
570     OUT P1,240  F0
580     ① OUT P,255   FF
590     ④ OUT P3,244  F4
600     ③ OUT P1,244  F4
-----
610     FOR X=1 TO 13
620     OUT P,TIME(X) ✓
630     0+ OUT P2,0 ✓
640     OUT P2,1 ✓
650     NEXT X
-----
660     ① OUT P1,248  F8
670     OUT P3,240  F0
-----
680     PRINT "THE CLOCK IS SET"
690     END

```

III. RTC.ASM

```

;*****
; SciTronics S-100 Real-Time Clock      *
;                                         *
;      Date      -      801024          *
;      Revision  -      801202          *
;      Programmer -      A. I. Larky     *
;                                         *
;*****
;      COPYRIGHT 1980 - SCITRONICS, INC  *
;*****
;
;      ORG      100H
;
BDOS      EQU      5H      ;DISK SYSTEM ETP
CONIN     EQU      1H      ;READ CONSOLE DEVICE
PRINT     EQU      9H      ;PRINT LINE BUFFER
;
CR        EQU      13
LF        EQU      10
;
;*****
;      TEST PROGRAM                      *
;      THE CODE WHICH FOLLOWS IS AN EXAMPLE *
;      OF THE INITIALIZATION AND DISPLAY OF *
;      CLOCK INFORMATION.                 *
;      IT SHOULD BE CUSTOMIZED FOR YOUR OWN *
;      APPLICATION. THE CODE WHICH FOLLOWS *
;      THE DIVIDING LINES IS COMMON TO ALL *
;      CLOCK PROGRAMS.                   *
;*****
;
;      LXI      SP,STACK
;      CALL    MSG
;      DW      ID
;      CALL    STOPS      ;STOP THE CLOCK
;      CALL    SETUP     ;SET UP DATE AND TIME
;      CALL    STARTS    ;START THE CLOCK
AGAIN:    CALL    DISPLA
;      JMP     AGAIN
;
;      ID      DB      '(801202) - SCITRONICS REAL-TIME CLOCK'
;      DB      CR,LF,'$'

```

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```

;*****
; THE DISPLAY ROUTINES BUILD AN OUTPUT STRING *
; AT "LINE" WHICH CAN BE PRINTED TO SHOW DATE *
; AND TIME. THE USER SHOULD INSERT HIS OWN *
; PRINT ROUTINE IN PLACE OF THE BDOS CALL IN *
; THE ROUTINE "MSG". *
;*****
;
DISPLA: LXI      H,OLD
        MOV      A,M      ;EXAMINE FLAG
        ANA      A
        JZ       DISPLA   ;SAME OLD DATA
        DI                    ;DON'T INTERRUPT WHILE
                                ;WE'RE MAKING THE LINE IMAGE
        MVI      M,0      ;CLEAR THE FLAG
        LXI      B,6
        LXI      D,LINE   ;OUTPUT BUFFER
        LXI      H,CLOCK
        CALL     DISP8    ;DISPLAY DATE
        INX      H        ;SKIP DAY OF THE WEEK
        CALL     BLANK
        MVI      C,6
        CALL     DISP8    ;SET UP TO DISPLAY TIME
;
; IF YOU HAVE A Z-80 CPU YOU MUST SELECT MODE 0
; INTERRUPTS BY PUTTING
; DB          0EDH
; AND . . . . .
; DB          46H
; IN PLACE OF THE NOP'S BELOW.
        NOP
        NOP
;
        EI          ;ITS OK TO TURN INTERRUPT BACK ON
        CALL     CRLF
        CALL     MSG    ;PRINT THE LINE IMAGE
        DW      LINE
        RET
;
DISP8:  CALL     DISP9
        CALL     DISP9 ;PLANT 2ND DIGIT
        MVI      A,':'
        CALL     DISP9A ;PLANT COLON
        JNZ     DISP8
        RET

```

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```

;
DISP9:  MOV    A,M
        INX    H
        ANI    0FH
        ADI    '0'
        DCR    C
DISP9A: STAX   D
        INX    D
        RET

;
BLANK:  MVI    A,' '
        JMP    DISP9A

;
CRLF:   MVI    A,13
        CALL   DISP9A
        MVI    A,10
        CALL   DISP9A
        MVI    A,'$'
        JMP    DISP9A

```

```

;
SETUP:  CALL   MSG
        DW     DOYOU
        CALL   READ    ;GET ANSWER
        CPI    'Y'
        STA    OLD     ;UNKNOWN TIME
        RNZ    ;NO
        CALL   MSG
        DW     ASKFOR  ;PROMPT FOR DATA
        CALL   NUMIN   ;GET DATE AND TIME
        JMP    SETTER  ;SET THE CLOCK

;
NUMIN:  LXI    D,CLOCK
        MVI    B,4
        CALL   NUMCON  ;GET DATE INFO
        DCX   D        ;ONLY ONE DIGIT TO DAY-OF-WEEK
        LDAX  D        ;GET IT
        DCX   D        ;BACKUP
        STAX  D        ;PLANT IT
        INX   D
        MVI    B,2
        JMP    NUMCON  ;GET TIME INFO (HR. & MIN. ONLY)

```

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```

;
NUMCON: MVI      L,0      ;CLEAR THE NUMBER
NUMC2:  CALL     READ     ;GET ONE DIGIT
        CPI      ' '
        JZ       NUMC4    ;BLANK IS AN ENDING
        CPI      ','
        JZ       NUMC4    ;SO IS COMMA
        CPI      '.'
        JZ       NUMC4    ;SO IS PERIOD
        SUI      '0'      ;NOW WE ASSUME A DIGIT
        DAD      H        ;BEGIN THE *16
        DAD      H
        DAD      H
        DAD      H
        ADD      L        ;INSERT NEW DIGIT
        MOV      L,A
        JMP      NUMC2    ;GET MORE DIGITS
; THE CODE ABOVE ENSURES THAT WE TREAT ONE-DIGIT
; AND TWO-DIGIT ENTRIES ALIKE.
NUMC4:  MOV      A,L
        RRC
        RRC              ;MOVE HIGH STUFF LOW
        RRC
        RRC
        ANI      0FH
        STAX     D
        INX     D
        MVI      A,0FH
        ANA     L
        STAX     D        ;PLANT A DIGIT
        INX     D
        DCR     B        ;MORE PAIRS ?
        JNZ     NUMCON   ;YES
        RET
;
; THE USER SHOULD INSERT HIS OWN OUTPUT
; ROUTINE CALL IN PLACE OF THE CALL TO BDOS
;
; NOTE: $ IS THE END-OF-PRINT-LINE FLAG
; FOR BDOS, NOT A PRINTABLE CHARACTER.

```

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```

MSG:      XTHL
          MOV      E,M
          INX      H
          MOV      D,M
          INX      H
          XTHL
          MVI      C,PRINT
          JMP      BDOS

;
; THE USER SHOULD INSERT HIS OWN CHARACTER INPUT
; ROUTINE IN PLACE OF THE CALL TO BDOS.
;
READ:     PUSH     B
          PUSH     D
          PUSH     H
          MVI      C,CONIN
          CALL     BDOS
          POP      H
          POP      D
          POP      B
          RET

;
ASKFOR:   DB      '  ENTER DATE AND TIME',CR,LF
          DB      '  (YR,MON,DAY,DATE,HR,MIN.)'
          DB      CR,LF,' IN THE FORM: 80,10,25,6,18,12.'
          DB      CR,LF,'  (SUNDAY = DAY 0)',CR,LF,'$'

;
DOYOU:   DB      CR,LF,'  SET NEW TIME ? - $'

;
LINE:    DS      25
OLD:     DS      1      ;OLD CHECKSUM KEPT HERE

;
;*****
;      END OF DISPLAY EXAMPLE      *
;*****
; THE ROUTINES WHICH FOLLOW SHOULD BE *
; PART OF ANY CLOCK SOFTWARE.  WHILE *
; THE READING OF THE CLOCK IS DONE VIA *
; PRIORITY INTERRUPT, THE USER MAY READ*
; THE CLOCK AT ANY TIME BY CALLING THE *
; ROUTINE "INTR".  IF THE CLOCK IS NOT *
; TO BE READ UNDER INTERRUPT, REMOVE *
; THE 'EI' INSTRUCTION FROM THE END OF *
; THE "INTR" AND "STARTS" ROUTINES.  *
;*****

```

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```

;
PORT    EQU    24        ;BASE PORT ADDRESS
;
; THE VALUE FOR 'PORT' MUST MATCH THAT WHICH YOU HAVE
; SELECTED BY THE SWITCHES ON YOUR CARD.  THE ONE SHOWN
; ABOVE CORRESPONDS TO SWITCH SETTINGS: 0110000
;
PORT1   EQU    PORT+1
PORT2   EQU    PORT+2
PORT3   EQU    PORT+3
;
; THE VALUE FOR 'RSTART' MUST MATCH THAT WHICH YOU HAVE
; SELECTED BY THE SWITCHES ON YOUR CARD.  THE ONE SHOWN
; BELOW CORRESPONDS TO SWITCH SETTINGS: ON OFF OFF
;
RSTART  EQU    48        ;RESTART ADDRESS
;
; THIS IS THE INTERRUPT SERVICE ROUTINE WHICH IS
; INVOKED BY THE CLOCK, ONCE PER SECOND.
;
INTR:   PUSH    PSW      ;SAVE ALL REGISTERS
        PUSH    B
        PUSH    D
        PUSH    H
        MVI    A,0F0H   ;SEQUENCE TO ENABLE THE CLOCK
        OUT    PORT1   ;FOR READING
        MVI    A,0FH
        OUT    PORT
        MVI    A,07FH
LOOP1:  INR     A
        JNZ    LOOP1
        MVI    A,0FCH
        OUT    PORT3
        MVI    A,0F4H
        OUT    PORT1
        LXI    B,NDATA
        LXI    H,CLOCK+NDATA-1

```

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Scitronics RTC-100 Real-Time Clock

Continued from previous page.

```

LOOP2:  MOV     A,B
        OUT     PORT      ;CODE DIGIT TO SELECT CLOCK ELEMENT
        NOP
        NOP              ;WE NEED A BIT OF DELAY HERE TOO
        NOP
        NOP
        NOP
        NOP
        IN      PORT      ;READ CLOCK ELEMENT
        ANI     0F0H      ;DROP CODE DIGIT
        RRC
        RRC              ;MOVE DATA TO LOW NIBBLE
        RRC
        RRC
        MOV     M,A       ;SAVE DATA DIGIT
        DCX    H
        INR    B
        DCR    C
        JNZ    LOOP2
; NOW WIPE OUT THE LEAP YEAR AND 24HR MARKS
        LXI    D,HOUR-CLOCK+1
        DAD    D          ;OFFSET TO HOUR TENS
        MOV    A,M
        ANI    3
        MOV    M,A
        DCX    H          ;BACK UP TO MONTH
        DCX    H
        DCX    H
        MOV    A,M
        ANI    3
        MOV    M,A       ;WIPE OUT LEAP YEAR MARK
INTR4:  MVI    A,0F8H   ;BEGIN SEQUENCE TO RETURN 298
        OUT     PORT1   ;CLOCK TO INTERRUPT MODE
        MVI    A,0FH    15
        OUT     PORT
        IN      PORT2    ;CLEAR MINUTES INTERRUPT
    
```

Continued on next page.

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```

;NOTE ** IF YOU WANT TO INTERRUPT EVERY MINUTE, CHANGE
; THE TWO INSTRUCTIONS BELOW TO THE VALUES IN PARENTHESES.
MVI    A,0F8H    ;(MVI A,0F9H)  *****
OUT    PORT3    ;DISABLE (ENABLE) MINUTES INTERRUPT
MVI    A,0FDH    ;(MVI A,0FCH)  *****
OUT    PORT1    ;ENABLE (DISABLE) SECONDS INTERRUPT
MVI    A,0FH    ;
OUT    PORT     ;
STA    OLD      ;SET DISPLAY FLAG
POP    H        ;RESTORE ALL REGISTERS
POP    D
POP    B
POP    PSW
; IF YOU HAVE A Z-80 CPU, SELECT INTERRUPT MODE 0 BY
; PUTTING . . . . .
;    DB    0EDH
;AND . . . . .
;    DB    46H
; IN PLACE OF THE NOP'S WHICH FOLLOW
NOP
NOP
;
;    EI          ;RE-ENABLE INTERRUPT MODE
;    RET

```

```

;
;SETTER: DI      ;TURN OFF INTERRUPT
MVI    A,0F4H    244 ✓
OUT    PORT3
MVI    A,0FFH    255 ✓
OUT    PORT2
MVI    A,0F0H    240 ✓
OUT    PORT3
MVI    A,0FFH    255 ✓
OUT    PORT2
MVI    A,0F0H    240 ✓
OUT    PORT1
MVI    A,0FFH    255 ✓
OUT    PORT
MVI    A,0F4H    244 ✓
OUT    PORT3
MVI    A,0F4H    244 ✓
OUT    PORT1
;

```

*from 477 docs
same as basic*

Continued on next page.

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```

;*****
; THE CLOCK IS PROGRAMMED BY OUTPUTTING THE *
; DESIRED DIGITS, ONE AT A TIME. EACH DIGIT *
; MUST BE IN THE UPPER HALF OF A BYTE WITH *
; A DIGIT IN THE LOWER BYTE TO IDENTIFY WHICH *
; CLOCK ELEMENT IS TO BE SET. 0=SECONDS, 1=TENS*
; OF SECONDS, 2=MINUTES, 3=TENS OF MINUTES, 4= *
; HOURS, 5=TENS OF HOURS, 6=DAY-OF-THE-WEEK, 7= *
; DATE, 8=TENS OF DATE, 9=MONTH, 10=TENS OF MON-*
; TH, 11=UNITS OF YEAR, 12=TENS OF YEAR. *
; *
; THE LOOP BELOW SHIFTS THE INFORMATION DIGITS *
; TO THE HIGH NIBBLE, AND ADDS THE CODE DIGITS. *
; *
; NOTE: THE SECONDS MUST BE ACCESSED, EVEN *
; THOUGH THEY CAN'T BE SET, IN ORDER TO RESET *
; THEM. A MARKER IS SET ON TENS OF HOURS *
; FOR 24-HR. TIME. *
;*****
;
        LXI        H,CLOCK ;SET UP CONTROL DIGITS
        MVI        C,NDATA
START2:  MOV        A,M      ;GET ONE DIGIT
        ADD        A        ;MOVE TO HIGH END
        ADD        A        ; *4
        ADD        A        ; *8
        ADD        A        ; *16
        ADD        C        ;INSERT CODE DIGIT
        DCR        A        ;CORRECT IT
        MOV        M,A
        INX        H
        DCR        C
        JNZ        START2
        LXI        D,HOUR-CLOCK-NDATA ;OFFSET TO HOUR
        DAD        D
        MOV        A,M
        ORI        128      ;SET MILITARY TIME
        MOV        M,A

```

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; NOW THAT WE HAVE THE PROPER FORM OF DATA IN 'CLOCK',
 ; WE CAN DO THE ACTUAL CLOCK SETTING OPERATION.

```

    LXI    H,CLOCK ; INITIAL DATA AREA
    MVI    B,NDATA
LOOP4:  MOV    A,M      ; SET UP CLOCK
        OUT    PORT
        MVI    A,0
        OUT    PORT2   ; CREATE A STROBE PULSE
        NOP    ; WE NEED SOME DELAY
        NOP
        NOP
        NOP
        MVI    A,1
        OUT    PORT2   ; END OF STROBE
        INX    H
        DCR    B
        JNZ    LOOP4
        MVI    A,0F8H
        OUT    PORT1
        MVI    A,0F0H
        OUT    PORT3
        RET
  
```

rest of clock

```

;
STARTS: DI
        PUSH   PSW      ; DUMMY PUSHES TO ENABLE US
        PUSH   B        ; TO USE THE TAIL END OF
        PUSH   D        ; THE "INTR" ROUTINE TO
        PUSH   H        ; ENABLE INTERRUPTS
; SET UP THE INTERRUPT VECTOR
        LXI    H,RSTART
        MVI    M,JMP
        INX    H
        MVI    M,INTR AND 0FFH
        INX    H
        MVI    M,INTR SHR 8
        JMP    INTR4    ; NOW DO THE ENABLING
  
```

```

;
STOPS:  DI
        MVI    A,0
        OUT    PORT1
        OUT    PORT3
        RET
  
```

not like Basic or dos (B)

Continued on next page.

Continued from previous page.

```
;
;CLOCK DATA AREA
;
CLOCK:  DB      8CH,0BH ;YEAR DIGITS      (80)
        DB      0AH,99H ;MONTH          (09)
        DB      18H,87H ;DATE           (18)
        DB      26H      ;DAY-OF-WEEK    (2 = TUES.)
HOUR    EQU     $      ;OFFSET TO HOURS
        DB      05H,94H ;HOURS         (09)
        DB      13H,2H  ;MINUTES      (10)
        DB      1,0    ;SECONDS      (00)
;
NDATA   EQU     $-CLOCK
;
        DS      50
STACK:  DS      0
;
        END
```

IV. TIME.BAS

```

10  DEFINT A-Z
20  DIM TIME(13),W$(7),MO$(12)
30  P0=208 'CLOCK PORT 0D0H change to your port address
40  P1=P0+1
50  P2=P0+2
60  P3=P0+3
70  W$(0)   ="Sunday  "
80  W$(1)   ="Monday  "
90  W$(2)   ="Tuesday  "
100 W$(3)   ="Wednesday "
110 W$(4)   ="Thursday "
120 W$(5)   ="Friday  "
130 W$(6)   ="Saturday "
140 '
150 MO$(1)  =" January "
160 MO$(2)  =" February "
170 MO$(3)  =" March   "
180 MO$(4)  =" April   "
190 MO$(5)  =" May     "
200 MO$(6)  =" June    "
210 MO$(7)  =" July    "
220 MO$(8)  =" August  "
230 MO$(9)  =" September "
240 MO$(10) =" October "
250 MO$(11) =" November "
260 MO$(12) =" December "
270 '
280 PRINT CHR$(26)'clears screen on TeleVideo 912/920 terminal
290 PRINT
300 PRINT "Enter <T> for time display ONLY"
310 PRINT "Enter <S> for time setting"
320 PRINT "Enter <E> for EXIT"
330 X1$=INKEY$
340 IF X1$< CHR$(32) THEN 330
350 IF X1$="T" THEN 1000
360 IF X1$="t" THEN 1000
370 IF X1$="E" THEN END
380 IF X1$="e" THEN END
390 IF X1$="S" THEN 420
400 IF X1$="s" THEN 420
410 GOTO 330

```

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```

420 PRINT CHR$(26)
430 PRINT
440 PRINT "Enter DATE in the form:"
450 PRINT "  YY,MM,DD"
460 INPUT YR,MO,DA
470 PRINT
480 PRINT "Enter DAY-OF-THE-WEEK"
490 PRINT
500 PRINT "  0 = Sunday"
510 PRINT "  1 = Monday"
520 PRINT "  2 = Tuesday"
530 PRINT "  3 = Wednesday"
540 PRINT "  4 = Thursday"
550 PRINT "  5 = Friday"
560 PRINT "  6 = Saturday"
570 PRINT
580 INPUT W
590 PRINT
600 PRINT "Enter TIME on 24HR clock in the form of:"
610 PRINT "  HH,MM"
620 INPUT HR,MIN
630 'PREPARE THE DATA FOR ENTRY
640 TIME (1) =16*INT(YR/10)+12
650 TIME (2) =16*(YR-10*INT(YR/10))+11
660 TIME (3) =16*INT(MO/10)+10
670 TIME (4) =16*(MO-10*INT(MO/10))+9
680 TIME (5) =16*INT(DA/10)+8
690 TIME (6) =16*(DA-10*INT(DA/10))+7
700 TIME (7) =16*W+6
710 TIME (8) =16*INT(HR/10)+5+128
720 TIME (9) =16*(HR-10*INT(HR/10))+4
730 TIME(10) =16*INT(MIN/10)+3
740 TIME(11) =16*(MIN-10*INT(MIN/10))+2
750 TIME(12) =1
760 TIME(13) =0
770 'DATA IS READY, ASK FOR
780 'START SIGNAL FROM USER
790 PRINT
800 PRINT "Press any key to set and start clock with zero seconds"
810 X$=INKEY$
820 IF X1$< CHR$(32) THEN 810
830 IF LEN(X$)=0 THEN 810

```

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```
840 'THIS IS THE SETTING SEQUENCE
850 OUT P3,244
860 OUT P2,255
870 OUT P3,240
880 OUT P2,255
890 OUT P1,240
900 OUT P0,255
910 OUT P3,244
920 OUT P1,244
930 FOR X=1 TO 13
940     OUT P0,TIME(X)
950     OUT P2,0
960     OUT P2,1
970 NEXT X
980 OUT P1,248
990 OUT P3,240
1000 ' READ CLOCK
1010 PRINT CHR$(26)
1020 '
1030 ' THIS READS THE CLOCK DATA
1040 '
1050 OUT P1,240
1060 OUT P0, 15
1070 OUT P1,244
1080 OUT P3,252
1090 FOR X=1 TO 13
1100     OUT P0,13-X
1110     TIME(X)=INP(P0)
1120 NEXT X
1130 ' PUT CLOCK BACK INTO RUNNING MODE
1140 OUT P3,240
1150 OUT P1,248
1160 FOR X=1 TO 13
1170     TIME(X)=INT(TIME(X)/16)
1180 NEXT X
1190 ' THERE ARE SPECIAL MARKS ON HOURS AND MONTH
1200 ' STRIP THEM OFF
1210 TIME(3) = TIME(3) AND 3
1220 TIME(8) = TIME(8) AND 3
1230 '
```

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```
1240 Y$ = CHR$(TIME (1)+48)+CHR$(TIME (2)+48)
1250 MO = TIME(3)*10+TIME(4)
1260 IF TIME(5)>0 THEN D$=CHR$(TIME(5)+48)+CHR$(TIME(6)+48):GOTO 1280
1270 D$ = CHR$(TIME (6)+48)
1280 W   =      TIME (7)
1290 H$ = CHR$(TIME (8)+48)+CHR$(TIME (9)+48)
1300 MI$ = CHR$(TIME(10)+48)+CHR$(TIME(11)+48)
1310 S$ = CHR$(TIME(12)+48)+CHR$(TIME(13)+48)
1320 '
1330 X$=INKEY$
1340 IF X1$< CHR$(32) THEN 1330
1350 IF LEN(X$)<>0 THEN 280
1360 IF S1$=S$ THEN 1050 ELSE S1$=S$
1370 '
1380 PRINT CHR$(30);'Cursor home command
1390 PRINT "
";
1400 PRINT W$(W);
1410 PRINT H$;" ":"MI$;" ":"S$;
1420 PRINT MO$(MO);D$;" ":"19";Y$
1430 PRINT CHR$(30);
1440 GOTO 1050
```

V. READ.ASM

--- Note ---
Interrupts not used

;PGM by Harry Kaemmerer 810220

```

PROM      EQU      xxxxH      ;
CONOUT    EQU      xxxxH      ;ADD START OF PROM ADDRESS
PORT      EQU      xxH        ;ADD YOUR CONOUT CALL ADDRESS
                                     ;ADD BASE PORT ADDRESS FOR CLOCK
;
PORT1     EQU      PORT+1     ;
PORT2     EQU      PORT+2     ;
PORT3     EQU      PORT+3     ;
;
SECU      EQU      0          ;SECONDS UNITS
SECT      EQU      SECU+1     ;SECONDS TENS
MINU      EQU      SECT+1     ;MINUTES UNITS
MINT      EQU      MINU+1     ;MINUTES TENS
HRSU      EQU      MINT+1     ;HR'S UNITS
HRST      EQU      HRSU+1     ;HR'S TENS
DAYW      EQU      HRST+1     ;DAY OF THE WEEK
DAYU      EQU      DAYW+1     ;DAY UNITS
DAYT      EQU      DAYU+1     ;DAY TENS
MONU      EQU      DAYT+1     ;MONTH UNITS
MONT      EQU      MONU+1     ;MONTH TENS
YEAU      EQU      MONT+1     ;YEAR UNITS
YEAT      EQU      YEAU+1     ;YEAR TENS
;
ASCII     EQU      30H        ;OFFSET TO MAKE CHAR. ASCII
;
ORG       PROM                ;
;
TIME:     CALL      TSTART     ;DO CLOCK INIT SUB
          CALL      DAY0       ;DISPLAY TIME
          CALL      TIMED      ;RESET CLOCK BOARD
          RET
;
;

```

Continued on next page.

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```

;-----;
; SUB ROUTINES START HERE ;
;-----;
;
DAY0  LXI    H,STR3      ;POINTS TO LOOKUP TABLE FOR DAY
      LXI    B,0H        ;CLEAR B&C REGISTERS
      MVI    A,DAYW      ;DAY READ INSTRUCTION
      CALL   GETDIG1     ;GET IT
      MOV    C,A         ;MOVE DAY OF WEEK POINTER IN C.
      DAD    B           ;ADD B&C TO H&L REGISTERS
      MOV    C,M         ;GET OFFSET ADDRESS
      LXI    H,STR4     ;GET DAY NAME
      DAD    B           ;POINT TO NAME
      CALL   MESAG       ;SEND IT TO TERMINAL
;
HRS1  MVI    A,HRST     ;SELECT HR'S TENS DIGIT
      CALL   GETDIG1     ;GET DIGIT
      ANI    3           ;ELIMINATE EXTRA BIT
      CALL   SENDCH      ;SEND IT TO TERMINAL
;
HRS2  MVI    A,HRSU     ;SELECT HR'S UNITS DIGIT
      CALL   GETDIG      ;SEND IT TO TERMINAL
;
HRS3  MVI    A,':'      ;LOAD ":" SEPERATOR
      CALL   SENDIT      ;SEND IT TO TERMINAL
;
MIN1  MVI    A,MINT     ;SELECT MINUTES TENS DIGIT
      CALL   GETDIG      ;SEND IT TO TERMINAL
;
MIN2  MVI    A,MINU     ;SELECT MINUTES UNITS DIGIT
      CALL   GETDIG      ;SEND IT TO TERMINAL
;
MIN3  MVI    A,':'      ;LOAD ":" SEPERATOR
      CALL   SENDIT      ;SEND IT TO TERMINAL
;
SEC1  MVI    A,SECT     ;SELECT SECONDS TENS DIGIT
      CALL   GETDIG      ;SEND IT TO TERMINAL
;
SEC2  MVI    A,SECU     ;SELECT SECONDS UNITS DIGIT
      CALL   GETDIG      ;SEND IT TO TERMINAL
;

```

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```

MON1    MVI    A, MONT           ;SELECT MONTH TENS DIGIT
        CALL   GETDIG1         ;GET DIGIT
        ANI    3                ;ELIMINATE EXTRA BIT
        LXI    H, STR5         ;POINT TO OFFSET LOOKUP TABLE
        CPI    1                ;SEE IF IT IS A MONTH AFTER SEPT.
        CZ     LAB1            ;IF IT IS A ONE THEN CALL
                                   ;
MON2    MVI    A, MONU           ;SELECT MONTH UNITS DIGIT
        CALL   GETDIG1         ;
        DCR    A                ;DECR. MONTH VALUE BY ONE JAN.=0 THEN
        LXI    B, 0             ;CLEAR B&C REGISTERS
        MOV    C, A            ;PUT CLOCK DIGIT IN C REGISTER
        DAD    B                ;ADD B&C TO H&L REGISTERS
        MOV    C, M            ;PUT OFFSET NUMBER IN C REGISTER
        LXI    H, STR6         ;LOAD MONTH NAME POINTER
        DAD    B                ;ADD OFFSET TO H&L REGISTERS
        CALL   MESAG           ;SEND MESSAGE
                                   ;
DAY1    MVI    A, DAYT           ;SELECT DAY TENS DIGIT
        CALL   GETDIG1         ;
        CPI    0                ;TEST FOR ZERO
        JZ     DAY2            ;JUMP TO DAY IF ZERO
        PUSH   PSW             ;SAVE RESULT ON STACK
        ADI    ASCII           ;MAKE IT ASCII
        MOV    C, A            ;PUT IN C REGISTER
        CALL   CONOUT          ;SEND IT
        POP    PSW            ;RESTORE A REGISTER
                                   ;
DAY2    MVI    A, DAYU           ;SELECT DAY UNITS DIGIT
        CALL   GETDIG         ;SEND IT TO TERMINAL
                                   ;
YEA0    LXI    H, STR7         ;LOAD FIRST TWO DIGITS OF YEAR
        CALL   MESAG           ;SEND IT TO TERMINAL
                                   ;
YEA1    MVI    A, YEAT           ;SELECT YEAR TENS DIGIT
        CALL   GETDIG         ;SEND IT TO TERMINAL
                                   ;
YEA2    MVI    A, YEAU           ;SELECT YEAR UNITS DIGIT
        CALL   GETDIG         ;SEND IT TO TERMINAL
        RET
                                   ;

```

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```

TSTART  MVI      A,0F0H ✓           ;SEQUENCE TO ENABLE THE CLOCK
        OUT      PORT1             ;
        MVI      A,0FH ✓           ;
        OUT      PORT              ;
                                           ;
        MVI      A,0F0H             ;LOAD DELAY CONST.
        CALL     DELAY              ;DO SOME DELAY
                                           ;
        MVI      A,0FCH ✓           ;
        OUT      PORT3             ;
        MVI      A,0F4H ✓           ;
        OUT      PORT1             ;
        RET                               ;
                                           ;
TIMED   MVI      A,0F8H ✓           ;RETURN CLOCK TO RUN MODE
        OUT      PORT1             ;
        MVI      A,0FH ✓           ;
        OUT      PORT              ;
        MVI      A,0F8H ✓           ;
        OUT      PORT3             ;
        MVI      A,0FCH ✓           ;
        OUT      PORT1             ;
        MVI      A,0FH ✓           ;
        OUT      PORT              ;
        RET                               ;
                                           ;
MESAG   MOV      A,M                ;GET CHARACTER FROM MEMORY
        CPI      0                  ;TEST FOR ZERO
        JZ       MSS1               ;IF ZERO EXIT
        CALL    CONOUT              ;SEND CHARACTER
        INX     H                   ;MOVE POINTER TO NEXT CHARACTER
        JMP     MESAG               ;DO IT AGAIN UNTILL DONE
MSS1    RET                          ;RETURN
                                           ;
GETDIG  CALL     GETDIG1             ;READ CLOCK
SENDCH  PUSH    PSW                 ;SAVE FLAGS AND ACC.
        ADI     ASCII               ;MAKE IT ASCII
        MOV     C,A                 ;PUT IN ACC
        CALL   CONOUT              ;SEND IT TO TERMINAL
        POP    PSW                 ;RESTORE ACC. AND FLAGS
        RET                          ;RETURN TO CALLER
                                           ;

```

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```

SENDIT  PUSH    PSW                ;SAVE FLAGS AND ACC.
        MOV     C,A                ;PUT IN ACC
        CALL   CONOUT             ;SEND IT TO TERMINAL
        POP    PSW                ;RESTORE ACC. AND FLAGS
        RET                               ;RETURN TO CALLER
;
GETDIG1 OUT    PORT                ;CODE DIGIT TO SELECT CLOCK ELEMENT
        MVI    A,0FAH             ;DELAY FACTOR
        CALL   DELAY              ;DELAY SOME TIME HERE
        IN     PORT                ;READ CLOCK ELEMENT
        ANI    0F0H               ;DROP CODE PART OF DIGIT
        RRC                               ;MOVE DATA TO LOW NIBBLE
        RRC                               ;
        RRC                               ;
        RRC                               ;NUMBER RETURNED IN ACC.
        RET                               ;
;
LAB1    LXI    D,0                 ;CLEAR D&E REGISTERS
        MVI    E,0AH              ;IF THE RESULT WAS OCTOBER OR LATER
        DAD    D                   ;ADD X10 OFFSET
        RET                          ;LOAD POINTER OFFSET AND RETURN
;
DELAY:  INR    A                   ;
        JNZ   DELAY               ;NOT DONE DELAY SOME MORE
        RET                          ;
;
STR3    DB     00H,08H,10H,19H     ;OFFSET LOOKUP TABLE
        DB     24H,2EH,36H         ;FOR DAY OF THE WEEK
;
STR4    DB     'Sunday ',0         ;
        DB     'Monday ',0        ;
        DB     'Tuesday ',0       ;
        DB     'Wednesday ',0     ;
        DB     'Thursday ',0      ;
        DB     'Friday ',0        ;
        DB     'Saturday ',0      ;
;

```

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```

STR5  DB      00H,0AH,15H,1DH  ;OFFSET LOOKUP TABLE
      DB      25H,2BH,32H,39H  ;FOR MONTH NAME
      DB      42H,4FH,59H,64H  ;
                                           ;
STR6  DB      ' January ',0    ;
      DB      ' February ',0   ;
      DB      ' March ',0      ;
      DB      ' April ',0      ;
      DB      ' May ',0        ;
      DB      ' June ',0       ;
      DB      ' July ',0       ;
      DB      ' August ',0     ;
      DB      ' September ',0  ;
      DB      ' October ',0    ;
      DB      ' November ',0   ;
      DB      ' December ',0  ;
                                           ;
STR7  DB      ' 19 ',0         ;YEAR LEADIN MESS.
      END      PROM

```

VI. NORTHSTAR SOFTWARE

```

10 REM*****RTCSET*****
20 REM****NORTH STAR BASIC*****
30 REM PROGRAM TO SET SCITRONICS CLOCK - 801003*
40 REM **COPYRIGHT 1980 - SCITRONICS, INC*****
50 REM****CONV BY RICE COMMUNICATIONS INC*****
60 !"PROGRAM TO SET THE SCITRONICS CLOCK"\DIMT(13)
70 !"SCITRONICS, INC., BETHLEHEM, PA 18015"\!
80 !"ENTER CLOCK BASE PORT ADDRESS"
90 !"IN DECIMAL INTER FORM - 0,4,8,16,20,ETC"
100 !"MAXIMUM VALUE = 252"\INPUT P
110 REM CHECK FOR PROPER VALUE AND RANGE
120 IFP>=256THEN80\M=INT(P/4)\IF(4*M-P)<>0THEN80\P1=P+1\P2=P+2\P3=P+3
130 REM GET THE TIME DATA
140 !\!"ENTER DATE IN THE FORM: YR,MO DA"\!"ONLY LAST TWO DIGITS FOR YR!"
150 INPUT Y,M,D!\!\!"ENTER DAY-OF-THE-WEEK - 0=SUNDAY"\INPUTW\!
160 !"ENTER TIME ON 24HR CLOCK IN THE"\!"FORM: HR,MIN"
170 !"CLOCK ALWAYS STARTS ON 00 SECONDS, SO"
180 !"BE SURE TO ENTER THE NEXT MINUTE."\INPUTH,M1\REM PREPARE THE DATE
190 T(1)=16*INT(Y/10)+12\T(2)=16*(Y-10*INT(Y/10))+11\T(3)=16*INT(M/10)+10
200 T(4)=16*(M-10*INT(M/10))+9\T(5)=16*INT(D/10)+8\T(6)=16*(D-10*INT(D/10))+7
210 T(7)=16*W+6\T(8)=16*INT(H/10)+5+128\T(9)=16*(H-10*INT(H/10))+4
220 T(10)=16*INT(M1/10)+3\T(11)=16*(M1-10*INT(M1/10))+2\T(12)=1\T(13)=0
230 REM DATA IS READY, ASK FOR START SIGNAL FROM USER
240 !\!"ENTER 1 AND CARRIAGE RETURN TO SET CLOCK"
250 !"PUSH CR ON THE ZERO SECOND"\INPUTJ\REM THIS IS TO SET SEQUENCE
260 OUTP3,244\OUTP2,255\OUTP3,240\OUTP2,255\OUTP1,240\OUTP,255\OUTP3,244
270 OUTP1,244\FORX=1TO13\OUTP,T(X)\OUTP2,0\OUTP2,1\NEXTX\OUTP1,248\OUTP3,240
280 !"THE CLOCK IS SET"\CHAIN"RTCREAD"

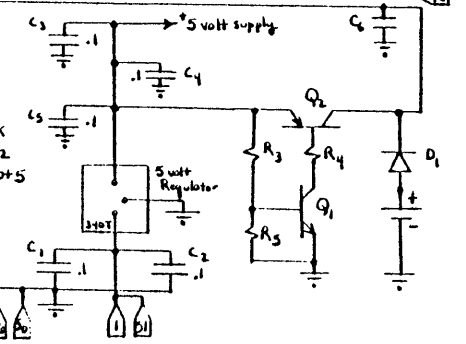
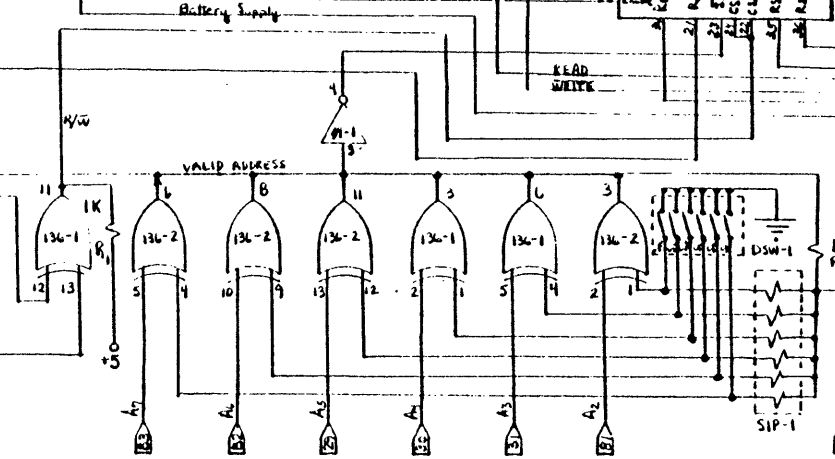
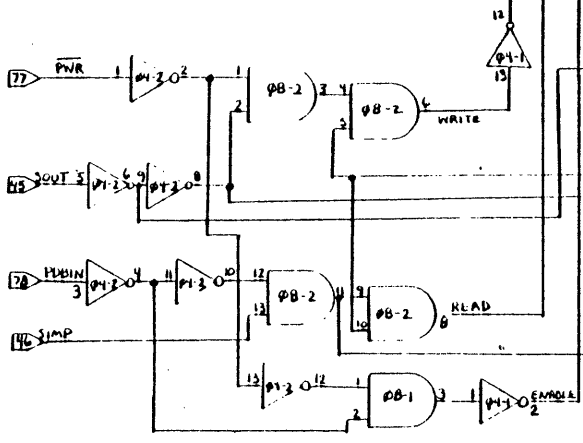
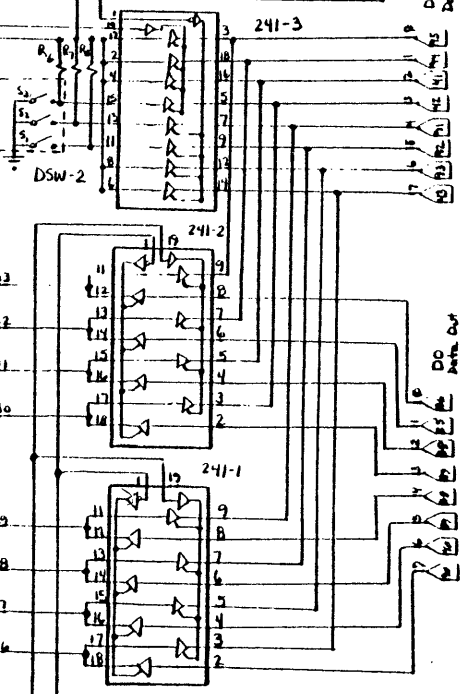
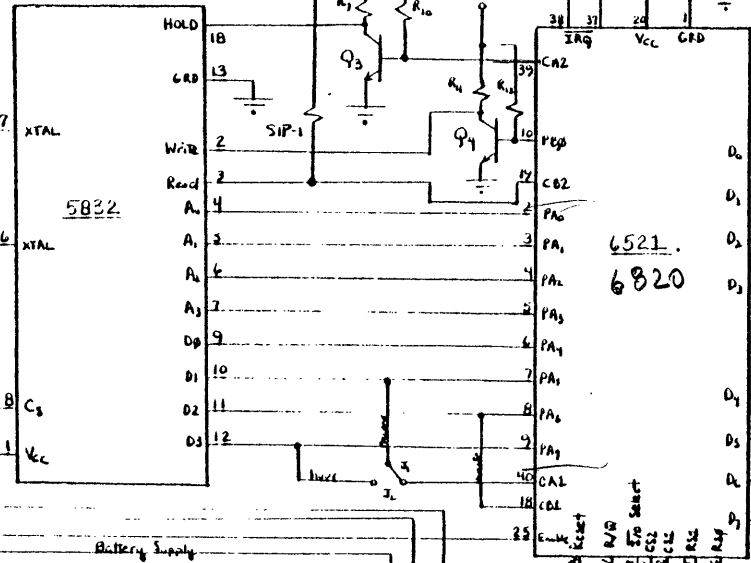
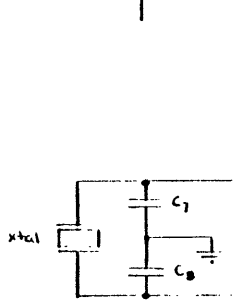
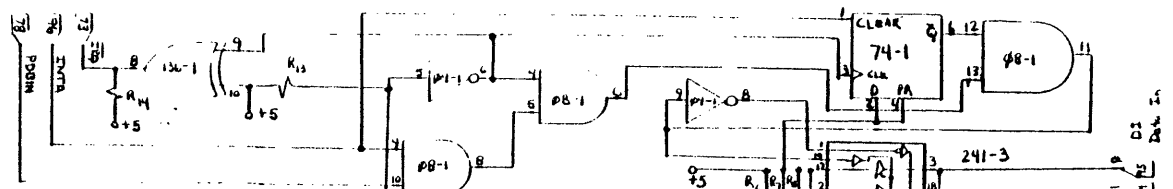
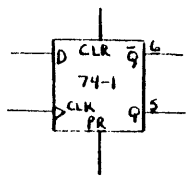
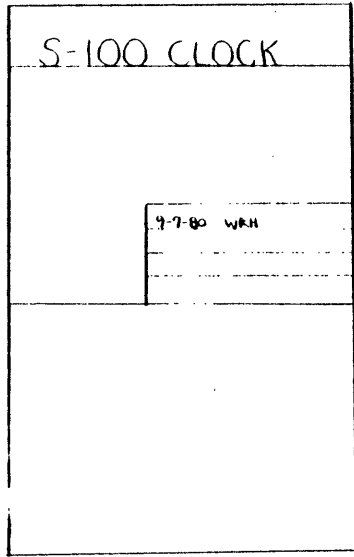
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10 REM *****RTCREAD*****
20 REM THIS PROGRAM IS IN NORTH STAR BASIC*****
30 REM ****CONV BY RICE COMMUNICATIONS INC*****
40 REM ** READ SCITRONICS REAL-TIME CLOCK*****
50 REM *COPYRIGHT 1980 - SCITRONICS, INC.*****
60 REM *****PRESS (ESC) TO STOP READ OUT*****
70 DIM T(13),W$(21)\W$="SUNMONTUEWEDTHRFRISAT"
80 !"PROGRAM TO DISPLAY CLOCK DATA"
90 !"SCITRONICS, INC., BETHLEHEM, PA"\!
100 REM THIS IS THE NON INTERRUPT-DRIVEN VERSION
110 !"ENTER CLOCK BASE PORT ADDRESS"
120 !"IN DECIMAL INTER FORM - 0,4,8,12,16,20,ETC"
130 !"MAXIMUM VALUE = 252"\INPUT P
140 REM CHECK FOR PROPER VALUE AND RANGE
150 IFP>=256THEN80\M=INT(P/4)\IF(4*M-P)<>0THEN80\P1=P+1\P2=P+2\P3=P+3
160 IFINP(2)=155THEN80\GOSUB200\REM DISPLAY LOOP STARTS HERE
170 Y=T(1)*10+T(2)\MO=T(3)*10+T(4)\D=T(5)*10+T(6)\W=T(7)+1\H=T(8)*10+T(9)
180 M1=T(10)*10+T(11)\S=T(12)*10+T(13)
190 !Y,":",MO,":",D," ",\!W$(W*3-2,W*3),". ",\!H,":",M1,":",S," "\!\GOTO160
200 REM*****
210 REM THIS READS THE CLOCK DATE *
220 REM*****
230 OUT P1,240\OUTP,15\OUTP3,252\OUTP1,244\FORX=1TO13\OUTP,13-X
240 T(X)=INP(P)\NEXT X
250 REM*****
260 REM PUT CLOCK BACK INTO RUNNING MODE*****
270 REM*****
280 OUT P1,248\OUTP,15\OUTP3,248\OUTP1,252\OUTP,15\FORX=1TO13
290 T(X)=INT(T(X)/16)\NEXT X\T(3)=T(3)-INT(T(3)/4)*4

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SCHEMATIC
&
PARTS LIST

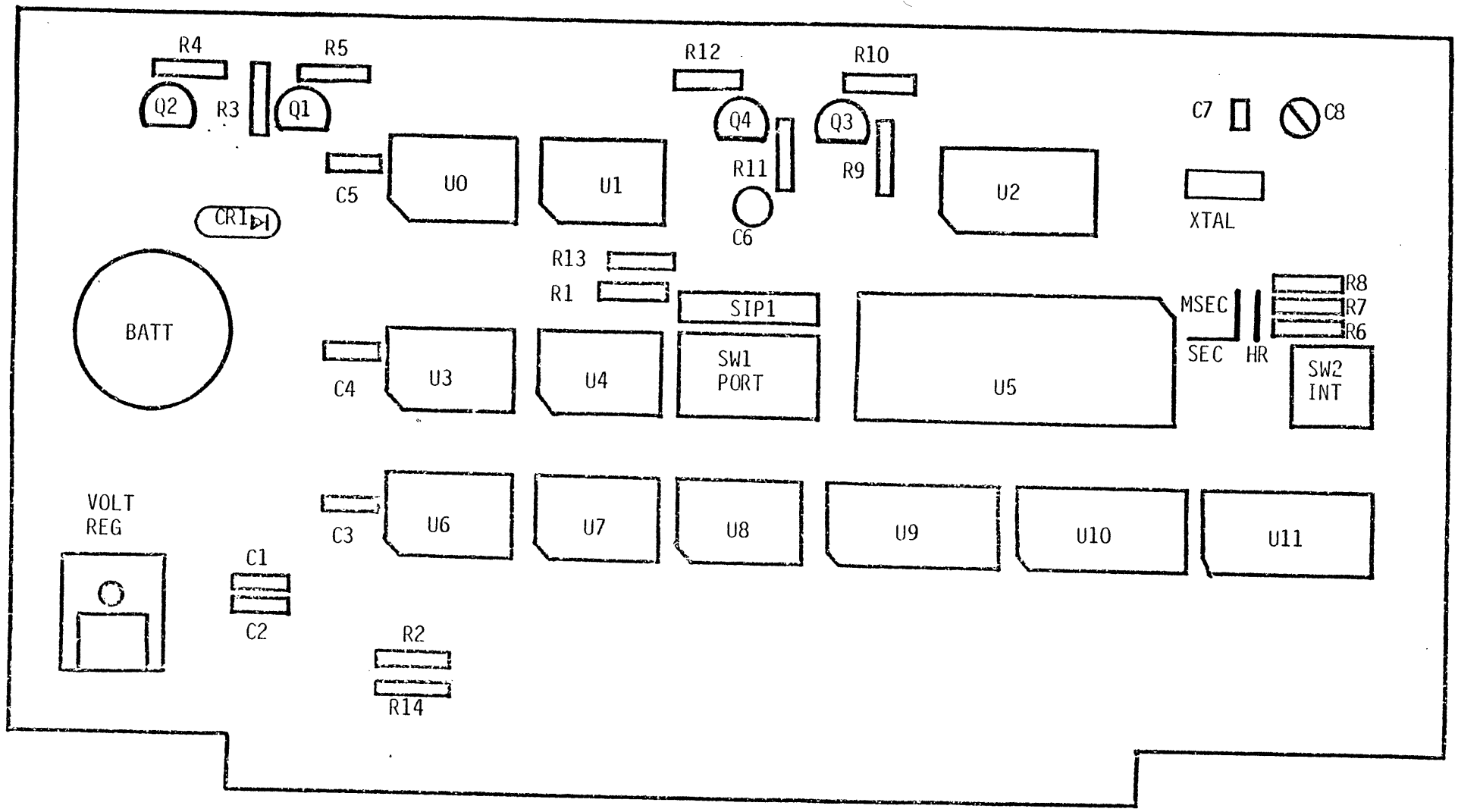


DO Data Out

RESET

READ SWEEP

Battery Supply



RTC-100 PARTS LAYOUT: Refer to Parts List for parts description

PARTS LIST --

PRODUCT: RTC-100PAGE 1 OF 3

LAYOUT #	SCITRONICS P/N	DESCRIPTION
B 1	17031	3 V Lithium Battery
C 1	12024	.1mF @ 12V Ceramic Disc Capacitor
C 2	12024	.1mF @ 12V Ceramic Disc Capacitor
C 3	12024	.1mF @ 12V Ceramic Disc Capacitor
C 4	12024	.1mF @ 12V Ceramic Disc Capacitor
C 5	12024	.1mF @ 12V Ceramic Disc Capacitor
C 6	12014	4.7mF @ 10V Solid Tantalum Capacitor
C 7	12031	15pF Ceramic Disc Capacitor
C 8	12031	15pF Ceramic Disc Capacitor
C 9	12032	5-30pF Variable Ceramic Capacitor
CR 1	13011	IN6263 Diode
D 1	20079	8 Position DIP Switch
D 2	20084	4 Position DIP Switch
DS 0	17012	14 Pin DIP Socket
DS 1	17012	14 Pin DIP Socket
DS 2	17032	18 Pin DIP Socket
DS 3	17012	14 Pin DIP Socket
DS 4	17012	14 Pin DIP Socket
DS 5	17034	40 Pin DIP Socket
DS 6	17012	14 Pin DIP Socket
DS 7	17012	14 Pin DIP Socket
DS 8	17012	14 Pin DIP Socket
DS 9	17033	20 Pin DIP Socket
DS 10	17033	20 Pin DIP Socket
DS 11	17033	20 Pin DIP Socket

PARTS LIST --

PRODUCT: RTC-100PAGE 2 OF 3

LAYOUT #	SCITRONICS P/N	DESCRIPTION
HS 1	17030	Heat Sink for Voltage Regulator
J 1	22010	Jumper (seconds)
Q 1	18001	2N4124 Transistor
Q 2	18003	2N4126 Transistor
Q 3	18006	MPSA13 Transistor
Q 4	18006	MPSA13 Transistor
VR 1	14041	+5 V Voltage Regulator
R 1	11013	1K $\frac{1}{2}$ W Carbon Film Resistor
R 2	11013	1K $\frac{1}{2}$ W Carbon Film Resistor
R 3	11022	51K $\frac{1}{2}$ W Carbon Film Resistor
R 4	11001	10K $\frac{1}{2}$ W Carbon Film Resistor
R 5	11001	10K $\frac{1}{2}$ W Carbon Film Resistor
R 6	11028	3.3K $\frac{1}{2}$ W Carbon Film Resistor
R 7	11028	3.3K $\frac{1}{2}$ W Carbon Film Resistor
R 8	11028	3.3K $\frac{1}{2}$ W Carbon Film Resistor
R 9	11012	20K $\frac{1}{2}$ W Carbon Film Resistor
R 10	11012	20K $\frac{1}{2}$ W Carbon Film Resistor
R 11	11012	20K $\frac{1}{2}$ W Carbon Film Resistor
R 12	11012	20K $\frac{1}{2}$ W Carbon Film Resistor
R 13	11028	3.3K $\frac{1}{2}$ W Carbon Film Resistor
R 14	11028	3.3K $\frac{1}{2}$ W Carbon Film Resistor
SR 1	11033	3.3K SIP Resistor Network
U 0	14047	7474 Dual D Flip Flop
U 1	14046	7408 Quad 2-in. AND Gate
U 2	14045	MSM5832 OKI Clock Chip

WARRANTY

All SciTronics Inc. computer boards are assembled and fully tested at the factory before shipment. Your Real Time Clock is warranted against defects in material and workmanship for a period of six (6) months from date of delivery. SciTronics will repair or replace products found to be defective during the warranty period, provided they are returned to SciTronics Inc. No other warranty is expressed or implied. We are not liable for improper use or inconsequential damages. We reserve the right to refuse to repair any product that in our opinion has been subjected to abnormal electrical or mechanical abuse. Products out of warranty are subject to a minimum service fee. Contact SciTronics before sending your unit in for repair. Please fill out the enclosed self-addressed warranty card to validate your warranty.

For your records:

Date Purchased _____

Serial # _____

(located on board)