

**NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia**

Electronics Division Internal Report No. 69

NRAO STANDARD SOLAR CALENDAR

Glenn Ertell

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NRAO STANDARD SOLAR CALENDAR

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Drawing: 2.440-1

Description

The calendar uses six electrically stepped and reset Veeder-Root counters for days, months and the units and tens digits of years to provide both visual display and BCD output, the latter in the form of contact closures to ground; a programmer that consists of ten switches that are cam operated by a ten track, sixty step motor driven drum; the necessary relays for sequencing; and a self-contained DC power supply. The calendar can be registered at any time by use of the manual set buttons on the counters and by manually rotating the programmer drum to the position matching the current month and year. A pulse put out from the master clock each midnight automatically steps the units of days counter by one. The coincidence between the days counters containing the number of days of the month plus one and the corresponding month position of the programmer drum initiates a sequence to reset the days of the months counters to one, advance the months counter by one or to reset them to one if the end of the year has occurred, and if a new year, step the year counters by one.

A time delay is provided between sensing coincidence between the day counters and the programmer drum and starting the reset sequence to allow for a relay settling out time after power is restored. This eliminates false operation of the calendar due to power failure.

Principle of Operation

Refer to drawings.

Relay RM is energized for the duration of the master clock pulse that occurs once every 24 solar hours. When RM becomes de-energized, the units of days Veeder-Root counter steps one count. The first 52 positions of the programmer drum are programmed for a consecutive 4 year cycle, starting with leap year (1968). Each year utilizes 13 drum positions. Each of the first 12 of the 13 are programmed for the number

of days plus one of consecutive months. The 13th position is required to sequence from one year to the next. The remaining 8 positions of the drum are programmed to cause the drum to advance through them to the beginning of the 4 year cycle. When coincidence occurs between switches actuated by the cam on the programmer drum and the contacts in the days Veeder-Root counters, a circuit is closed that causes time delay relay RT to be energized. After a time delay, an RT contact causes relays RA and RCX to be energized.

The function of RA is to reset the days counters to zero, and if it is the end of the year, to reset the months counters to zero. RA connects circuits that pulse the reset circuits of the counters with half wave voltage. Relay RA also energizes relay RC. The function of RC is to step the days counter from zero to one, and through a programmer switch designated CM to step the month counter by one. RC also advances the years counters by one through a programmer switch designated CY.

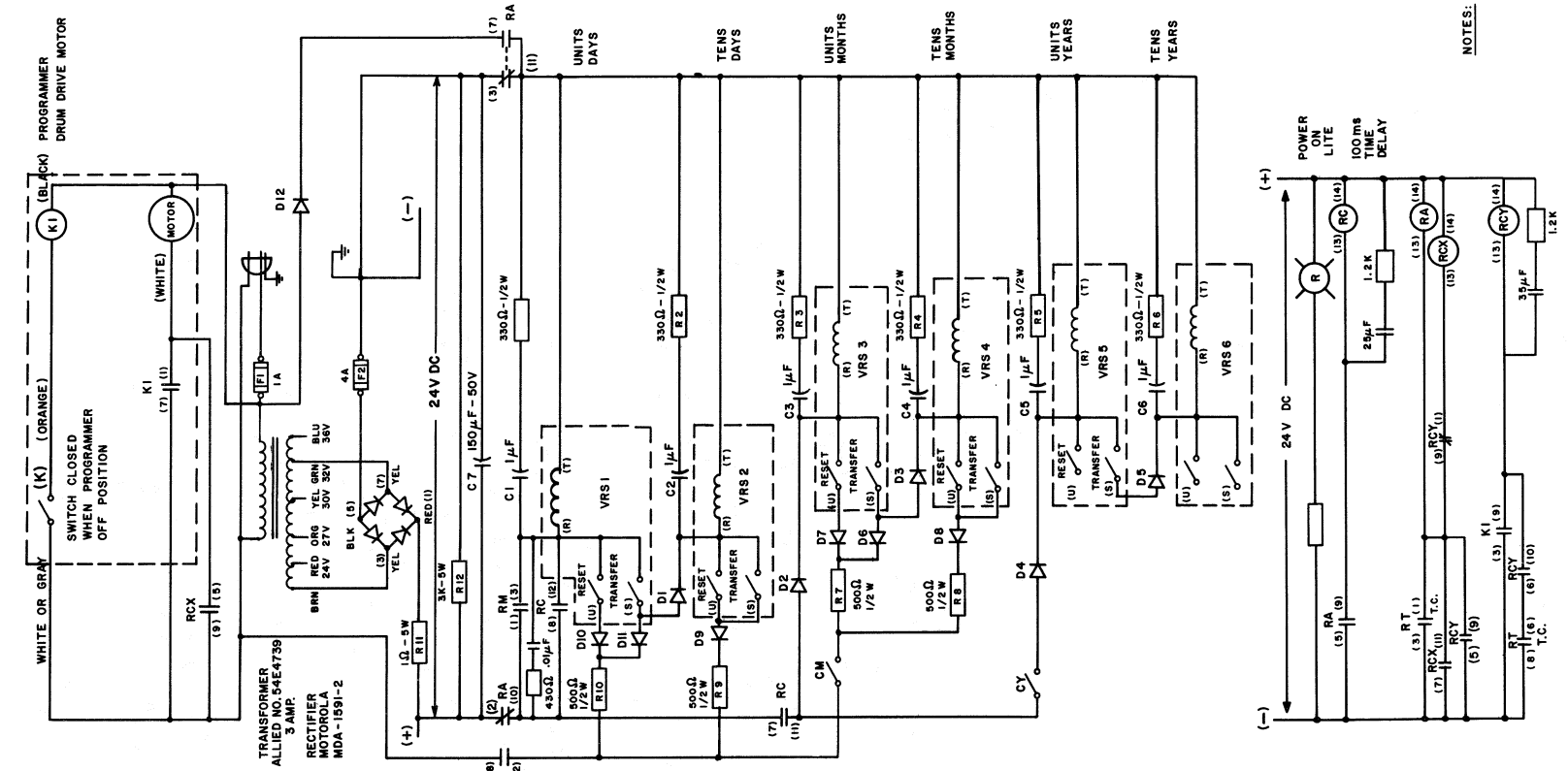
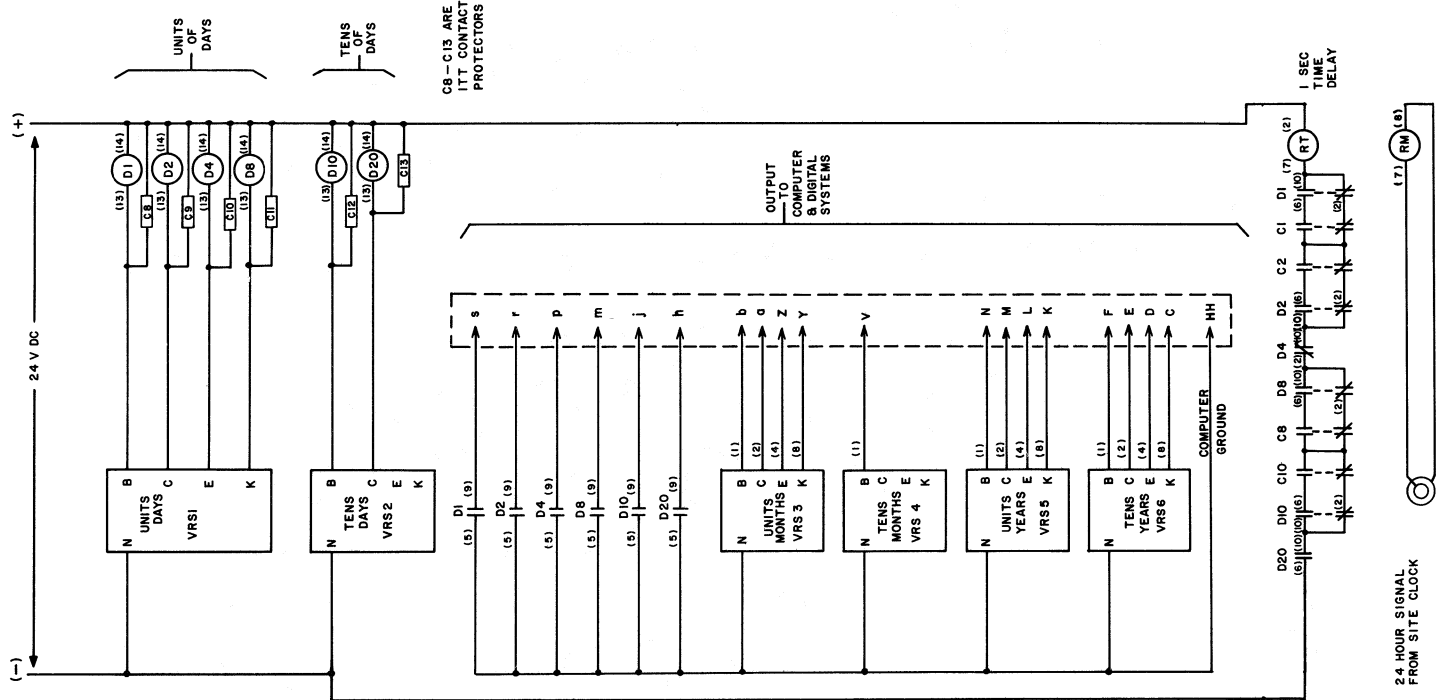
The function of RCX is to assure that the programmer drum advances one full position if RT is de-energized before the drum completes its advance. RCX simultaneously seals itself in and energizes the programmer drum drive motor. As the drum rotates toward the next position, a cam releases a switch to energize relay K1 and the cam switch is not actuated to de-energize K1 until the drum is again in position. When K1 is energized, one of its contacts makes a circuit to energize relay RCY.

The function of RCY is to assure that the programmer drum advances only one position if RT is energized for longer than the time required to advance the drum one position. RCY also keeps RA and RC from being de-energized until RT is de-energized. This holds back the RA-RC cycle previously described until the programmer drum reaches the next position, causing K1 to be de-energized, then RCY, then RA, and then RC.

Every four years the programmer drum is advanced through the excess positions to the start position thru the circuit set up by the programmer switch designated CSY.

Set-Up Procedure

Be sure the power is on. If the programmer drum is manually rotated partway to the next position, it will continue to rotate by itself through the latter part of each positioning step and will stop automatically and correctly in position. See the table on drawing 2.440-1. Manually set the programmer drum to the position as read by the pointer corresponding to the current year and month. Complete the set up procedure by pushing the manual buttons on the front of the days, months, and years counters until the visual display corresponds with the current date.



— CAM SETTINGS FOR PROGRAMMING SWITCH —

STEP	(A) C1	(B) C2	(C) C3	(D) C4	(E) C5	(F) C6	(G) C7	(H) C8	(I) C9	(J) C10	(K) C11	(L) C12	(M) C13
1	P	P	P	P	P	P	P	P	P	P	P	P	P
2	P	P	P	P	P	P	P	P	P	P	P	P	P
3	P	P	P	P	P	P	P	P	P	P	P	P	P
4	P	P	P	P	P	P	P	P	P	P	P	P	P
5	P	P	P	P	P	P	P	P	P	P	P	P	P
6	P	P	P	P	P	P	P	P	P	P	P	P	P
7	P	P	P	P	P	P	P	P	P	P	P	P	P
8	P	P	P	P	P	P	P	P	P	P	P	P	P
9	P	P	P	P	P	P	P	P	P	P	P	P	P
10	P	P	P	P	P	P	P	P	P	P	P	P	P
11	P	P	P	P	P	P	P	P	P	P	P	P	P
12	P	P	P	P	P	P	P	P	P	P	P	P	P
13	P	P	P	P	P	P	P	P	P	P	P	P	P
14	P	P	P	P	P	P	P	P	P	P	P	P	P
15	P	P	P	P	P	P	P	P	P	P	P	P	P
16	P	P	P	P	P	P	P	P	P	P	P	P	P
17	P	P	P	P	P	P	P	P	P	P	P	P	P
18	P	P	P	P	P	P	P	P	P	P	P	P	P
19	P	P	P	P	P	P	P	P	P	P	P	P	P
20	P	P	P	P	P	P	P	P	P	P	P	P	P
21	P	P	P	P	P	P	P	P	P	P	P	P	P
22	P	P	P	P	P	P	P	P	P	P	P	P	P
23	P	P	P	P	P	P	P	P	P	P	P	P	P
24	P	P	P	P	P	P	P	P	P	P	P	P	P
25	P	P	P	P	P	P	P	P	P	P	P	P	P
26	P	P	P	P	P	P	P	P	P	P	P	P	P
27	P	P	P	P	P	P	P	P	P	P	P	P	P
28	P	P	P	P	P	P	P	P	P	P	P	P	P
29	P	P	P	P	P	P	P	P	P	P	P	P	P
30	P	P	P	P	P	P	P	P	P	P	P	P	P
31	P	P	P	P	P	P	P	P	P	P	P	P	P
32	P	P	P	P	P	P	P	P	P	P	P	P	P
33	P	P	P	P	P	P	P	P	P	P	P	P	P
34	P	P	P	P	P	P	P	P	P	P	P	P	P
35	P	P	P	P	P	P	P	P	P	P	P	P	P
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37	P	P	P	P	P	P	P	P	P	P	P	P	P
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43	P	P	P	P	P	P	P	P	P	P	P	P	P
44	P	P	P	P	P	P	P	P	P	P	P	P	P
45	P	P	P	P	P	P	P	P	P	P	P	P	P
46	P	P	P	P	P	P	P	P	P	P	P	P	P
47	P	P	P	P	P	P	P	P	P	P	P	P	P
48	P	P	P	P	P	P	P	P	P	P	P	P	P
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55	P	P	P	P	P	P	P	P	P	P	P	P	P
56	P	P	P	P	P	P	P	P	P	P	P	P	P
57	P	P	P	P	P	P	P	P	P	P	P	P	P
58	P	P	P	P	P	P	P	P	P	P	P	P	P
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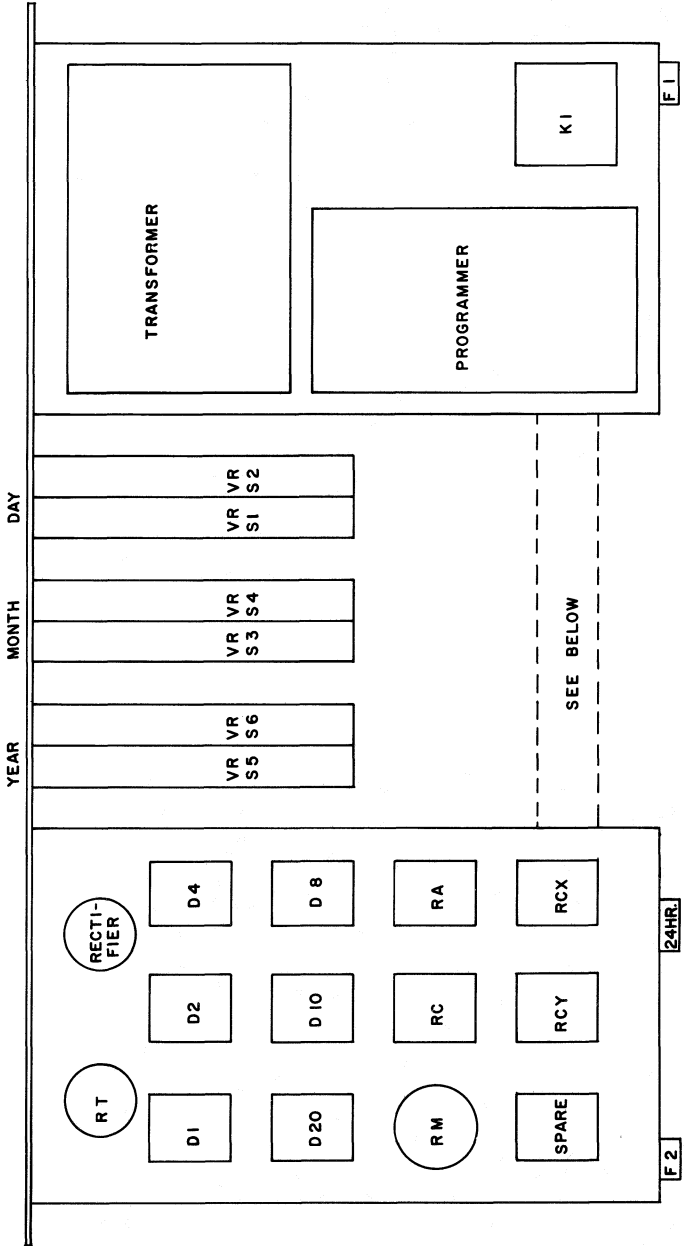
KEY: P = POINTED CAM
 N = NOTCHED CAM
 S = SHORTING CAM

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OBSERVATORY**

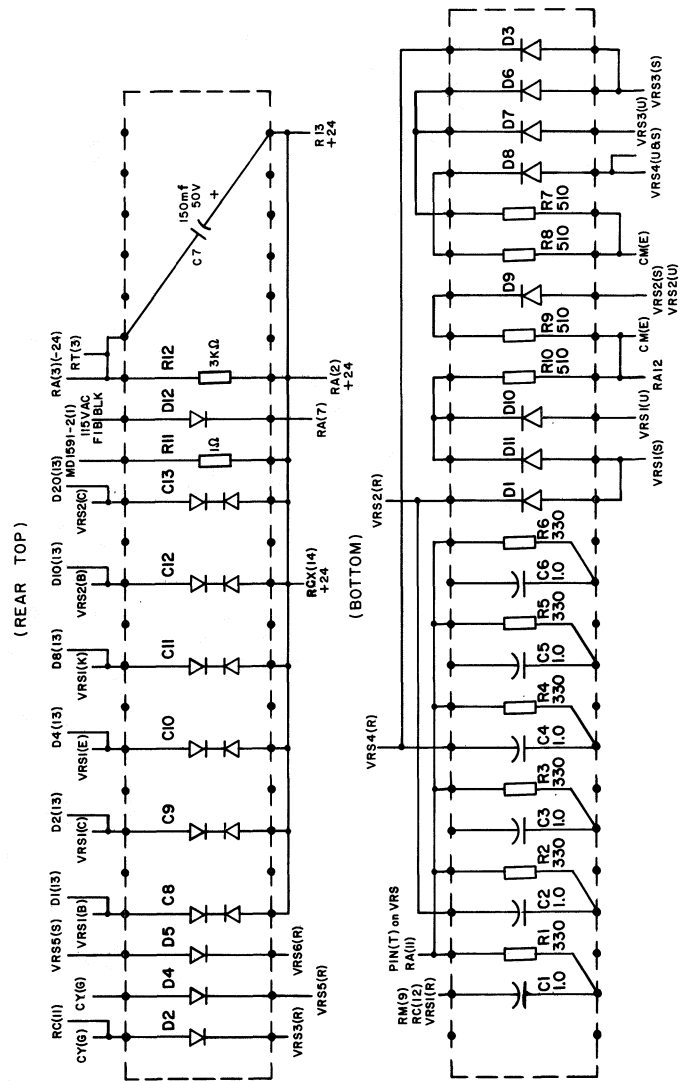
TITLE: N.R.A.O. STANDARD CALENDAR

DESIGN BY: G. ERTELL DATE: 4-30-68
 APPROVED BY: *[Signature]* DRAWN BY: A. J. M.
 No. 5-2-62 BY: *[Signature]* Dwg. No. S2-440-1 Sheet 1 of 2

NOTES: 1. DO NOT USE ELECTROLYTICS FOR 1μF CAPACITORS
 2. ALL DIODES IN 1N613 UNLESS OTHERWISE NOTED



TOP VIEW



(FRONT TOP)

NATIONAL RADIO ASTRONOMY
OBSERVATORY

TITLE NRAO STANDARD CALENDAR
LAYOUT & WIRING

DESIGN BY: G. ERTELL DATE: 5-2-68

APPROVED BY: *[Signature]* DRAWN BY: A.J.M.

DWG. No. S2-440-1 Sheet 2 of 2

No.	DATE	BY	REVISIONS