INSTRUCTIONS

GEH-2030D
Supersedes GEH-2030C

TIMING RELAYS

TYPES

RPM11A
RPM11B
RPM11D
RPM11E
RPM11H
RPM11J
RPM14A
RPM14B

RPM14D

GENERAL ELECTRIC

CONTENTS

TIMING RELAYS

TYPE RPM

DESCRIPTION

The Type RPM relays are DC timing relays specifically designed for use with distance relays for transmission line protection. Their function is to provide target indication and suitable time delays for first, second and third zone trip protection in step distance relay applications. Each timing relay has three electrically separate trip circuits. The first zone trip circuit consists of a target in series with a time delay contact. The third zone trip circuit consists of third target in series with a second time delay contact. The targets, when operated, indicate the fault location in terms of which zone of relay protection operated to trip the breaker. The time delay contacts of the relay delay tripping so as to provide time coordination with other relaying applied to the system. One Type RPM relay is required with each set of three distance relays providing phase packaged three zone step distance transmission line protection.

These relays are mounted in a size S2 drawout case. The outline and panel drilling is shown in Figure 16. The basic differences between the various model relays are listed in Table 1. The RPM11D and RPM11H relays are suggested for standard applications.

TABLE 1

RELAY TYPE	INTERNAL CONN	TIMING RANGE	COIL CIRCUIT TIME RATING	CONTACT DWELL TIME+	
				Second Zone	Third Zone
	Figure	Seconds	Seconds	Cycles†	Cycles†
RPM11A	6, 7	0.15-3.0	60	9-15	9-15
RPM11B	8, 9	0.15-3.0	60	9-15	9-15
RPM11D	6, 7	0.15-3.0	60	Maintained	9-15
RPM11E	8, 9	0.15-3.0	60	Maintained	9-15
RPM11H	6, 7	0.10-1.0	60	Maintained	3-4.5
RPM11J	8, 9	0.10-1.0	60	Maintained	3-4.5
RPM14A	10, 11	0.15-3.0	Continuous	9-15	Maintained
RPM14B	12, 13	0.10-1.0	Continuous	Maintained	Maintained
RPM14D	12, 13	0.15-3.0	Continuous	Maintained	Maintained

+Contact dwell time depends on the time dial setting
†60-Cycle basis

APPLICATION

The Type RPM relays are DC timing relays specifically designed for use with distance relays for transmission line protection. Their function is to provide target indication and suitable time delays as required for first, second and third zone trip protection in step distance relay applications. The standard schemes for this type of protection employ either the RPM11D or the RPM11H relay depending upon whether a three second or a one second timer is desired. These relays have maintained second zone time

delay contacts. They provide an advantage over relays with passing (non-maintained) contacts when applied on three terminal transmission lines.

Figures 4 and 5 are typical external connection diagrams for the RPM11D and RPM11H relays when used with GCX51 and GCY51 distance relays respectively. The RPM11A relay is identical to the RPM11D relay except that it has a passing second zone contact. Thus Figures 4 and 5 also apply to the RPM11A relay.

The RPM14A, RPM14B and RPM14D relays have continuously rated coil circuits. Aside from this they are functionally equivalent to the RPM11A, RPM11H and RPM11D respectively. While the internal connections of the RPM14A, RPM14B and RPM11D are somewhat different from the internal connections of the RPM11A, RPM11H and RPM11D relays, the stud arrangements are such that these relays are electrically interchangeable. It is possible to substitute any one for the other using the same relay case by simply removing one relay from its case and substituting the other. However, such a procedure is suggested only if these relays are employed in a standard application such as illustrated in Figures 4 and 5. Note that if different internal connections are visualized for the RPM14A, RPM14B and RPM14D relays, Figures 4 and 5 may be also used for the external connections to these relays.

The RPM11B, RPM11E and RPM11J are similar to each other except for the differences noted in Table 1. These three types all have the same internal connections, which are somewhat different from the internal connections of the RPM11A, RPM11D and RPM11H relays. It is in this sense only that they are somewhat special. They are included in this book without any application guide because they are available and may suit the needs of someone having a special relaying problem.

None of the relays covered by these instructions contain seal-in units. The seal-in units of the associated distance relays are used to seal-in around the RPM contacts.

OPERATING CHARACTERISTICS

THREE SECOND RELAYS

The minimum time setting of these relays is 0.15 seconds. The minimum difference in time between the TU2 and the TU3 contact settings is between 0.084-0.117 second. The average dwell time at 0.75 second setting is 0.15 second. At the three second setting the average dwell time is 0.25 second.

ONE SECOND RELAYS

The minimum time setting for these relays is six cycles (60-cycle basis). The minimum difference in time between the TU2 and TU3 contact settings is two-four cycles. The average dwell time at the 15 cycle setting is three cycles and at the 60-cycle setting is 4.5 cycles.

TX UNIT

The pickup time of the TX unit with rated voltage applied is approximately two cycles on a 60-cycle basis. Pickup time is the time from the instant voltage is applied to the instant a normally closed contact opens.

RATINGS

The RPM11A, RPM11B, RPM11D, RPM11E, RPM11H and RPM11J relays are available for intermittent (60 seconds) rating at standard DC control voltages from 24 to 250 volts. The RPM14A, RPM14B and RPM14D relays are continuously rated at standard DC control voltages from 24 to 250 volts.

TARGET RATINGS - AMPERES

RATING	CONT.	TRIP DUTY	RES. OHMS
0.2	0.5	5	7.360
0.6	1.5	20	0.73
1.0	2.5	30	0.346
2.0	4.0	30	0.120
4.0	8.0	30	0.020

CONSTRUCTION AND CIRCUITRY

The operating magnet of all these relays is a curved solenoid called a rotonoid and is designated as TU. Its armature is able to rotate through approximately 180 degrees. The rotonoid winds up a spiral spring from which is obtained the energy to drive the main shaft. Mounted on the main shaft are the circular calibrated time dial and two insulated cams for operating the timing contacts, TU2 and TU3. Also connected to the main shaft through a set of spur gears is a magnetic damping element for regulating the speed of operation. This element consists of a copper cylinder rotating in an annular air gap across which exists a permanent magnetic field. The relative position of the cylinder in the air gap determines the amount of damping obtained.

The insulated cam on those relays which have a maintained second zone is such that when the second zone contact (TU2) is closed, it remains closed until the relay completely times out. The insulated cam on the relays which do not have a maintained second zone hold the TU2 contact closed only for the length of time stated in Table 1.

The third zone contact (TU3) is maintained on the continuously rated relays. This is accomplished by adding to the intermittently rated relay a telephone unit designated TY. The continuous rating of the RPM14 is achieved when TY operates to open the rotonoid (TU) circuit yet does not affect the TX circuit. As long as TX and TY are picked up, TU3 will be maintained.

The time dial of the three second relays is calibrated in tenths of a second, while the time dial of the one second relays is calibrated in cycles (60 cycle basis) with graduations of 2.5 cycles.

Table 2 lists the circuit resistance for the various relays covered by these instructions.

TABLE 2
CIRCUIT RESISTANCE

RELAY	VOLTS	Resistance						
		TU	R1	TX	R2	R3 +	TY	R4
INTERMITTENTLY RATED RELAYS	250	100	300	$\frac{3700}{550}$	2500	$\frac{1200}{2500}$	-	-
	220	100	250	$\frac{3000}{550}$	2000	$\frac{1000}{2000}$	-	-
	125	100	100	$\frac{3700}{550}$	1200	None	-	-
	110	100	75	$\frac{3000}{550}$	1000	None	-	-
	48	6.5	13.5	$\frac{340}{130}$	95	$\frac{45}{95}$	-	-
	24	6.5	3	$\frac{340}{130}$	45	None	-	-
CONTINUOUSLY RATED RELAYS	250	100	300	$\frac{3700}{550}$	2500	$\frac{1200}{2500}$	7500	7500
	220	100	250	$\frac{3700}{550}$	2000	$\frac{1000}{2000}$	7500	7500
	125	100	100	$\frac{3700}{550}$	1200	None	7500	None
	110	100	75	$\frac{3700}{550}$	1000	None	7500	None
	48	6.5	13.5	$\frac{340}{130}$	95	$\frac{45}{95}$	425	425
	24	6.5	3	$\frac{340}{130}$	45	None	425	None

+ Tapped Resistor $\left[\frac{1200}{2500}\right]$ - series section
- parallels high resistance section of TX

INSTALLATION

RECEIVING

These relays when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are damaged or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

LOCATION AND MOUNTING

The location should be clean and dry, free from dust and excessive vibration, and will be lighted to facilitate inspection and testing. The relay should be mounted on a vertical surface. The outline and panel drilling diagram for the relays covered by this instruction book is shown in Figure 16.

CONNECTIONS

The internal wiring diagrams for the various relays covered by these instructions are shown in Figures 6 to 13 inclusive. Typical external connection diagrams are shown in Figures 4 and 5.

Unless mounted on a steel panel which adequately grounds the relay case, it is recommended that the case be grounded through a mounting stud or screw which a conductor not less than #12 B & S gauge copper wire or its equivalent.

It should be noted that an external means must be provided to open the rotonoid coil (TU) circuit after any of the intermittently rated relays have operated.

SETTINGS

As shipped from the factory (unless otherwise specified) TU2 cam will be set at one second on the three second relays and at 20 cycles on the one second relay. The TU3 contact for both the three and the one second relays is set at its maximum time limit position.

In order to change the time setting of either the TU2 or the TU3 contact simply loosen the clamping screw that holds the pointer in position. Move the pointer to the desired time and then tighten the clamping screw.

MAINTENANCE

PERIODIC TESTING

It is recommended that a mechanical inspection and an operation test be performed at least annually, and if possible at the same time associated equipment is tested.

The interval of time may vary depending on the relative importance of individual protective equipment, their exposure to unfavorable conditions such as extreme heat, moisture or fumes. Dust and dirt may contaminate the relay when the protective cover is removed.

Periodic tests consist of checking the contacts for corrosion and pitting, and the relay calibration.

SERVICING

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact.

Fine silver contacts should not be cleaned with knives, files or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts, thus preventing closing.

The burnishing tool described above can be obtained at the factory.

MECHANICAL ADJUSTMENTS

The relays are adjusted at the factory and it is advisable not to disturb the adjustments. If for any reason they have been disturbed, the following points should be observed in restoring them. Refer to Figures 1, 2, 3 and 14 for the location of the parts mentioned.

CAUTION: When the time scale is rotated manually it should only be turned far enough so the inner cam clears its contact brush.

1. The gap between the contact tips on each set of the timing unit contacts should be approximately 1/16 inch. Each contact brush should bear against its respective scraper brush.

2. When rotated, the insulated cams should touch the inner contact brush at the "V" only, but high enough on the "V" to insure 1/64 inch wipe on the outer contact brush. These cams should not extend beyond the edge of their respective contact brush.

3. With the pointer of the rear insulated cam set at maximum time setting on the scale, this cam should rotate far enough beyond the apex of the "V" in the contact brush to allow the contacts to reopen when the timing unit is fully operated.

4. There should be at least 1/32 inch clearance between the time scale assembly and the front mounting plate.

5. There should be no binding between the gear on the main shaft and the pinion on the magnetic damping element shaft.

6. The pawl of the ratchet assembly on the magnetic damping element shaft should remain engaged to the same tooth when the time scale is rotated from zero to the maximum time setting mark and should allow the gear to slip when the scale is released.

7. The flexible stop arm at the rear of the main shaft should clear the supporting bracket by at least 1/32 inch.

8. With the operating magnet in either the de-energized or the fully operated position, the driving arm should clear the cutout section of the main shaft supporting bracket by at least 1/32 inch.

9. The driving arm assembly should clear the rear mounting plate by at least 1/32 inch.

10. There should be at least 1/64 inch clearance between the reset spring collet and the rear bearing of the rotonoid.

11. The time of operation for any scale setting may be varied by sliding the copper cylinder forward or backward on its shaft or turning the driving spring collet on its shaft. Be sure to tighten the set screw after adjustments have been made.

12. With the rotonoid de-energized, the reset spring is prewound approximately one-half revolution and the driving spring is prewound approximately three-fourths of a turn.

13. The gap of all TX and TY unit contacts should be at least 1/64 inch.

14. The wipe of all TX and TY unit contacts should be approximately 0.006 inch.

15. The end of the residual screw of the TX unit should be flush with the inside face of the armature.

To check the time calibration connect the Type RPM relay as shown in Figure 15. In testing the Type RPM relays with a passing second zone contact the clock will be stopped only momentarily and the reading must be made at that instant since the timing unit contacts are closed only 0.15 seconds. A fast operating self-scaling auxiliary relay energized through the timing unit contacts may be used to stop the clock.

Set the pointers of the front and rear insulated cams so that the notched edge coincides with the desired calibration marks on the scale. Check the time by closing S1, then read the time when the clock stops momentarily. Note that S1 should be opened as soon as the intermittently relays have timed out.

If necessary, the time calibration may be corrected by sliding the copper cylinder forward or backward on the magnetic damping element shaft or by turning the driving spring collet on its shaft.

Moving the copper cylinder forward decreases the time delay and moving it backward increases the time delay. Never move the copper cylinder backward enough to strike the bottom plate of damping magnet element.

Turning the driving spring collet in a counter clockwise direction (front view) decreases the time delay and in a clockwise direction increases the time delay.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specifying the quantity required and describing the parts by catalog numbers as shown in Renewal Parts Bulletin No. GEF-3835.

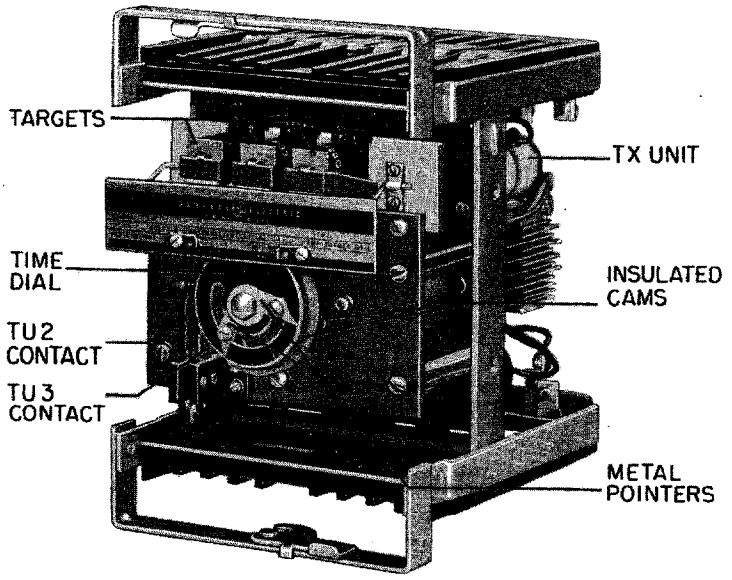


FIG. 1 (8027902) TYPE RPM RELAY REMOVED FROM CASE (FRONT VIEW)

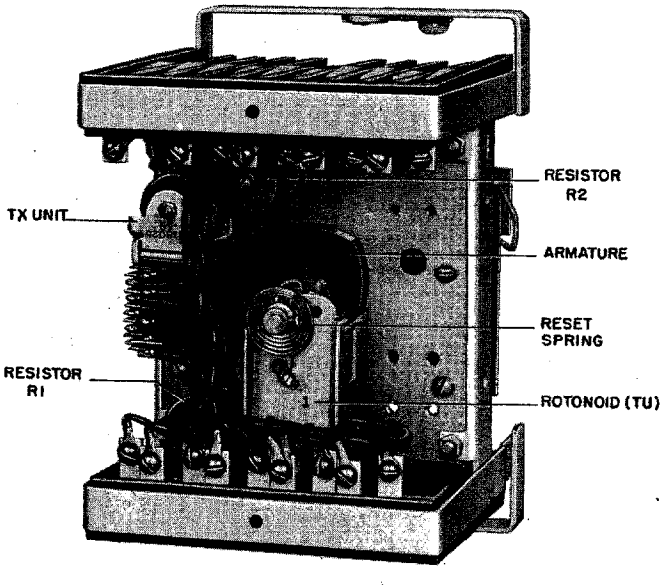


FIG. 2 (8007803) TYPE RPM11 RELAY REMOVED FROM CASE (REAR VIEW)

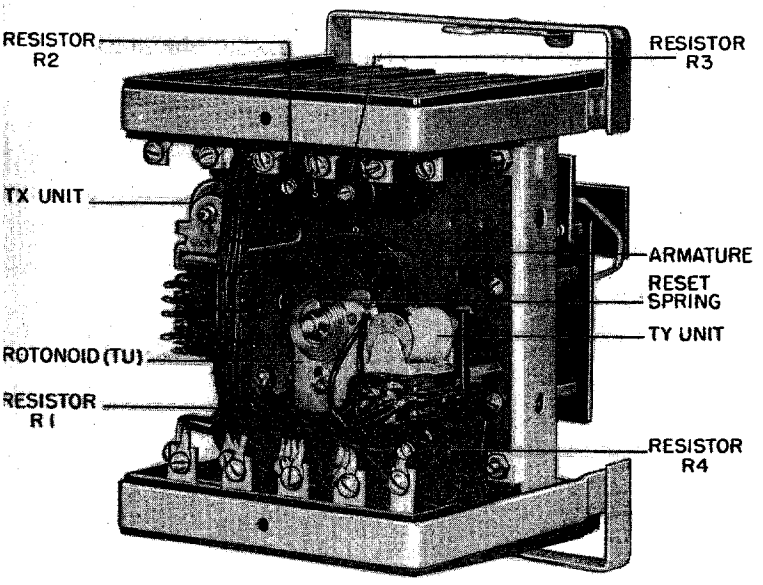


FIG. 3 (8020357) TYPE RPM14 RELAY REMOVED FROM CASE (REAR VIEW)

LEGEND			
DEVICE NO.	DEVICE TYPE	INCL ELEM.	DESCRIPTION
21	GCX51A&B		REACTANCE TYPE STEP DISTANCE RELAY
		TR	TRANSACTOR
		M	MHO UNIT
		O	REACTANCE UNIT
		OX	ZONE TRANSFER AUXILIARY FOR O
		T&SI	TARGET AND SEAL-IN
21X	RPM11D & 11H		TIMING RELAY
		T1, T2, T3	ZONE 1, ZONE 2, ZONE 3, TARGETS
		TU	TIMING ELEMENTS
		TU-2	FIRST TIMING CONTACT TO CLOSE
		TU-3	SECOND TIMING CONTACT TO CLOSE
		TX	AUXILIARY FOR TIMING ELEMENTS
52			CIRCUIT BREAKER
		a	AUXILIARY SWITCH
		TC	TRIP COIL
94	HGA14AM OR AL		AUXILIARY TRIPPING RELAY

TABULATION OF DEVICES			
DEVICE TYPE		INT. CONNS.	OUTLINE
GCX51A&B		0165A7706	K-6209276
RPM11D&H		0178A7092	K-6209272
HGA14AM (BACK CONNS)		K-6400533	K-6400533
HGA14AL (FRONT CONNS)		377A139	377A139
TRIP RECTIFIER (102L2186-2)	125V		104A8584
TRIP RECTIFIER (102L2186-4)	250V		104A8584

FIG. 4A

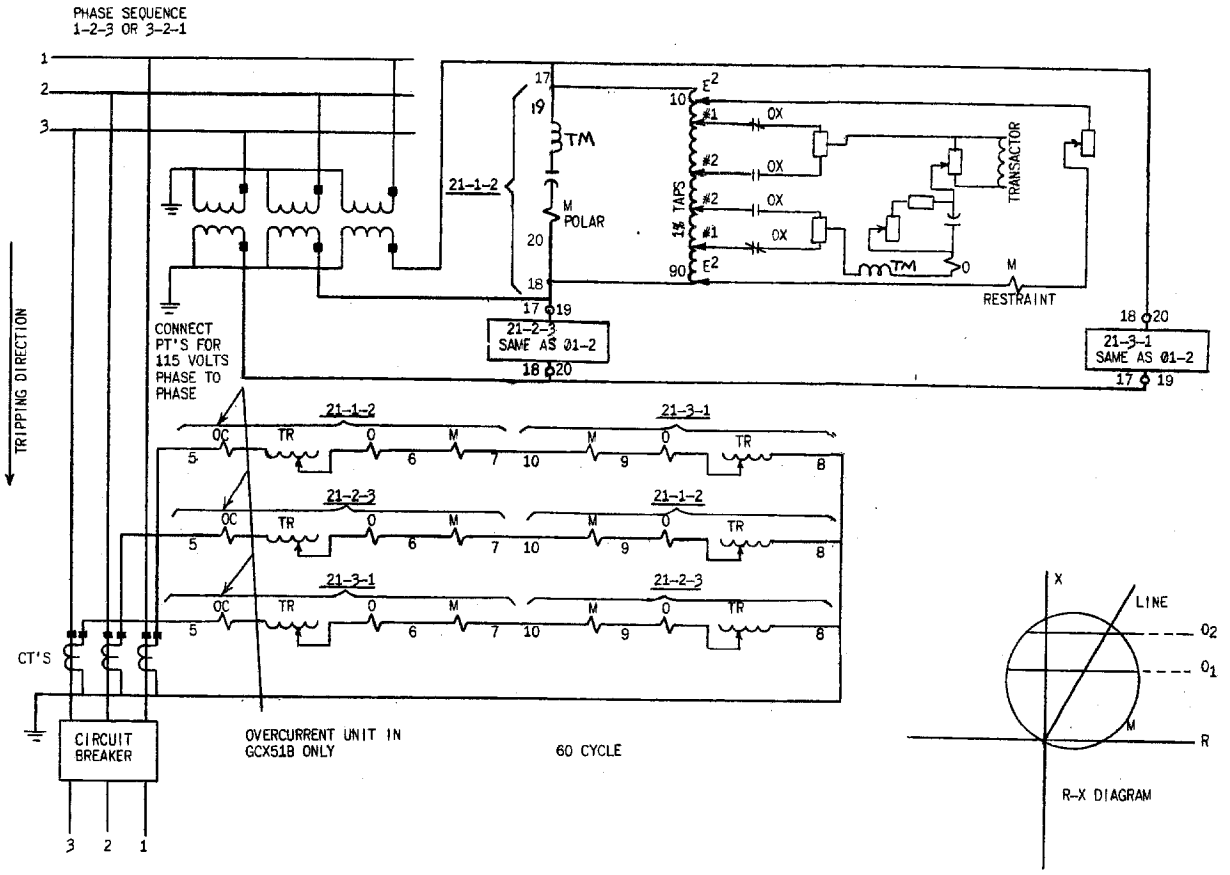


FIG. 4B

FIG. 4 (7381B93-5) TYPICAL EXTERNAL CONNECTION FOR

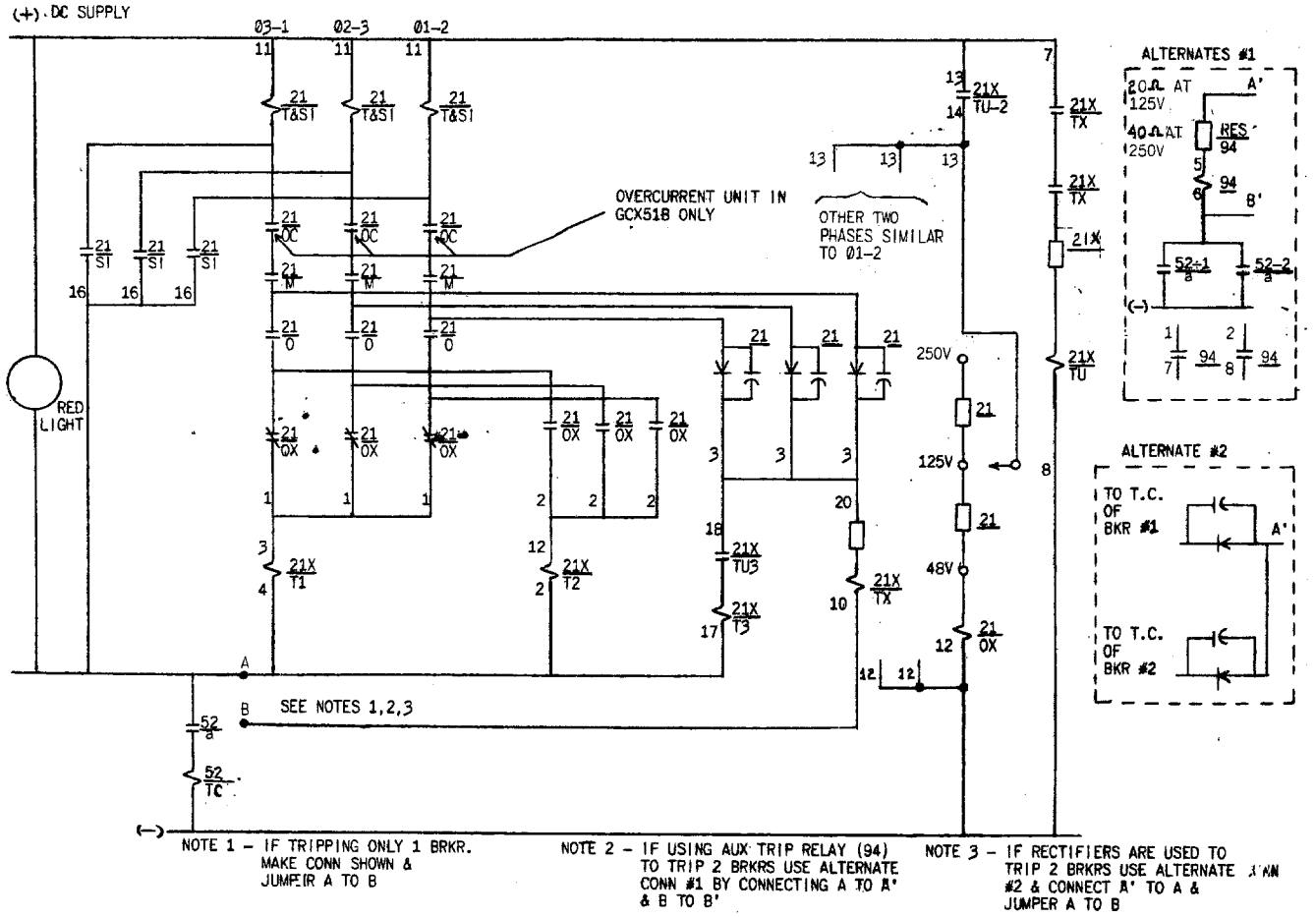


FIG. 4C

PM11D AND RPM11H RELAYS WHEN USED WITH GCX51 RELAYS

LEGEND			
DEVICE NO.	DEVICE TYPE	INC. ELEM.	DESCRIPTION
21	GCY		MHO TYPE STEP DISTANCE RELAY
		M1	1ST ZONE MHO UNIT
		M2	2ND ZONE MHO UNIT
		OM3	3RD ZONE MHO UNIT
		TR-1	TRANSACTOR INPUT TO M1
		TR-3	TRANSACTOR INPUT TO OM3
		T&SI	TARGET AND SEAL-IN
21X	RPM	T1	ZONE 1 TARGET
		T2	ZONE 2 TARGET
		T3	ZONE 3 TARGET
		TU	TIMING UNIT
		TU-2	FIRST TIMING CONTACT TO CLOSE
		TU-3	SECOND TIMING CONTACT TO CLOSE
		TX	AUXILIARY FOR TIMING ELEMENT
50	PJC		CURRENT FAULT DETECTOR
		T&SI	TARGET AND SEAL-IN
52			CIRCUIT BREAKER
		a	AUXILIARY SWITCH
		TC	TRIP COIL
50	CHC		CURRENT FAULT DETECTOR
94	HGA14AM OR AL		AUXILIARY TRIPPING RELAY

TABULATION OF DEVICES			
TYPE OR DESCRIPTION		INT. CONN.	OUTLINE
GCY51A		0178A7049*	K-6209276
RPM11D & H		0178A7092	K-6209271
PJC31C		K-6375726	K-6209272
CHC12A		0148A3956	K-6209272
TRIP RECTIFIER(1021218G-2)	125V.		104A8584
TRIP RECTIFIER(1021218G-4)	250V.		104A8584

FIG. 5A

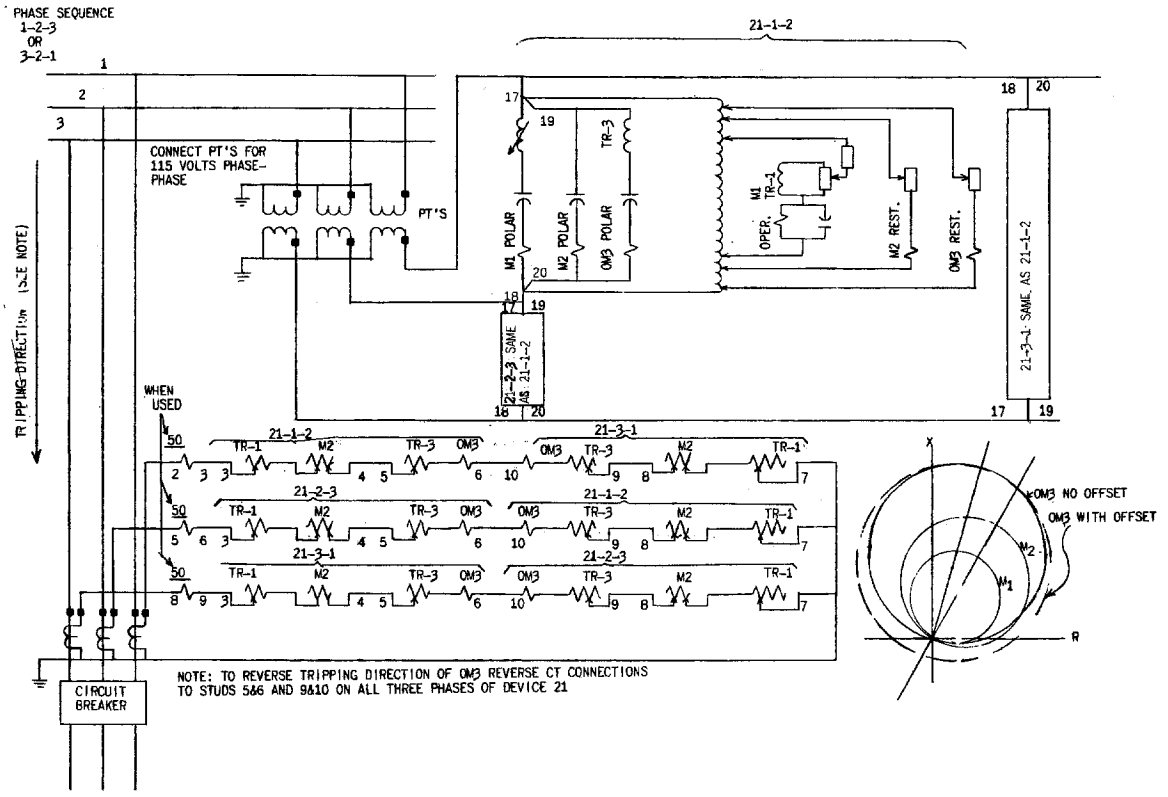


FIG. 5B

FIG. 5 (0116B9303-2 SH. 1) TYPICAL EXTERNAL CONNECTIONS FOR RPM11D AND RPM11H RELAYS WHEN USED WITH GCY51A PHASE DISTANCE RELAYS

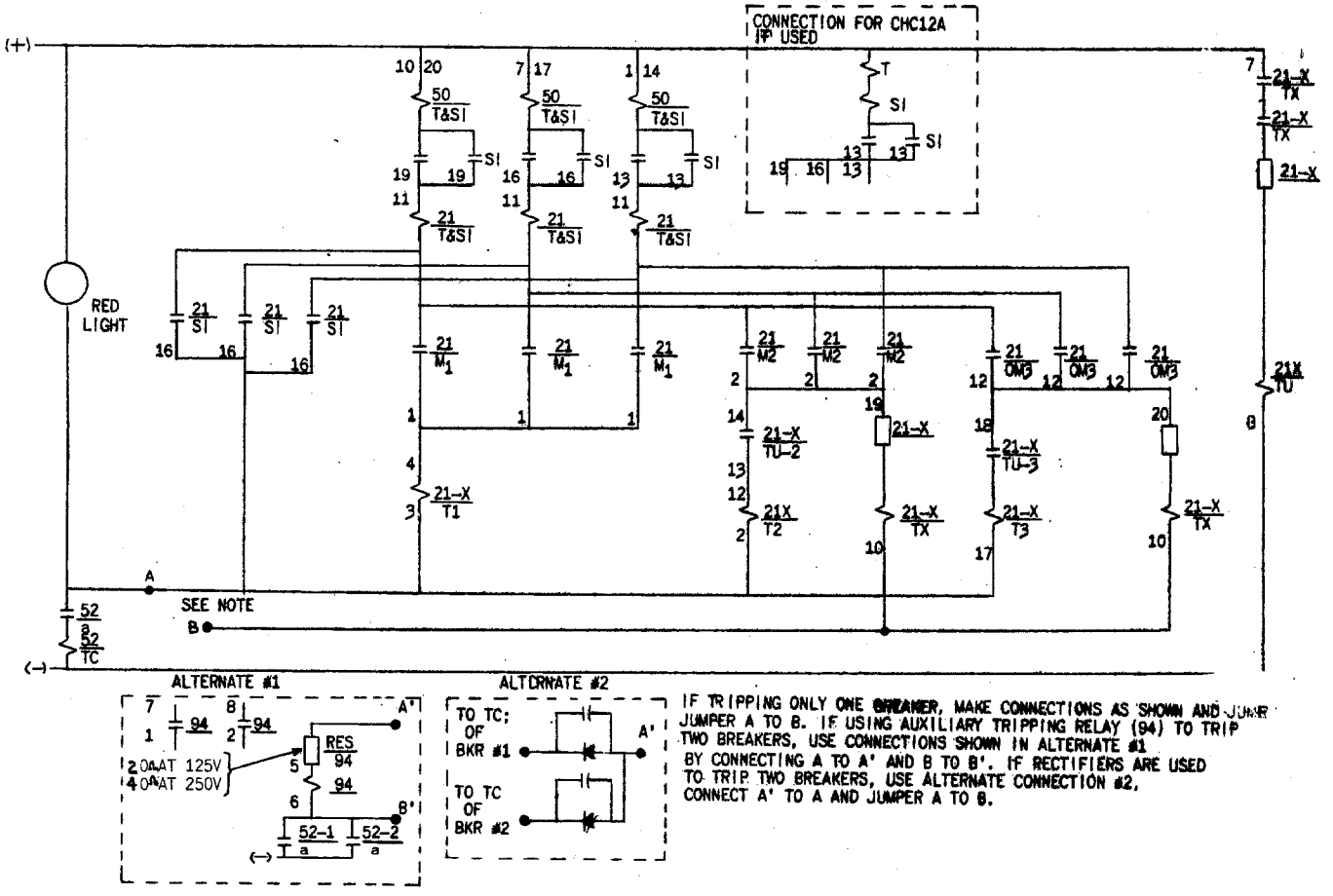

CONNECTION FOR CHC12A IF USED
(+)
(-)
RED LIGHT
50 T&SI
21 T&SI
SI
21 SI
21 M1
21 M2
21 OM3
21-X T1
21X T2
21-X TX
21-X TU-2
21-X TU-3
21X TU
52 a 52 TC
SEE NOTE
A
B
ALTERNATE #1
ALTERNATE #2
94
RES 94
20AAT 125V
40AAT 250V
52-1 a
52-2 a
A'
B'
TO TC OF BKR #1
TO TC OF BKR #2
IF TRIPPING ONLY ONE BREAKER, MAKE CONNECTIONS AS SHOWN AND JUMPER A TO B. IF USING AUXILIARY TRIPPING RELAY (94) TO TRIP TWO BREAKERS, USE CONNECTIONS SHOWN IN ALTERNATE #1 BY CONNECTING A TO A' AND B TO B'. IF RECTIFIERS ARE USED TO TRIP TWO BREAKERS, USE ALTERNATE CONNECTION #2, CONNECT A' TO A AND JUMPER A TO B.

FIG. 5C

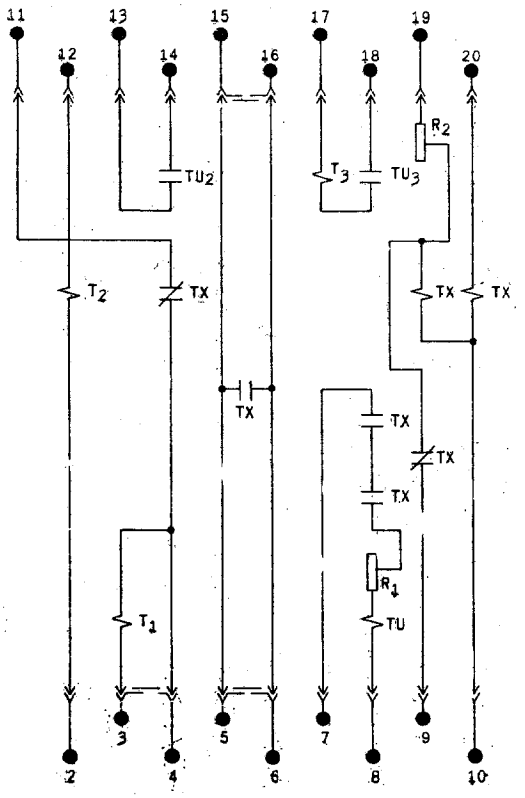


FIG. 6 (K-6209282-3) INTERNAL CONNECTIONS FOR RPM11A, RPM11D AND RPM11H RELAYS (FRONT VIEW) FOR 24, 110 AND 125 VOLTS, DC

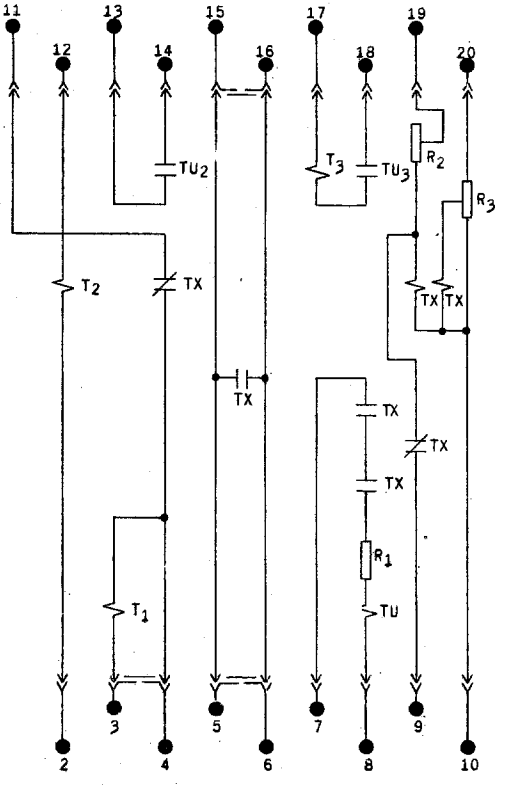


FIG. 7 (K-6400680-6) INTERNAL CONNECTIONS FOR RPM11A, RPM11D, AND RPM11H RELAYS (FRONT VIEW) FOR 48, 220 AND 250 VOLTS, DC

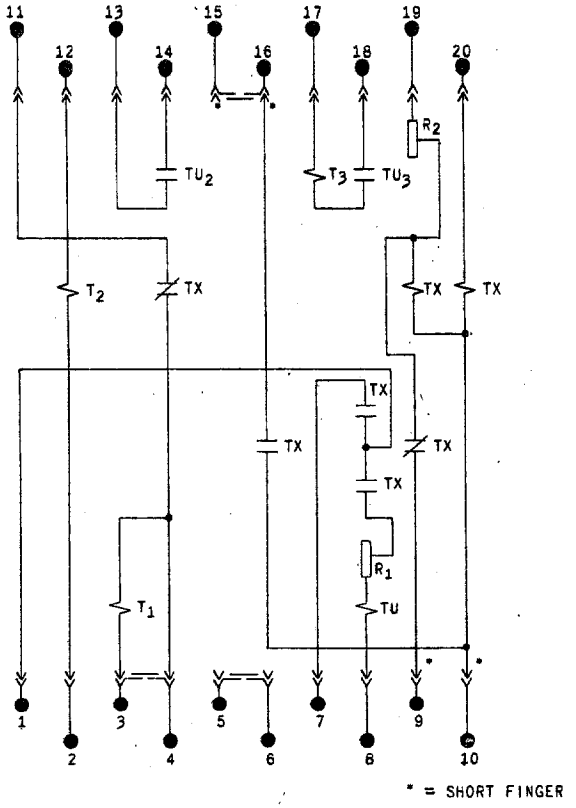


FIG. 8 (K-6209284-3) INTERNAL CONNECTIONS FOR RPM11B RPM11E, AND RPM11J RELAYS (FRONT VIEW) FOR 24,110 AND 125 (VOLTS) DC

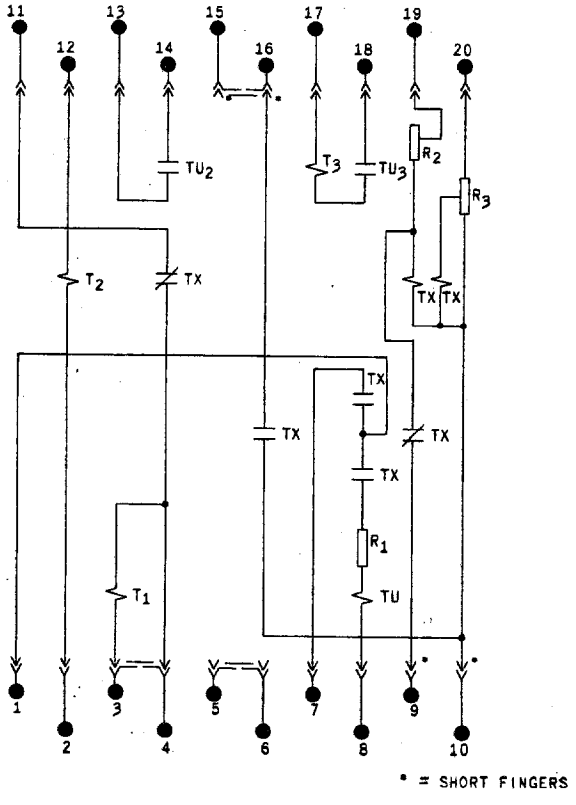


FIG. 9 (K-6400792-5) INTERNAL CONNECTIONS FOR RPM11E AND RPM11J RELAYS (FRONT VIEW) FOR 48,220 AND 250 VOLTS DC

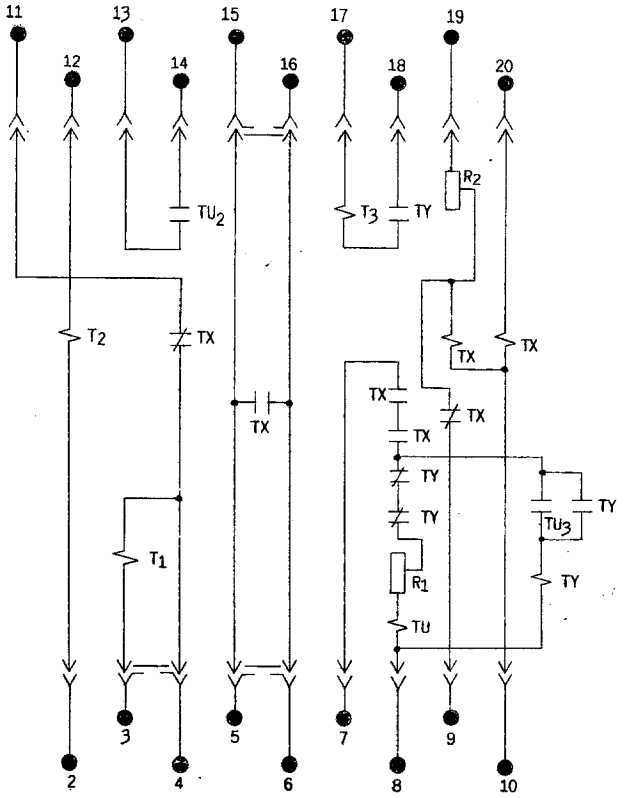


FIG. 10 (0403A0186-2) INTERNAL CONNECTIONS FOR RPM14A RELAY (FRONT VIEW) FOR 24,110 AND 125 VOLTS, DC

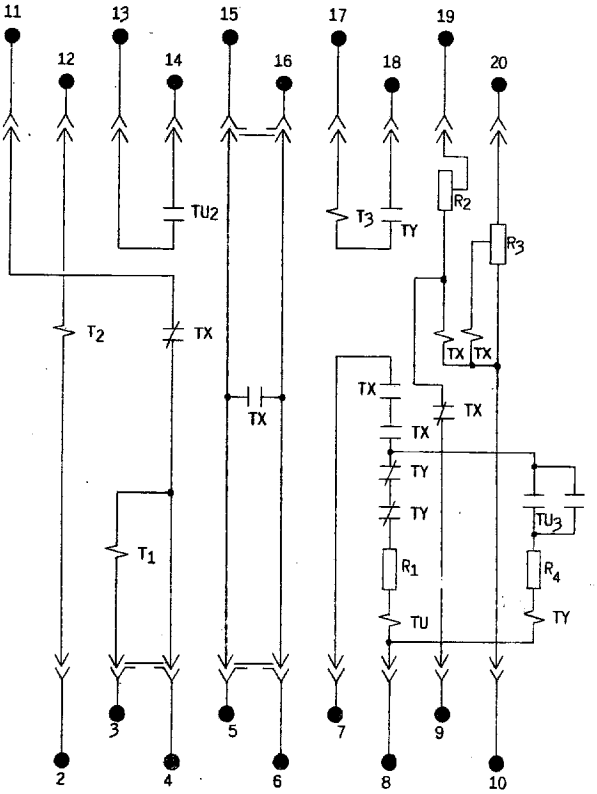


FIG. 11 (0403A0185-2) INTERNAL CONNECTIONS FOR RPM14A RELAY (FRONT VIEW) FOR 48,220 AND 250 VOLTS, DC

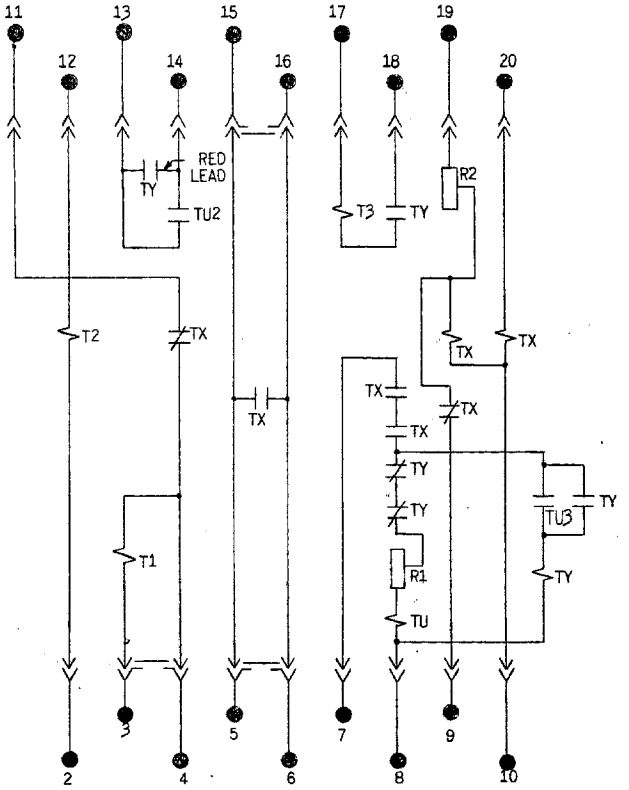


FIG. 12 (0104A8960-1) INTERNAL CONNECTIONS FOR RPM14B AND RPM14D RELAYS (FRONT VIEW) FOR 24 and 125 VOLTS,DC

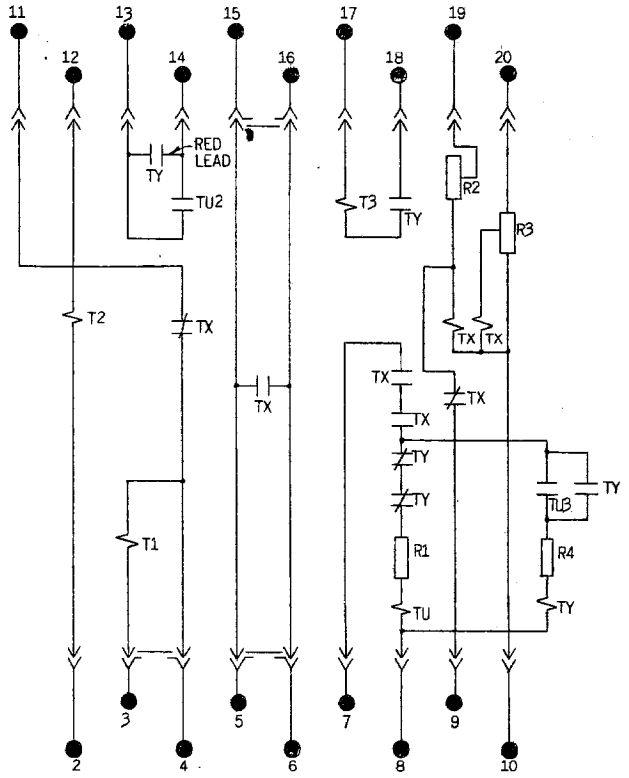
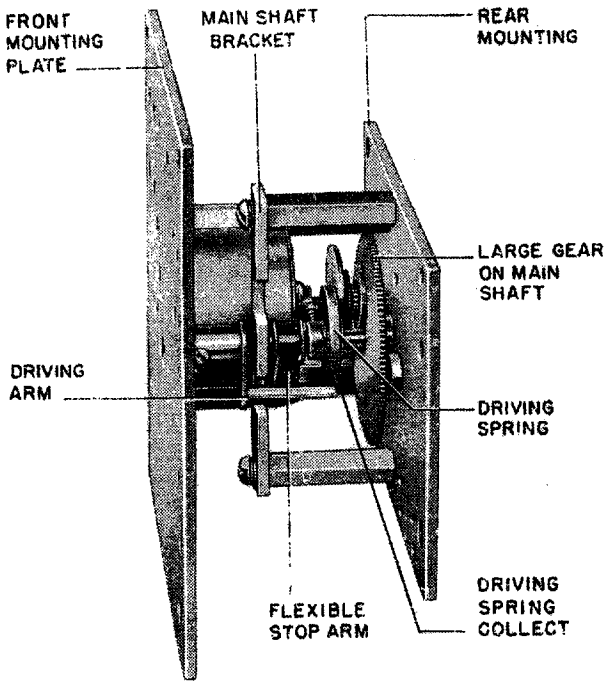
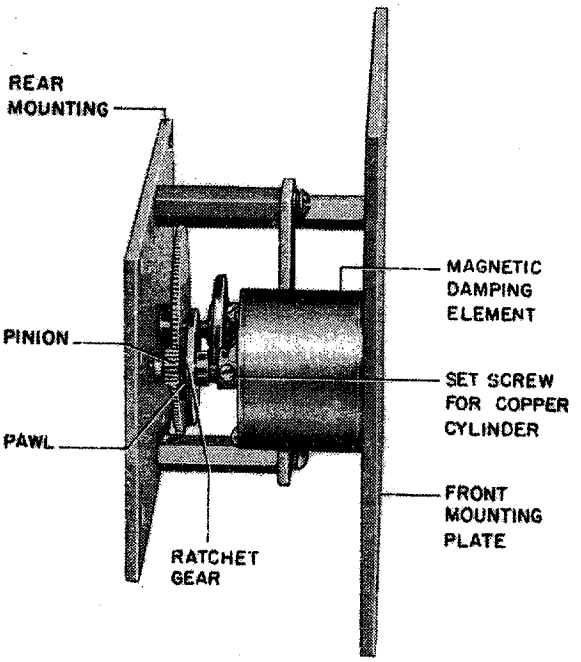


FIG. 13 (0104A8961-1) INTERNAL CONNECTIONS FOR RPM14B AND RPM14D RELAYS (FRONT VIEW) FOR 48 AND 250 VOLTS,DC



LEFT SIDE VIEW (8004823)



RIGHT SIDE VIEW (8004824)

FIG. 14 TYPE RPM RELAY UNIT SUBASSEMBLY BETWEEN FRONT AND REAR MOUNTING PLATES

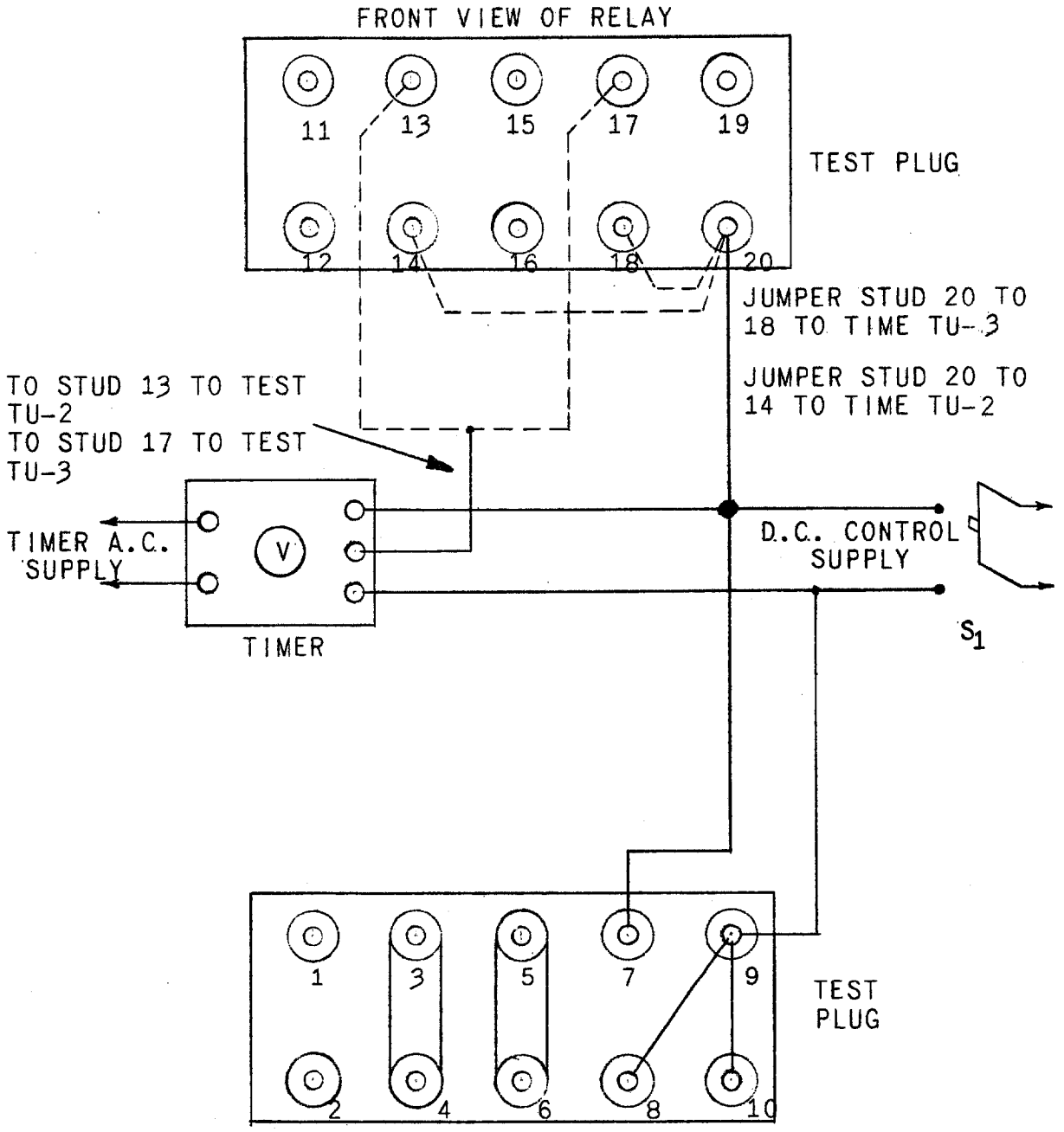


FIG.4

CAUTION:-
DO NOT KEEP S1 CLOSED LONGER THAN NECESSARY TO OBTAIN TIME TEST, BECAUSE OF THE SHORT TIME RATING OF THE ROTONOID.

FIG. 15 (0377A0130-2) TEST CONNECTIONS FOR CHECKING TIME CALIBRATION OF TYPE RPM RELAY

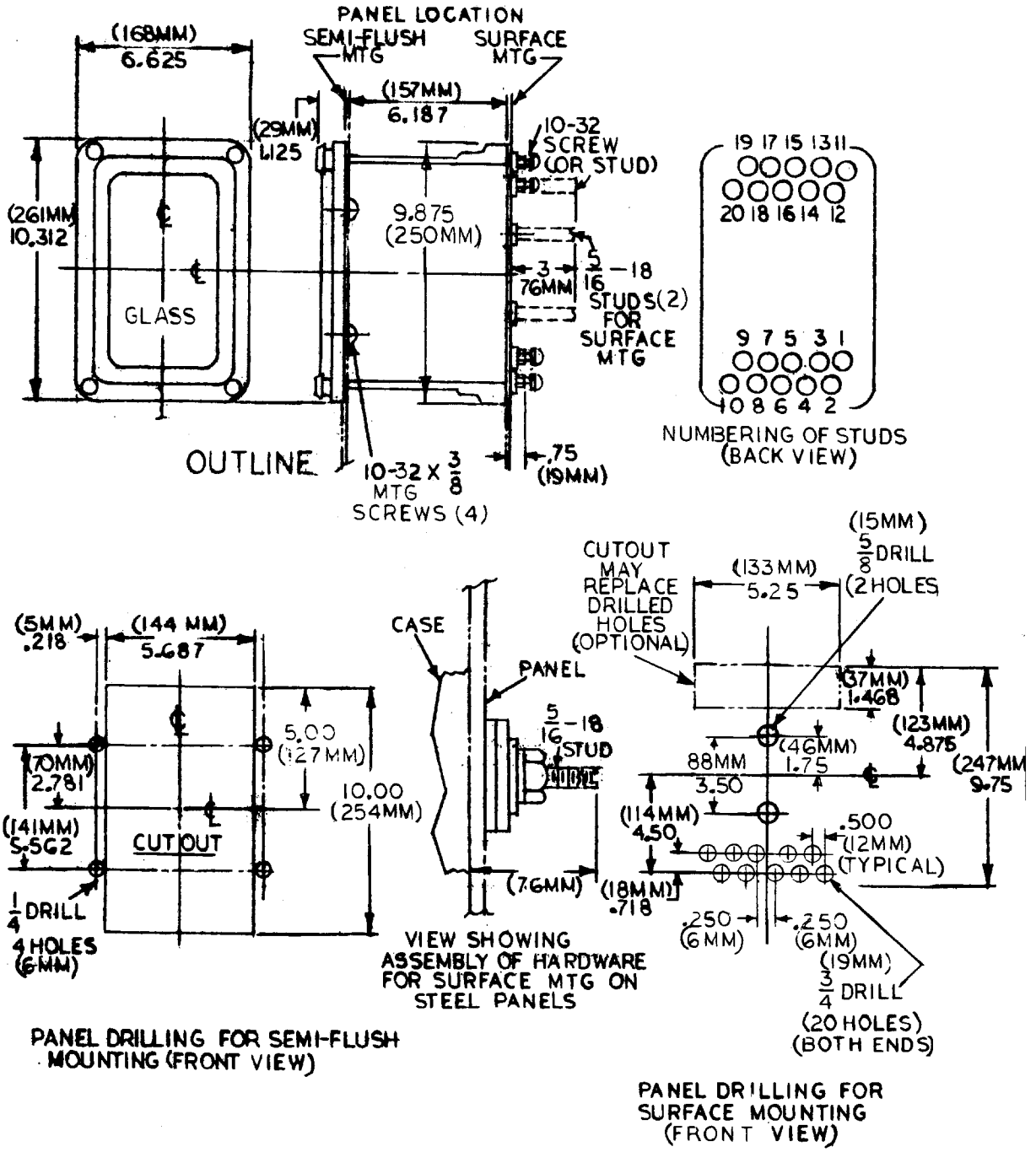


FIG. 16 (K-6209272-4) Outline and Panel Drilling Diagram for the Type RPM Relay