INSTRUCTIONS

GEH-2055C

SUPERSEDES GEH-2055B

TIMING RELAYS

Types

RPM21A
RPM21D
RPM21H
RPM24A
RPM24B
RPM24D

CONTENTS

GENERAL ELECTRIC

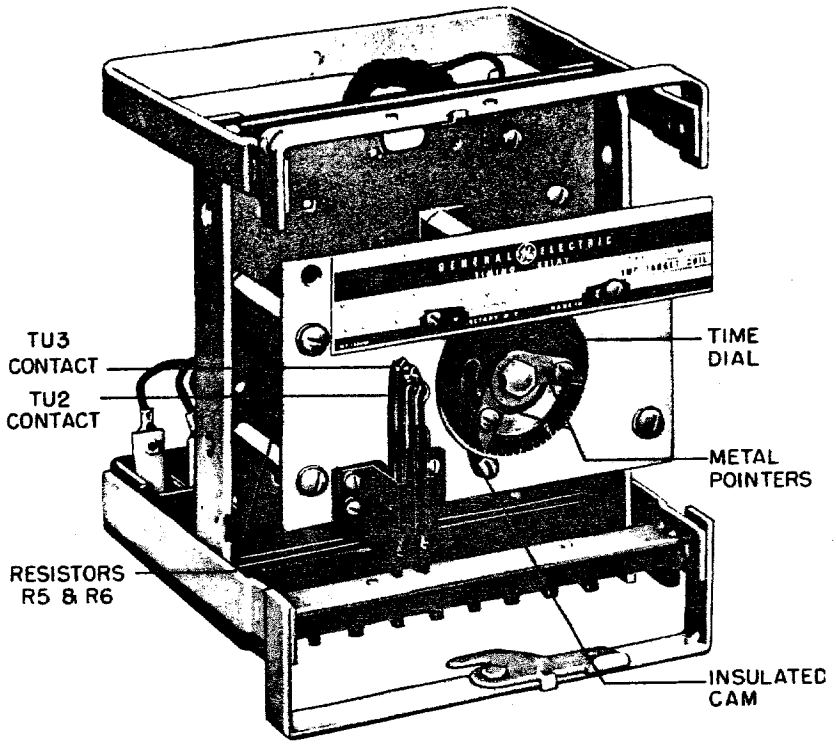


Fig. 1 (8027902) Type RPM Relay Removed from Case (Front View)

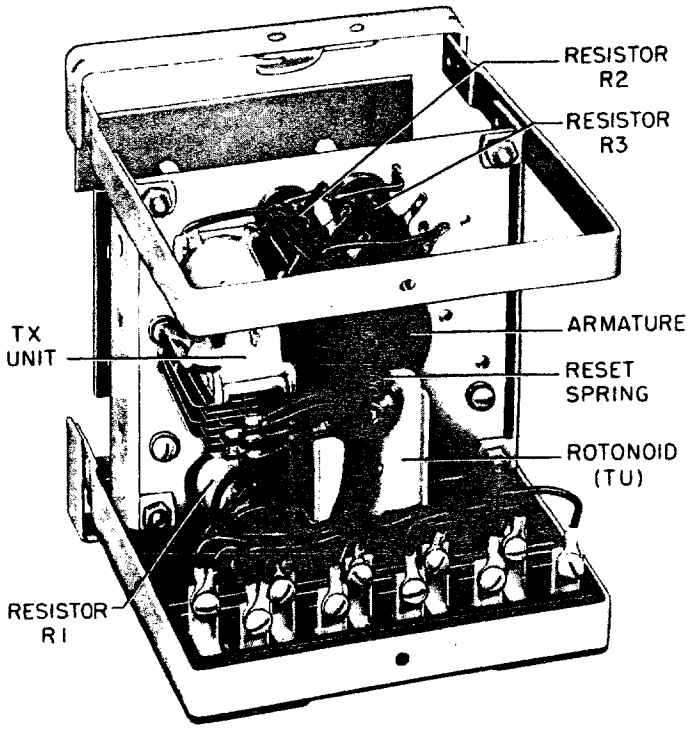


Fig. 2 (8007803) Type RPM21 Relay Removed from Case (Rear View)

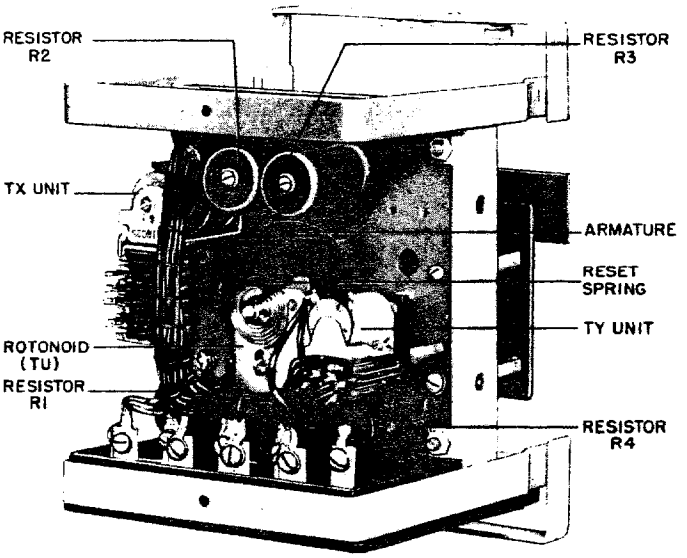


Fig. 3 (8912942) Type RPM24 Relay Removed from Case (Rear View)

TIMING RELAYS
TYPE RPM

DESCRIPTION

INTRODUCTION

The RPM relays covered by this instruction book were specifically designed for application with our zone packaged distance relays for three step distance protection. Each of these relays has two electrically separate trip circuits, one for each time delay zone of protection. The first zone trip is taken directly from the first-zone distance relay and does not pass through the RPM relay. The second-zone trip circuit contains a time delay contact and the third-zone trip circuit contains a second time delay contact. These relays contain no zone targets because the targets in the zone packaged relays indicate the zone of the fault.

The important functional differences between the various different types are listed in Table I. The RPM21D and RPM21H relays are suggested for standard applications.

APPLICATION

One Type RPM relay covered by this book is required with each set of zone packaged relays to provide for three zone step distance protection. The standard schemes for this kind of protection employ either the RPM21D relay or the RPM21H relay depending on whether a three-second or a one-second timer is required. These types have maintained second-zone contacts which provide an advantage over relays with passing second-zone contacts when applied on some multi-terminal lines. Fig. 4 is a typical external connection diagram for both the RPM21D and RPM21H relays.

The RPM21A relay is identical to the RPM21D relay except that it has a passing second-zone contact. Thus Fig. 4 will also apply to the RPM21A relay.

The RPM24A, RPM24B and RPM24D relays have continuously rated coil circuits. Aside from this, they are functionally equivalent to the RPM21A, RPM21H, and RPM21D respectively. While the internal connections of the RPM24A, RPM24B and RPM24D are somewhat different from the internal connections of the RPM21A, RPM21H and RPM21D 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 only suggested if these relays are used in a standard application such as illustrated in Fig. 4. Note that if different internal connections are visualized for the RPM24A, RPM24B and RPM24D relays Fig. 4 may also be used for the external connections to these relays.

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 second. The minimum difference in time between the TU2 and the TU3 contact settings is

TABLE I

RELAY TYPE	TIMING RANGE	COIL CIRCUIT TIME RATING	CONTACT DWELL TIME +	
			2nd Zone	3rd Zone
	Seconds	Seconds	Cycles ‡	Cycles ‡
RPM21A	0.15-3.0	60	9-15	9-15
RPM21D	0.15-3.0	60	Maintained	9-15
RPM21H	0.10-1.0	60	Maintained	3-4.5
RPM24A	0.15-3.0	Continuous	9-15	Maintained
RPM24B	0.10-1.0	Continuous	Maintained	Maintained
RPM24D	0.15-3.0	Continuous	Maintained	Maintained

\+ Contact dwell time depends on the time dial setting.
‡ 60 Cycle basis

between 0.084 - 0.117 second. The average dwell time at the 0.75 second setting is 0.15 second. At the 3 second setting the average dwell time is 0.25 second.

ONE SECOND RELAYS

The minimum time setting for these relays is 6 cycles. (60 cycle basis) The minimum difference in time between the TU2 and the TU3 contact settings is 2-4 cycles. The average dwell time at the 15 cycle setting is 3 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 RPM21A, RPM21D, and RPM21H relays are available for intermittent (60 seconds) rating at standard DC control voltages from 24 to 250 volts. The RPM24A, RPM24B and RPM24D relays are continuously rated at standard DC control voltages from 24 to 250 volts.

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 I.

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 RPM24 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 3 second relays is calibrated in tenths of a second, while the time dial of the 1 second relays is calibrated in cycles (60 cycle basis) with graduations of 2.5 cycles.

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 injured 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.

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 Fig. 10.

CONNECTIONS

The internal wiring diagrams for the various relays covered by these instructions are shown in Figs. 5 to 7, includive. A typical external connection diagram is shown in Fig. 4.

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 1 second on the 3 second relays and at 20 cycles on the 1 second relay. The TU3 contact for both the 3 and the 1 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 anually 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; 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 surfaces, 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 from 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 Figs. 1, 2, 3 and 8 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 the 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 re-open 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 ratched 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.

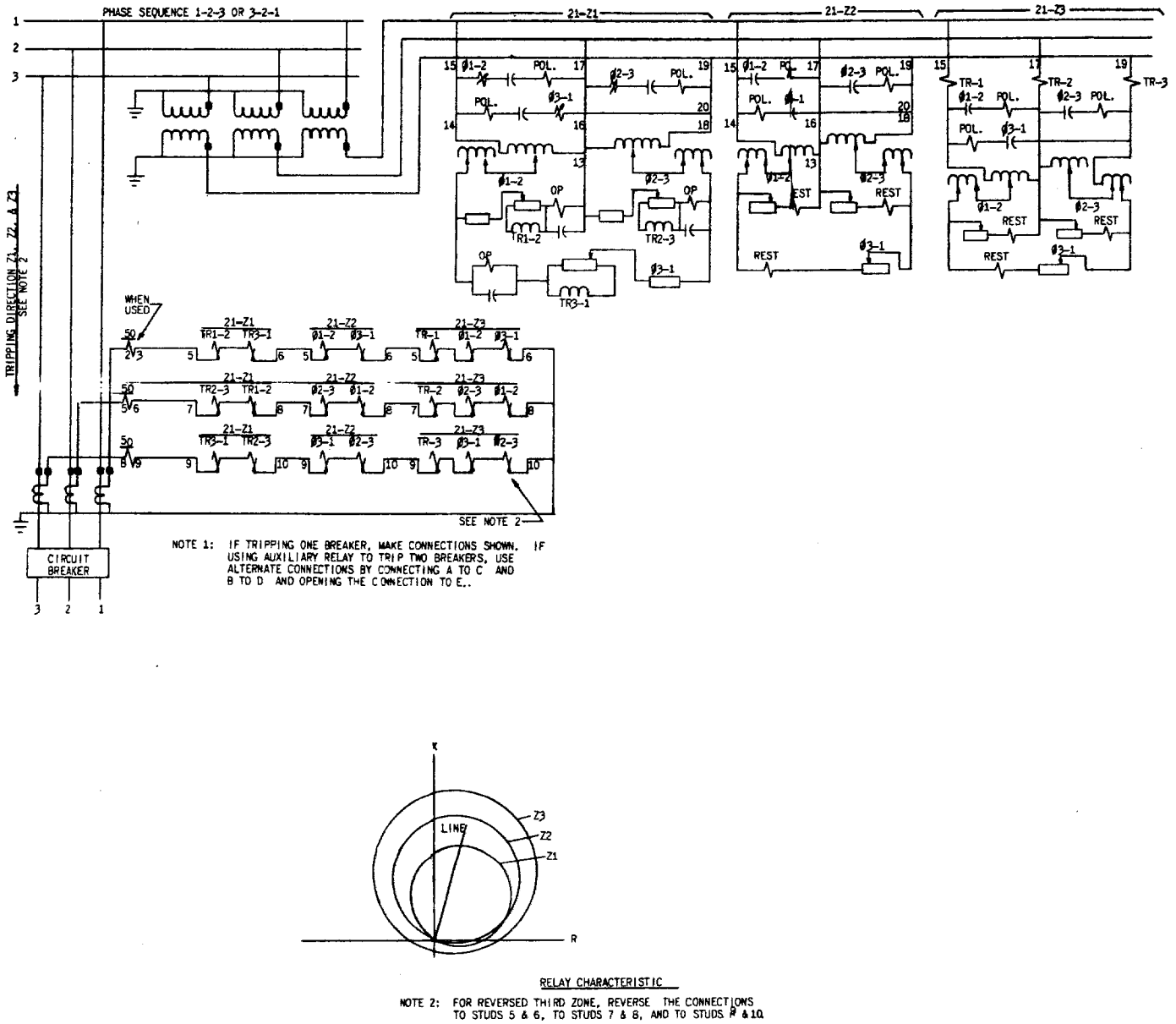
11. The time of operation for any scale setting may be varied by sliding the copper cylinder forward or backward on its shaft or turning the driving spring collet on its shaft. Be sure to tighten the set screw after adjustments have been made.

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 revolution.

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.

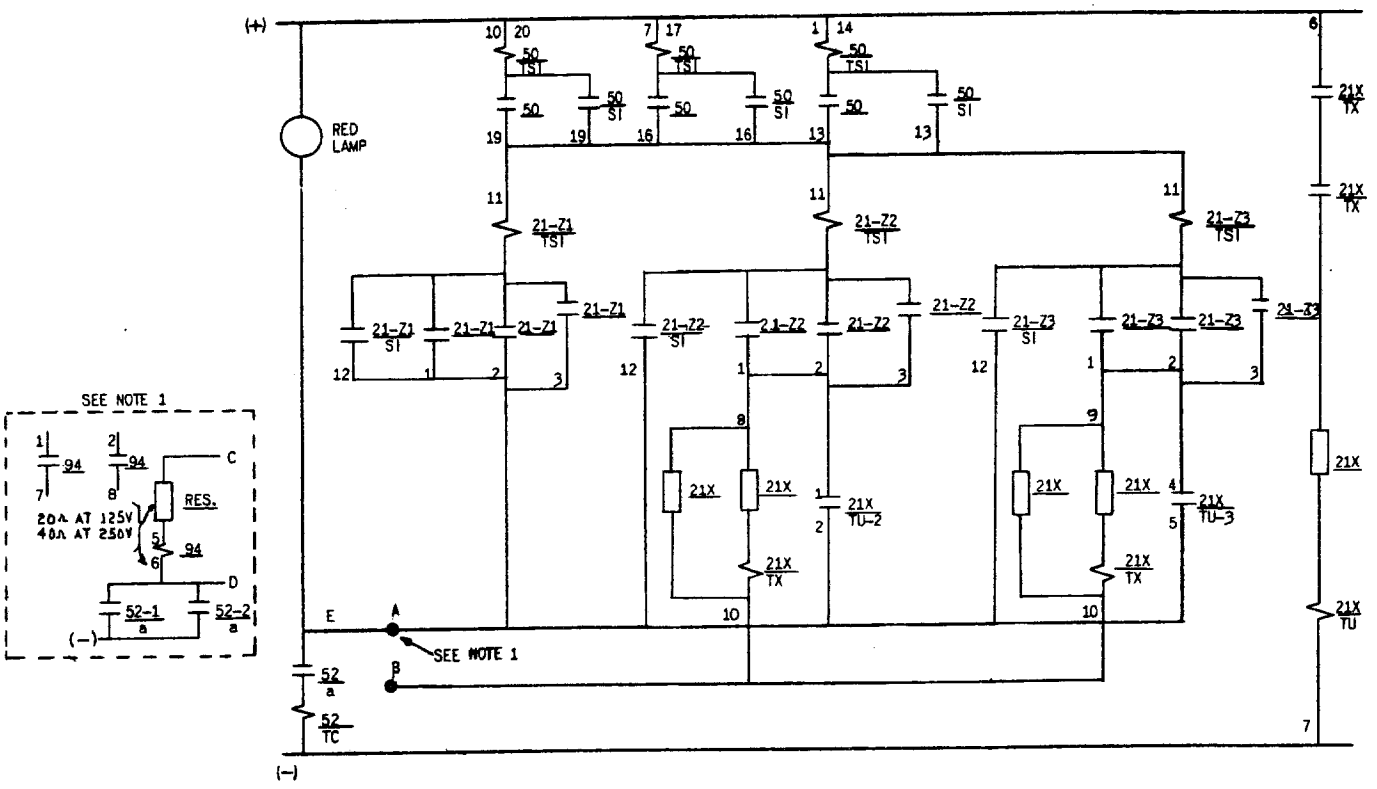
15. The end of the residual screw of the TX unit should be flush with the inside face of the armature.



RELAY CHARACTERISTIC

NOTE 2: FOR REVERSED THIRD ZONE, REVERSE THE CONNECTIONS TO STUDS 5 & 6, TO STUDS 7 & 8, AND TO STUDS 9 & 10.

Fig. 4 (0116B9309-3) External Connections Diagram for the RPM21D and RPM21H Relays when used with Zone Packaged Distance Relays.



LEGEND			
DEVICE NO.	DEVICE TYPE	INCL. ELEM.	DESCRIPTION
21-Z1	CEY51A		3 PHASE-1ST. ZONE MHO RELAY
		Ø 1-2	PHASE 1-2 UNIT ETC.
		TR-2	PHASE 1-2 TRANSACTOR ETC.
		T & SI	TARGET & SEAL-IN UNIT
21-Z2	CEY52A		3 PHASE-2ND ZONE MHO RELAY
		Ø 1-2	PHASE 1-2 UNIT ETC.
		T & SI	TARGET & SEAL-IN UNIT
21-Z3	CEB52A		3 PHASE-3RD ZONE OFFSET MHO RELAY
		Ø 1-2	PHASE 1-2 UNIT ETC.
		TR-1	PHASE 1 TRANSACTOR ETC.
		T & SI	TARGET & SEAL-IN UNIT
21X	RPM21D		TIMING RELAY
		TU	TIMING UNIT
		TX	AUXILIARY TO TIMING UNIT
50	PJC31C		INSTANTANEOUS PHASE FAULT DET.
		T & SI	TARGET & SEAL-IN UNIT
94	HGA14 AM or AL		AUXILIARY TRIPPING RELAY

TABULATION OF DEVICES		
TYPE OR DESCRIPTION	INTERNAL CONNS.	OUTLINE
CEY51A	0178A7132	0168A7336
CEY52A	0178A7133	0178A7336
CEB52A	0178A7134	0178A7336
RPM21D	0127A9440	K-6209271
PJC31C	K-6375726	K-6209272
HGA14AM (BACK CONNS.)	K-6400533	K-6400533
HGA14AL (FRONT CONNS.)	377A139	377A139

(Cont'd.) Fig. 4 (0116B9309-3) External Connections Diagram

VOLTS	RESISTANCE - DC OHMS							
	TU	TX FR. WDG.	TX REAR WDG	R1	R2	R3	R5	R6
250	100	5000	5000	300	5000	5000	10000	10000
125	100	5000	5000	100	–	–	10000	10000
48	6.5	200	200	13.5	200	200	2000	2000
24	6.5	200	200	3	–	–	2000	2000
110	100	5000	5000	75	–	–	10000	10000
220	100	5000	5000	250	3.3K	3.3K	10K	10K

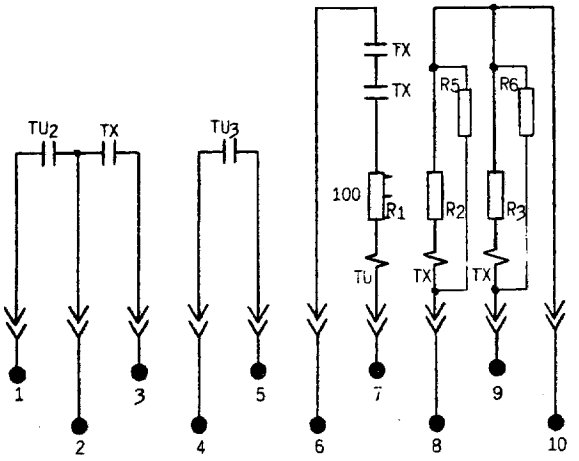


Fig. 5 (0127A9440-3) Internal Connections for RPM21A, RPM21D and RPM21H Relays (Front View)

VOLTS	RESISTANCE - DC OHMS									
	TU	TX FR. WDG.	TX REAR WDG	TY	R1	R2	R3	R4	R5	R6
250	100	5000	5000	7500	300	5000	5000	7500	10000	10000
125	100	5000	5000	7500	100	–	–	–	10000	10000
48	6.5	200	200	4	13.5	200	200	425	2000	2000
24	6.5	200	200	4	3	–	–	–	2000	2000

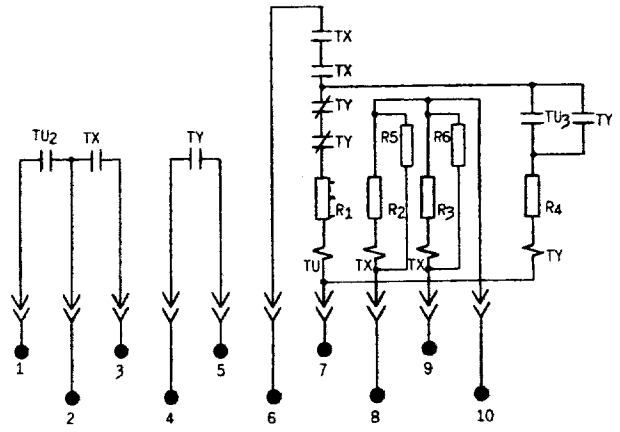


Fig. 6 (0127A9441-1) Internal Connections for RPM24A Relay (Front View)

VOLTS	RESISTANCE - DC OHMS									
	TU	TX FR. WDG.	TX REAR WDG.	TY	R1	R2	R3	R4	R5	R6
250	100	5000	5000	7500	300	5000	5000	7500	10000	10000
125	100	5000	5000	7500	100	–	–	–	10000	10000
48	6.5	200	200	425	13.5	200	200	425	2000	2000
24	6.5	200	200	425	3	–	–	–	2000	2000
220	100	5000	5000	7500	250	3300	3300	7500	10000	10000

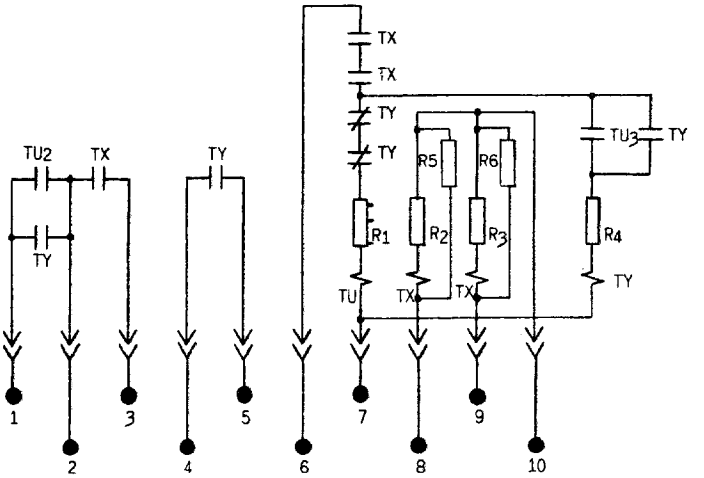
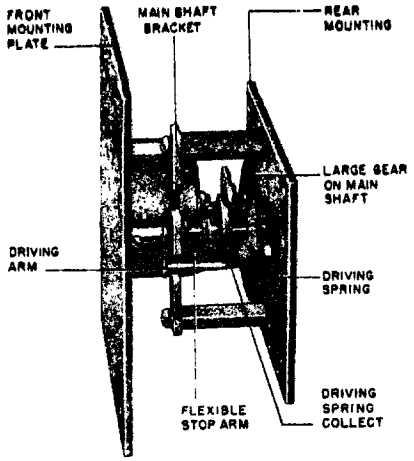
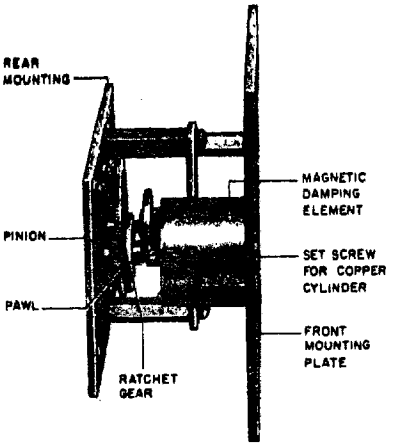


Fig. 7 (0127A9442-3) Internal Connections for RPM24B and RPS24D Relays (Front View)



Left Side View (8004823)



Right Side View (8004824)

Fig. 8 Type RPM Relay Unit Subassembly Between Front and Rear Mounting Plates

TIME CALIBRATION

To check the time calibration connect the Type RPM relay as shown in Fig. 9. 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 second. 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 S_1, then read the time when the clock stops momentarily. Note that S_1 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 catalogue numbers as shown in Renewal Parts Bulletin No. GEF-3538*.

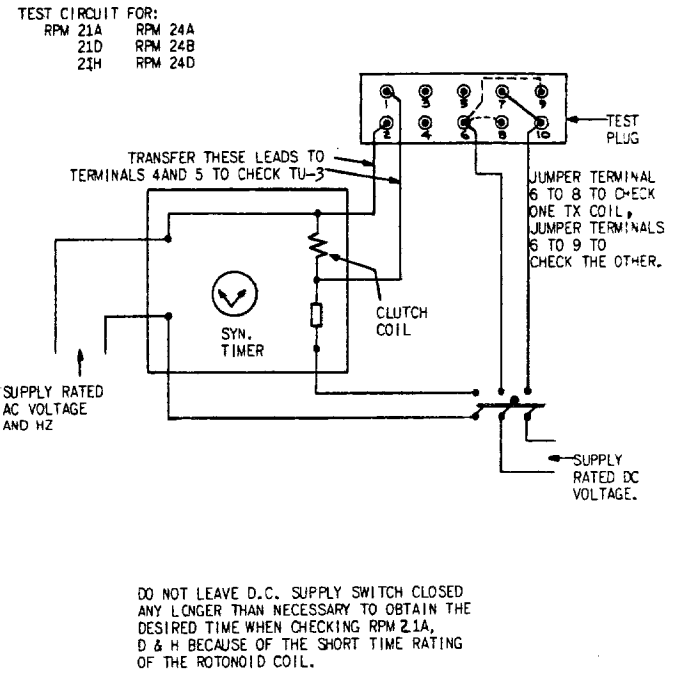


Fig. 9 (0208A2399-0) Test connections for Checking Time Calibration of Type RPM Relay

* Indicates revision

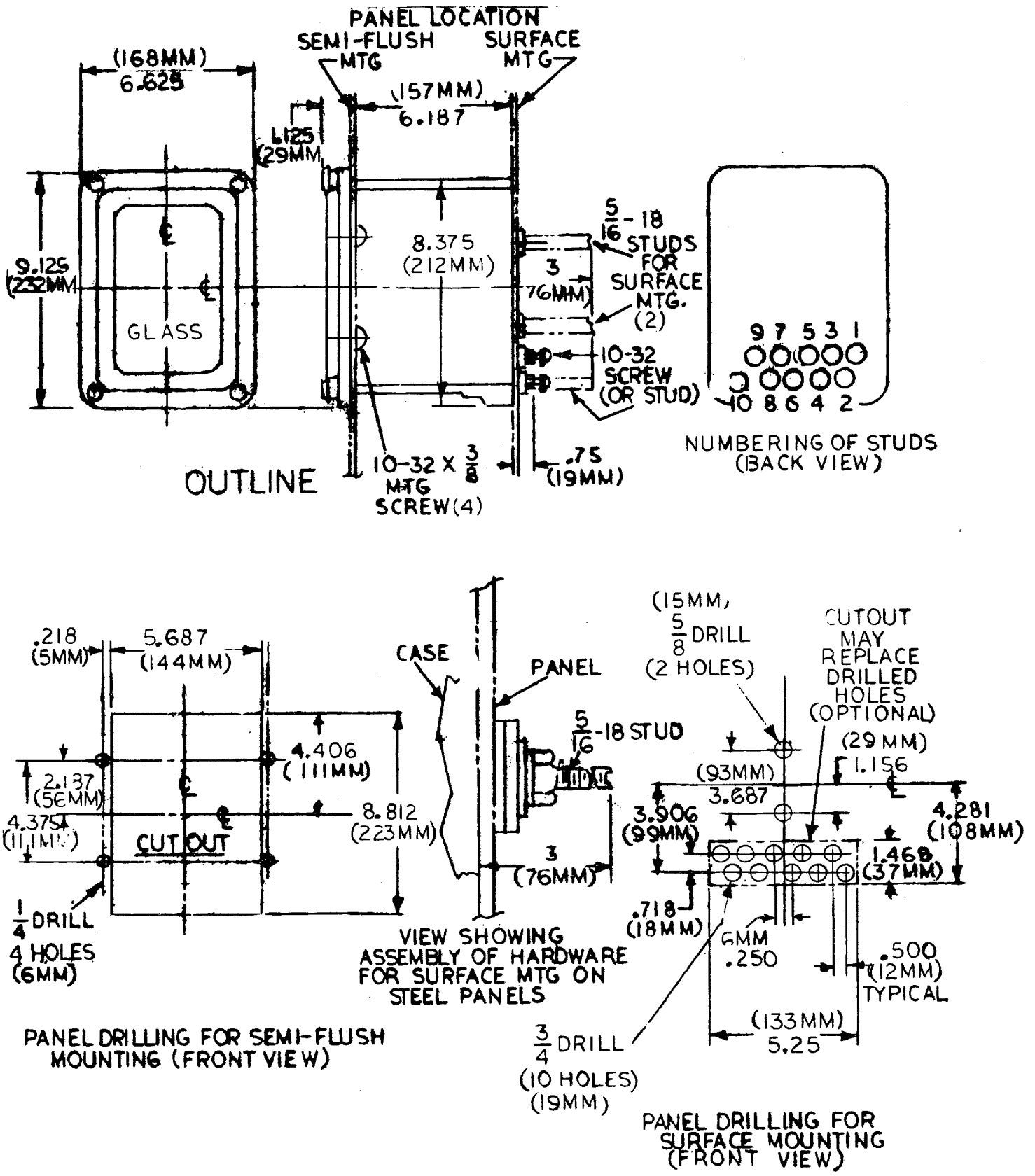


*Fig. 10 (6209271-5) Outline and Panel Drilling Diagram for Type RPM Relays

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