

**MODEL 120  
CALENDAR  
CLOCK USER'S GUIDE**

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CODAR TECHNOLOGY, INC.  
Computer Products Division  
1500 Kansas Avenue, Bldg. 2E  
Longmont, Colorado 80501 USA  
Telex No.: 4947090 Codar  
FAX: (303) 776-1806  
Phone: (303) 776-0472

## TABLE OF CONTENTS

<b>SECTION #</b>	<b>SUBJECT</b>	<b>PAGE #</b>
SECTION 0.0	INTRODUCTION _____	1
SECTION 1.0	GENERAL _____	1
SECTION 2.0	HANDLING _____	1
SECTION 3.0	INSTALLATION _____	2
SECTION 4.0	CLOCK ADJUSTMENT _____	2
SECTION 5.0	SPECIFICATIONS _____	2
SECTION 6.0	DEVICE ADDRESSES _____	3
SECTION 7.0	COMPONENT LOCATIONS _____	4
SECTION 8.0	BATTERIES _____	5
SECTION 9.0	OPERATING SYSTEM INTEGRATION _____	5
APPENDIX A	DETAILED PROGRAMMING INFORMATION _____	7
	WARRANTY _____	9
	ERRATA _____	10

# *Model 120 Calendar Clock User's Guide*

## **SECTION 0.0 INTRODUCTION**

This manual describes the Model 120 Calendar Clock and how to use it. Specific information on integrating the Model 120 with Digital's RT11, MicroRSX, RSX11M, RSX11S, RSX11M-Plus, and MicroVMS, and with S&H Computer Systems' TSX-Plus operating systems is provided here, as well as in the file README.1ST on the Support Kit.

## **SECTION 1.0 GENERAL**

The Model 120 is a dual-wide board for Q-Bus computer users, which provides a non-volatile calendar clock keeping date and time as day of week, year, month, day (with automatic leap day insertion), hour, minute, second and tenth of second.

Operation of the calendar clock is maintained by on-board Lithium batteries when primary system power is interrupted.

Integration of the Model 120 into an existing computer system is simple and fast. This manual and the Support Kit provide explicit instructions for bringing the Model 120 up on Digital's MicroVMS, RSX and RT operating systems, and on S&H Computer Systems' TSX-Plus. Other LSI-11 and MicroVAX systems are equally easy, but are not covered here. Users of these other operating systems (Digital's RSTS/E, ULTRIX and VAXELN, Bell Lab's UNIX, etc.), and of hardware systems based on Motorola's 68000 family processors, can use this information as a guide.

This manual assumes that your Model 120's calendar clock registers are at 777300-777337. Other address configurations are jumper selectable (see sections 6. and 7.); if you are using one of these, please make the appropriate substitutions where addresses are mentioned in the manual. Special address versions of the Model 120 can be provided, if necessary.

## **SECTION 2.0 HANDLING**

Always take precautions to avoid damage by static electricity. All packing materials should be saved, particularly the anti-static bag, as other bags may cause battery discharge.

The calendar clock oscillator is a high-impedance device. Take care to avoid touching this circuitry, which is located in the first row of chips (see section 7.). No harm is done to the devices, but the oscillator may stop momentarily, causing a loss of time.

The plastic sheet on the back of the board protects against battery discharge and loss of time if the board is placed on a conducting surface. If this sheet is removed, it should be replaced using non-corrosive RTV. RTV containing acetic acid (with a strong vinegar odor) must not be used.

The calendar clock chip is a CMOS device, and proper precautions must be taken to avoid damage by static if it is removed from its socket.

## SECTION 3.0 INSTALLATION

The Model 120 device addresses have been carefully chosen to minimize the chance of an address conflict, but you may wish to use console ODT to verify that no device on your system responds to any of these addresses. The standard Model 120 addresses are listed in section 6. At present, the only known conflict is with the SKYMNK array processor, manufactured by Sky Computers, Inc. If you discover an address conflict, the Model 120's addressing can be modified by changing the address PAL jumpers (see sections 6. and 7.).

The Model 120 can be installed in any standard Q-Bus slot. It is compatible with all 16-, 18-, and 22-bit backplanes and all known Q-Bus processors, including the MicroVAX. It propagates all interrupt lines, and uses none. As a result, you can install it in any available slot, without regard for its position relative to the processor or any other device on the bus.

### NOTES

- "SW1" is set to "OFF" when the board is shipped from the factory; it must be set to "ON" during installation to enable battery backup of date and time information (see section 7.).
- Your system must implement the standard Digital power sequence (BDCOK, BPOK, etc.) in order to ensure the integrity of data in the calendar clock. Most packaged systems (including those from Digital and CTI) comply with this requirement. On-board processor wakeup circuits are NOT sufficient. If you have questions about this requirement, contact CTI.
- Do not insert the Model 120 into a slot with the "C-D interconnect" or any other non-standard wiring scheme.

## SECTION 4.0 CLOCK ADJUSTMENT

The calendar clock is driven by a crystal controlled 32768 Hz oscillator. This oscillator is preset at the factory, but if adjustment becomes necessary it can be monitored on TP2 (connected to pin 13 of the calendar clock chip). After setting bit <3> of the clock control register (normally 177300), use a non-metallic screwdriver to change the setting of capacitor C3 (see section 7.). 1/8 turn corresponds to approximately 0.1 Hz. An accurate frequency counter MUST be used, since an offset of 0.1 Hz will result in an error of 0.26 seconds per day.

## SECTION 5.0 SPECIFICATIONS

Compatibility	Any Q-Bus processor (16- or 32-bit) Any Q-Bus backplane (16-, 18-, or 22-bit)
Module size	Dual-width, 5.2 x 8.9 inch
Operating Power	5V +/- 5%, 0.25 amp
Operating Temperature	0°C to 50°C
Relative Humidity	5% to 95% noncondensing
Bus Loading	One LSI-11 bus load per I/O line
Batteries	Two 3.0 V Lithium Type CR2430 Sanyo, GE or Varta Type DL2430 Duracell
Battery Backup	1600 days without system power

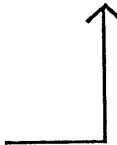
Battery Shelf Life 10 years or longer

Clock Accuracy 4 sec/month typical error,  
8 sec/month maximum error,  
15 to 40°C

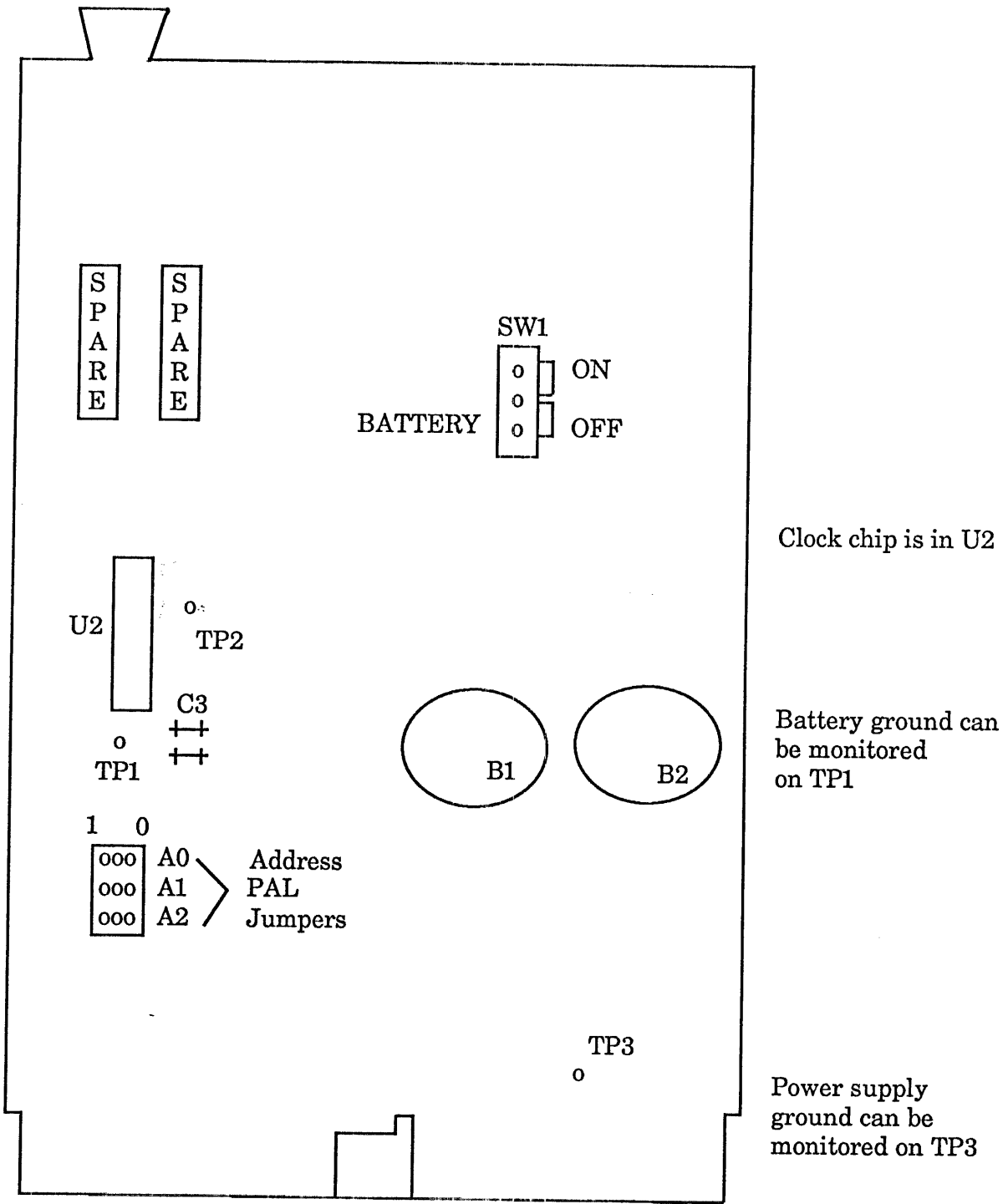
### SECTION 6.0 DEVICE ADDRESSES

	760740- 760777	770500- 770537	770700- 770737	772440- 772477	dis- abled	776640- 776677	777100- 777137	777300- 777337
A2	1 X-O	1 X-O	1 X-O	1 X-O	1-X O	1-X O	1-X O	1-X O
A1	1 X-O	1 X-O	1-X O	1-X O	1 X-O	1 X-O	1-X O	1-X O
A0	1 X-O	1-X O	1 X-O	1-X O	1 X-O	1-X O	1 X-O	1-X O

In this configuration,  
the Model 120 does not  
respond to any address



## SECTION 7.0 COMPONENT LOCATIONS



## **SECTION 8.0 LITHIUM BATTERIES**

The Model 120 uses two long-life Lithium batteries connected in parallel to maintain calendar clock information when primary power is off, or when the board is out of the system. To conserve battery power, they are automatically disconnected from the on-board circuitry when +5V power is available from the Q-Bus. These batteries have normal shelf lives of 10 years, and service lives in the Model 120 of 2.5 years each for a total lifetime of 5 years, assuming that the board is never connected to an external +5V supply. In practice, the service life will be longer than 5 years, corresponding to the amount of time you keep your system powered up.

Each battery is in series with a diode and a 1K Ohm resistor. The current drain in amps on each battery can be measured by reading the voltage across the 1K Ohm resistor and dividing by 1000. Total current consumption should be around 10 microamps; any cell that is not supplying current should be replaced. Because of the dual battery construction, it is possible to change batteries without losing date and time provided that at least one of the batteries is good.

We do not recommend that spare batteries be purchased until needed, as the battery's service life begins at the time of manufacture.

### **IMPORTANT**

- Remember to turn SW1 "ON" when you install the Model 120 (see section 7.).
- Shorting or reversing polarity may significantly reduce battery life.
- Do not incinerate discarded batteries.

- You may wish to turn SW1 "OFF" if the Model 120 is to be out of the system for an extended period.

## **SECTION 9.0 OPERATING SYSTEM INTEGRATION**

The Model 120 Support Kit (shipped with the board) is available on several media and in a number of different formats. The particular version you received depends upon the information specified when the Model 120 was ordered. The Support Kit label provides specific information on file structure, volume label (if any) and directory (if any). The Support Kit's "README" file contains system-specific information.

The Support Kit includes the command and source files needed to build the RTIME and STIME programs for MicroVMS, for RT11 and TSX-Plus, or for MicroRSX, RSX11M/S and RSX11M-Plus.

RTIME uses the Model 120's calendar clock to set the operating system's date and time; STIME uses the operating system's date and time to set the Model 120's calendar clock.

Copy the files to your directory...for example:

#### RSX/MCR

```
>SET /UIC=[200,200]
>PIP SY:=DX:*.*
```

#### RSX/DCL

```
>SET DEFAULT 1 54
>COPY DY:*. * SY:
```

#### RT11 or TSX-Plus

```
.COPY DY1:*. * DK:
```

#### MicroVMS

```
$ SET DEFAULT SYS$MANAGER
$ COPY DU2:[CODAR]*.*.*
```

Before proceeding with the installation, you should read the file named "README".

## NOTES

Once the files are on the system in the proper format, the rest of the installation is performed by the command files. Regardless of the system you are running, type

```
@RTIME<CR>
```

to your monitor. The command file will install STIME and RTIME. At this point you should set your operating system's date and time with its "DATE" and/or "TIME" commands, and then ...

```
RUN STIME<CR>
```

to initialize the Model 120's calendar clock. After this has been done once, you need not run STIME again except to make corrections for drift or for standard/daylight time changes.

To set the MicroVMS date and time automatically, each time the system is bootstrapped, add the line "RUN SYS\$SYSTEM:RTIME" to the file [SYS\$SYSMGR]SYSTARTUP.COM and use SYSGEN to "SET TIMEPROMPTWAIT 0".

To set the RT11 or TSX-Plus date and time automatically, put the file RTIME.SAV on your system disk (DK:) and add the line "R RTIME" to the file STARTS.COM (for the SJ monitor) or STARTF.COM (for the FB monitor).

To set the MicroRSX, RSX11M or RSX11M-Plus date and time automatically, put the file RTIME.TSK into the system directory (e.g. SY:[1,54]), and add the line "RUN \$RTIME/TASK=RTIME" to the file [1,2]STARTUP.CMD

To set the RSX11S date and time automatically, use VMR to define a partition, and to INStall, FIX and RUN RTIME.

- Don't forget to enable battery backup by setting SW1 to "ON".
- RTIME and STIME for RT11 will work only on unmapped systems (i.e. RT11SJ and RT11FB).
- For TSX or RT11XM systems, invoke RTIME under RT11SJ or RT11FB before booting the target system -- the date and time are passed to the incoming system.
- RTIME for RT11 will only work on V4.0 and later (systems with the .SDTTM programmed request).
- RT does not permit dates prior to 1972.
- There are two versions of RTIME for the RSX systems: the first sets the parameters in the executive directly, and will work on any RSX11M-Plus, RSX11M, MicroRSX or RSX11S system; the second uses the STIM\$ directive (standard on RSX11M-Plus and MicroRSX, and a SYSGEN option



## APPENDIX A

### DETAILED PROGRAMMING INFORMATION

We recommend that you use the subroutines provided in the Support Kit; the following information is presented for those cases in which this is impossible. Further documentation on the MM58274 clock chip is available from us or from National Semiconductor Corporation.

The calendar clock is accessed via sixteen consecutive work locations (usually 177300-177337). In all of these registers any undefined bits should be masked out before data values are used.

To read the date and time:

- 1) read the control register to clear "Data Changed" (177300<3>), then
- 2) read any or all of the 14 data registers (177302 through 177334), then
- 3) test "Data Changed" to see if the clock incremented while you were reading it. If so, go to step 1).

*Table A.1*

Standard Address	Bits Used	Read/Write	Description	Valid Values	Notes
177300	<3:0>	R/W	Control register	n/a	1
177302	<3:0>	R	Tenths of seconds	0-9	2,3
177304	<3:0>	R/W	Unit seconds	0-9	2
177306	<3:0>	R/W	Tens of seconds	0-5	2
177310	<3:0>	R/W	Unit minutes	0-9	2
177312	<3:0>	R/W	Tens of minutes	0-5	2
177314	<3:0>	R/W	Unit hours	0-9	2
177316	<3:0>	R/W	Tens of hours	0-2	2
177320	<3:0>	R/W	Unit days	0-9	2
177322	<3:0>	R/W	Tens of days	0-3	2
177324	<3:0>	R/W	Unit months	0-9	2
177326	<3:0>	R/W	Tens of months	0-1	2
177330	<3:0>	R/W	Unit years	0-9	2
177332	<3:0>	R/W	Tens of years	0-9	2
177334	<2.0>	R/W	Day of week	1-7	4
177336	<3:0>	R/W	Clock setting/interrupt	n/a	5,6

## NOTES

- 1) When read:
  - <3> = 1 ==> clock data have changed since last time control register was read
  - <0> = 1 ==> internal clock interrupt has occurredWhen written:
  - <3> = 0 selects normal mode.
  - = 1 selects test mode; gates the clock oscillator to pin 13 and TP2 (see sections 4. and 7.)
  - <2> = 0 starts clock.
  - = 1 stops clock.
  - <1> = 0 selects clock setting register at 177336
  - = 1 selects interrupt control register at 177336
  - <0> = 0 starts internal interrupt
  - = 1 stops internal interrupt
- 2) Register contains a BCD value — decimal values of 10, 11, 12, 13, 14 and 15 should never occur
- 3) This register is always cleared when the clock is restarted
- 4) Day of week register “wraps around” to 1, not 0. By convention, 1 ... 7 correspond to Sunday ... Saturday, respectively on PDP11s 1 ... 7 correspond to Monday ... Sunday, respectively on VAXs
- 5) This location is actually two read/write registers — either the clock setting register or the interrupt control register, depending upon the condition of 177300<1> (see Note 1 above)
  - Clock setting register:
    - <3:2> = 0 for leap year plus 1, etc.
    - <1> = 0 AM \
    - = 1 PM > if clock is in 12-hour mode
    - <0> = 0 selects 12-hour mode
    - = 1 selects 24-hour mode
  - Interrupt control register:
    - <3> = 0 selects single interrupt operation
    - = 1 selects repeated interrupt operation
    - <2:0> = 0 interrupt output cleared, interrupt start/stop set to 1 (stop), interrupts disabled
    - = 1 interrupt in 0.1 second (+/- 1 ms, non-accumulating)
    - = 2 interrupt in 0.5 second (+/- 1 ms, non-accumulating)
    - = 3 interrupt in 1 second (+/- 1 ms, non-accumulating)
    - = 4 interrupt in 5 seconds (+/- 1 ms, non-accumulating)
    - = 5 interrupt in 10 seconds (+/- 1 ms, non-accumulating)
    - = 6 interrupt in 30 seconds (+/- 1 ms, non-accumulating)
    - = 7 interrupt in 60 seconds (+/- 1 ms, non-accumulating)
- 6) Clock chip interrupts are not wired on the Model 120, but can be used in a polling manner.

## WARRANTY

Codar Technology, Inc. (CTI) warrants the Model 120 Calendar Clock to be free from defects in material or workmanship for twelve months from the date of shipment from Longmont, Colorado U.S.A. (the Factory). This Warranty is made to the original Purchaser only, and may not be transferred without the written permission of CTI. Under this Warranty, CTI's liability is limited to repairing or replacing the defective components which, in CTI's judgement, were originally defective or have failed in normal operation during the Warranty period.

Defective equipment must be returned to the Factory, together with a Return Material Authorization obtained from CTI by telephone, within twelve months from the date of original shipment from the Factory. Purchaser shall prepay shipping charges to CTI, and CTI shall pay shipping charges to return the product to Purchaser. However, Purchaser shall pay all shipping charges, duties, and taxes for equipment returned to CTI from another country.

CTI does not warrant that the operation of its equipment, software, or firmware will be uninterrupted or completely error free.

This Warranty shall not apply to any damage, defect or failure which results from: shipment, accident, misuse, or improper or inadequate maintenance by Purchaser; Purchaser-supplied software, firmware or interfacing; modifications, connections, installations or adjustments contrary to instructions furnished by CTI in writing; unauthorized operation outside of the environmental specifications for the equipment; or exposure to corrosive environments.

This Warranty does not apply to, nor does CTI assume any liability for, the use of the equipment in any life support application.

CTI shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

No other warranty is expressed or implied. CTI specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

This Warranty is in lieu of all other representation or warranties, expressed or implied, and no agent or representative of CTI is authorized to assume any other obligations in connection with the sale and purchase of this equipment.

***ERRATA***

No changes as of 15-Sep-87