



INSTRUCTIONS

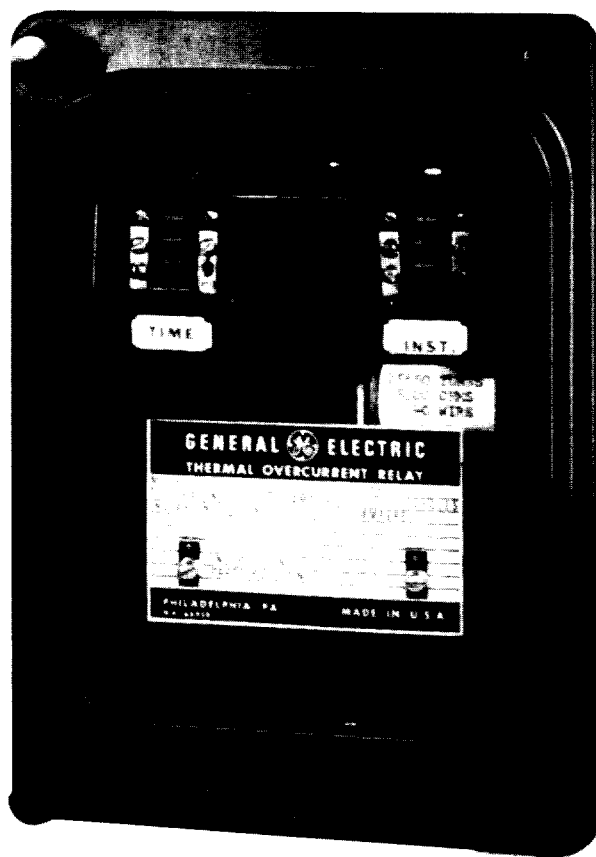
GEK-49941A

THERMAL OVERCURRENT RELAY

TYPES

TMC 24B

TMC 24D



GENERAL  ELECTRIC

CONTENTS

	<u>PAGE</u>
DESCRIPTION	3
APPLICATION	3
CONSTRUCTION	4
RATINGS	5
BURDENS	6
CHARACTERISTICS	7
RECEIVING, HANDLING AND STORAGE	7
ACCEPTANCE TESTS	7
INSTALLATION	9
PERIODIC AND ROUTINE MAINTENANCE	9
RENEWAL PARTS	10

LIST OF FIGURES

<u>FIG.</u>		<u>PAGE</u>
1	TMC24B RELAY, FRONT VIEW	11
2	TMC24B RELAY, REAR VIEW	12
3	TMC24B INTERNAL CONNECTIONS	13
4	TMC24D INTERNAL CONNECTIONS	14
5	TYPICAL EXTERNAL CONNECTIONS FOR TYPE TMC RELAY	15
6	TIME-CURRENT CHARACTERISTIC CURVE FOR TYPE TMC24B AND TMC24D RELAYS	16
7	TRANSIENT OVERREACH CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT	17
8	TIME-CURRENT CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT	18
9	THERMAL UNIT SELF RESETTING SWITCH	19
10	TEST CONNECTIONS FOR RELAY TYPE TMC24B USING A TEST PLUG	20
11	OUTLINE AND PANEL DRILLING DIMENSIONS FOR RELAYS - TYPE TMC24B AND TMC24D RELAYS	21

THERMAL OVERCURRENT RELAY
 TYPES TMC24B AND TMC24D

DESCRIPTION

The TMC24B and TMC24D are single-phase thermal overcurrent relays which provide overload protection for motors. The thermal induction unit operates a Micro Switch which in turn operates an auxiliary telephone relay to provide the contact outputs. The use of the Micro Switch enables the thermal induction unit to be self-resetting as it cools after an overload operations.

The additional features in these two models of the relay are as follows:

TMC24B - This model includes an instantaneous overcurrent unit complete with a mechanical target which provides short circuit protection for the motor circuit. A universal dual-rated target is provided for thermal trip indication. The auxiliary telephone relay circuit has a dual rating of 48/125 volts DC using an alternative resistor connection.

TMC24D - The Micro Switch operated by the thermal induction unit and the auxiliary telephone relay are both hermetically sealed. This makes the relay suitable for use in a corrosive or explosive atmosphere. The auxiliary telephone relay circuit has a dual rating of 120 volts AC 50/60 hertz or 24 volts DC. This relay has no targets or instantaneous overcurrent unit.

The thermal induction unit used in these relays is designed with ambient temperature compensation. This is discussed in detail in the section headed CHARACTERISTICS. The instantaneous unit contacts are self-resetting. All targets are hand reset from the outside of the relay case as described under CONSTRUCTION. The relay internal connections are shown in Figs. 3 and 4 and the S-1 case outline and panel drilling for both relays are shown in Fig. 11.

APPLICATION

The TMC relays described here are designed to provide thermal overload and short circuit protection for motors. These relays are not intended for use directly in primary motor circuits. They should always be applied with current transformers so that they will be self-protecting on primary short circuits. The CT's will saturate before excessive secondary currents can be reached.

The relay rating should be selected so that the maximum full load motor current on a secondary basis falls between the minimum and maximum values of current shown in the RELAY SELECTION TABLE. The full load motor current is determined as the nameplate current multiplied by the correction factor given in the following table depending upon the type of motor being used:

TEMPERATURE RATING OF MOTOR	CORRECTION FACTOR
Continuous, 1.15 service factor	1.0
Continuous, 1.0 service factor	0.9
Short time, 60 minutes	0.8
Short time, 30 minutes	0.75
Short time, 15 minutes	0.7
Short time, 5 minutes	0.6

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

The thermal unit tripping current is adjustable over the range of 90 to 110 percent of the nominal coil rating. The relay is calibrated at 40°C to just trip at the coil rating current with a plus zero minus ten percent tolerance. If the motor full load current (with correction factor applied) is near the maximum of the current selection range for the chosen relay, unnecessary tripping may occur because of the negative tolerance for the calibration current. If such unnecessary tripping should occur, the thermal unit trip current setting should be increased to 110 percent of coil rating to eliminate the problem.

RELAY SELECTION TABLE

TABLE 1

Motor Full Load Current Amperes		Thermal Unit Rating Amperes	Model 12TMC	
			24B	24D
Min.	Max.		Form	Form
1.32	1.45	1.64	1	1
1.46	1.59	1.82	2	2
1.60	1.75	2.00	3	3
1.76	1.93	2.20	4	4
1.94	2.11	2.42	5	5
2.12	2.33	2.65	6	6
2.34	2.55	2.92	7	7
2.56	2.81	3.20	8	8
2.82	3.09	3.52	9	9
3.10	3.39	3.87	10	10
3.40	3.74	4.25	11	11
3.75	4.11	4.68	12	12
4.12	4.47	5.15	13	13
4.48	4.97	5.60	14	14

The external connection diagram for these relays is shown in Fig. 5. A minimum of two relays is required for adequate motor protection as is shown.

CONSTRUCTION

The relay case is suitable for either surface or semiflush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case and also carries the reset mechanism.

The case has studs or screw connections at the bottom only for the external connections. The electrical connections between the relay units and the case studs are made through spring-backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer block, attached to the case, has the studs for the external connections, and the inner block has the terminals for the internal connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads being terminated at the inner block. This terminal is held firmly in the case with a latch at the top and the bottom and by a guide pin at the back of the case. The case and cradle are so constructed that the relay cannot be inserted in the case upside down. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews, holds the connecting plug in place.

To draw out the relay unit the cover is first removed, and the plug drawn out. Shorting bars are provided in the case to short the current transformer circuits. The latches are then released, and the relay unit can be easily drawn out. To replace the relay unit, the reverse order is followed.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current, or from other sources. Or, the relay unit can be drawn out and replaced by another which has been tested in the laboratory.

The TMC24B contains a target which is mounted on the front top left and consists of a small hinged-type unit that raises a target when picked up. The target is released by raising a rod located at the lower left corner of the relay cover.

The TMC24B also contains a hinged-type instantaneous unit mounted on the front top right. When the instantaneous unit picks up it raises a target which latches up and remains exposed until it is released. The same reset rod that releases the left target also releases the instantaneous unit target.

The TMC24B and TMC24D both contain auxiliary telephone relays that are energized by the closing of the thermal unit contacts. The TMC24D telephone relay and thermal unit contacts are hermetically sealed.

RATINGS

The TMC24B and TMC24D relays are both rated for 50 and 60 hertz applications. See Table I in the APPLICATION SECTION for thermal unit ratings.

The TMC24B also includes an instantaneous unit which has a rating of 6-150 amperes.

The auxiliary telephone relay used in the TMC24B is rated for 48/125 volts DC, where the TMC24D telephone relay is rated for either 24 volts DC or 120 volts 50/60 hertz.

HI-SEISMIC INSTANTANEOUS UNIT

The instantaneous coil is tapped for operation on either one of two ranges (low or high). Selection of the low or high range is determined by the connections made to terminal 6 and 6A. See the internal connections for the TMC24B shown in Fig. 3. Table II lists the instantaneous unit ranges, rating, one-second rating, etc.

TABLE II

Hi-Seismic Instantaneous Unit (Amps)	Range	** Range (Amps)	Continuous Rating (Amps)	**One-Second Rating (Amps)	K
6-150	Low	6-30	10.2	260	67600
	High	30-150	19.6		

**The range is approximate, which means that the 6-30, 30-150 may be 6-28, 28-150. There will always be at least one ampere overlap between the maximum low setting and the minimum high setting. Whenever possible select the higher range, since it has the higher continuous rating.

Higher currents may be applied for shorter lengths of time in accordance with the formula:

$$I = \sqrt{K/T}$$

HI-SEISMIC TARGET

Ratings for the target are shown in Table III.

TABLE III

	Tap	
	0.2	2.0
DC Resistance + 10% (ohms)	8.0	0.24
Min. Operating (Amp.) +0 -25%	0.2	2.0
Carry Continuoug (Amperes)	0.3	3.0
Carry 30 Amps for (Sec.)	0.03	4.0
Carry 10 Amps for (Sec.)	0.25	30.0
60 Hz Impedance (Ohms)	68.6	0.73

If tripping current exceeds 30 amperes an auxiliary relay should be used, the connections being such that the tripping current does not pass through the target coil of the protective relay.

CONTACTS

The contact closing current for tripping duty is 30 amperes. The contacts will carry three amperes continuously. The ampere interrupting ability of the telephone relay contacts is as shown in Table IV.

TABLE IV

VOLTS	RESISTIVE	INDUCTIVE**
48 DC	2.5	1.0
125 DC	1.3	0.5
250 DC	0.6	0.25
120-60 cyc.	1.9	0.75
240-60 cyc.	1.3	0.5

**Inductance of average trip coil

BURDENS

THERMAL UNIT

The burden at rated current is approximately 13.5 volt-amperes and 12 watts for 60 hertz operation or approximately 12.5 volt-amperes and 11 watts for 50 hertz operation.

The volt ampere burden of the thermal unit at five amperes is approximately equal to K divided by the square of the current rating, where K is 325 for 60 hertz and 305 for 50 hertz.

HI-SEISMIC INSTANTANEOUS UNIT

The Hi-Seismic instantaneous unit burdens are listed in Table V.

TABLE V

Hi-Seismic Inst. Unit (Amps)	Hz	Range	Range (Amps)	Min. Pickup (Amps)	Burdens at Min. Pickup (Ohms)			Burdens In Ohms (Z) Times Pickup		
					R	J χ	Z	3	10	20
6-150	60	Low	6-30	6	0.110	0.078	0.135	0.095	0.081	0.079
		High	30-150	30	0.022	0.005	0.023	0.022	0.022	0.022
6-150	50	Low	6-30	6	0.092	0.065	0.112	0.078	0.068	0.066
		High	30-150	30	0.018	0.004	0.019	0.018	0.018	0.018

CHARACTERISTICSTHERMAL UNIT

The thermal unit consists of a current coil placed over a bimetal helix that acts as the short circuited secondary of a transformer. The induced current heats the helix causing it to rotate in a direction to operate the Micro Switch. The Micro Switch will reset automatically when the helix has cooled sufficiently. Tripping current can be adjusted from 90 to 110 percent of coil rating.

The relay is calibrated at 40°C and has built-in compensation for changes in ambient temperature; the compensation is not perfect. There is a two percent variation in trip point per 10°C change in temperature from the 40°C calibration temperature. The trip point will decrease as the ambient-temperature increases.

The time-current characteristic curve is shown in Fig. 6, and the resulting time of the TMC relays should be within plus or minus 25 percent of this curve.

HI-SEISMIC INSTANTANEOUS UNIT

The instantaneous unit has a 25-to-1 range with a tapped coil. There are high and low ranges, selected by means of interchanging two leads on the case block. See the internal connections in Fig. 3 for the TMC24B relay.

HI-SEISMIC TARGET

The target has an operating coil tapped at 0.2 and 2.0 amperes. The relay is shipped from the factory with the top screw in the higher ampere position.

RECEIVING, HANDLING AND STORAGE

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. 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.

ACCEPTANCE TESTS

Immediately upon receipt of the relay an INSPECTION AND ACCEPTANCE TEST should be made to insure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. If the examination or test indicates that readjustment is necessary, refer to the section on SERVICING.

These tests may be performed as part of the installation or acceptance tests at the discretion of the user.

Since most operating companies use different procedures for acceptance and installation tests, the following section includes all applicable tests that may be performed on these relays.

VISUAL INSPECTION

Check the nameplate to insure that the model number and rating of the relay agree with the requisition.

Remove the relay from its case and check that there are no broken or cracked parts or any other signs of physical damage.

TESTING FACILITIES

All General Electric drawout case relays may easily be tested in the case by using either the XLA12A or XLA13A test plugs. The XLA12A has 20 fingers which bring both the ten relay connections and the ten outside world connections to the front of the relay for easy access. The XLA13A test plug brings only the ten relay connections to the front of the relay without disturbing the CT shorting bars.

For further information on these test plugs refer to Section 7332 in the General Electric Apparatus Handbook or contact the nearest General Electric Apparatus Sales Office.

POWER REQUIREMENTS - GENERAL

All alternating-current-operated devices are affected by frequency. Since non-sinusoidal waveforms can be analyzed as a fundamental frequency plus harmonics of the fundamental frequency, it follows that alternating-current devices (relays) will be affected by the applied waveform.

Therefore, in order to properly test alternating-current relays it is essential to use a sine wave of current and/or voltage. The purity of the sine wave (i.e., its freedom from harmonics) cannot be expressed as a finite number for any particular relay, however, any relay using tuned circuits, R-L or RC networks, or saturating electromagnets (such as time-overcurrent relays) would be essentially affected by non-sinusoidal waveforms. Hence a resistance-limited circuit, is recommended.

THERMAL UNIT

The relay has been adjusted at the factory; it is advisable not to disturb the adjustments. It is most important that the bimetal helix and the compensating bimetal should never be tampered with at any time.

Upon leaving the factory, the relay is set for the 100 percent calibration. If it is desired to adjust the relay to trip at a slightly higher or lower value of current, loosen the adjustment locking screw (see Fig. 1). Then the adjusting screw can be turned to provide the desired adjustment. Be sure to tighten the adjustment locking screw.

The electrical test will consist of checking one point on the time-current characteristic of the thermal unit at about 300 percent of rated coil current, plus the minimum pickup values of the several auxiliary units such as the targets, instantaneous unit and telephone relay in those relays where these components are used.

Tests on the thermal unit should be made with the cover on. To prevent some pre-heating of the unit, such as would occur while adjusting the current in the test circuit to the desired level with the thermal unit in the circuit, bypass rather than shorting out the thermal unit during the current setting. When the thermal unit is included in the circuit the magnitude of current will be somewhat less, but its value can be determined during the timing period to check the level of percentage overload. The resulting time should be within plus or minus 25 percent of the published time curves.

The auxiliary telephone relays should pick up at 80 percent or less than their rated voltages.

See Fig. 10 for a test setup for the TMC24B using a test plug. The TMC24D model may be tested in a like manner by connecting the source of supply to the proper studs as indicated in the internal connection diagram.

HI-SEISMIC INSTANTANEOUS UNIT

Make sure that the instantaneous unit is wired for the range in which it is to operate. See Fig. 10. Whenever possible use the higher range since the higher range has the higher continuous ratings.

The instantaneous unit has an adjustable core located at the top of the unit as shown in Fig. 1. To set the instantaneous unit to a desired pickup loosen the locknut and adjust the core. Turning the core clockwise decreases the pickup, turning the core counterclockwise increases the pickup. Bring up the current slowly until the unit picks up. It may be necessary to repeat this operation, until the desired pickup value is obtained. Once the desired pickup value is reached, tighten the locknut.

CAUTION - REFER TO TABLE II FOR THE CONTINUOUS AND ONE-SECOND RATINGS OF THE INSTANTANEOUS UNIT. DO NOT EXCEED THESE RATINGS WHEN APPLYING CURRENT TO THE INSTANTANEOUS UNIT.

The range of the instantaneous unit must be obtained between a core position of 1/8 of a turn of full clockwise and 20 turns counterclockwise from the full clockwise position.

HI-SEISMIC TARGET

The pickup and drop-out current is listed in Table VI.

TABLE VI

TAP	PICKUP CURRENT	DROP-OUT CURRENT
0.2	0.12 - 0.19	0.05 or more
2.0	1.2 - 1.9	0.50 or more

INSTALLATION

The relay should be installed in a clean, dry location free from dust, and well lighted to facilitate inspection and testing.

The relay should be mounted on a vertical surface. The outline and panel drilling is shown in Fig. 11.

The internal connection diagrams are shown in Figs. 3 and 4. Typical external connections are shown in Fig. 5.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system it is important that a periodic test program be followed. It is recognized that the interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements it is suggested that the interval be one to two years.

The thermal unit operating element has been adjusted at the factory and it is most important not to disturb the bimetal helix or the compensated operating arm assembly. The unit has been set at the factory for 100 percent calibration. If it is desired to adjust the unit to trip at a slightly higher or lower value of current, it may be done by adjusting the position of the Micro Switch. Each full turn of the adjusting screw changes the calibration approximately four percent. Rotating the adjusting screw clockwise reduces the pickup. A 2½ turn adjustment either clockwise or counterclockwise, therefore, will change the trip point approximately 10 percent.

Refer to Fig. 9 for a view of the Micro Switch and its adjusting screws. The two screws on either side of the Micro Switch serve to alter its position. The left hand screw is considered the adjusting screw, with the right screw serving as the locking screw.

In the event an operating coil with another rating is required, it may be installed as follows:

1. Refer to Fig. 1 and loosen the three mounting screws and remove the retaining plate.
2. Disconnect and remove the coil.
3. Install replacing coil taking care that the coil is mounted with the two locating pins on the lower side.
4. Replace the retaining plate so that it rests squarely against the end of the core.
5. Tighten mounting screws and connect the coil leads.
6. After installation is complete, check the operating time as described under ACCEPTANCE TESTS.

CLEANING CONTACTS

For cleaning fine silver contacts a flexible burnishing tool should be used. This consists of an etched roughened strip of flexible metal, resembling a superfine file which removes corroded material quickly without scratching the surface. The flexibility of the tool insures the cleaning of actual points of contact. Never use knives, files, abrasive paper or cloth to clean fine silver contacts. A burnishing tool as described above can be obtained from the factory.

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, specify quantity required, name of the part wanted, and give complete nameplate data. If possible, give the General Electric requisition number on which the relay was furnished.

Since the last edition, Figures 6 and 11 have been changed.

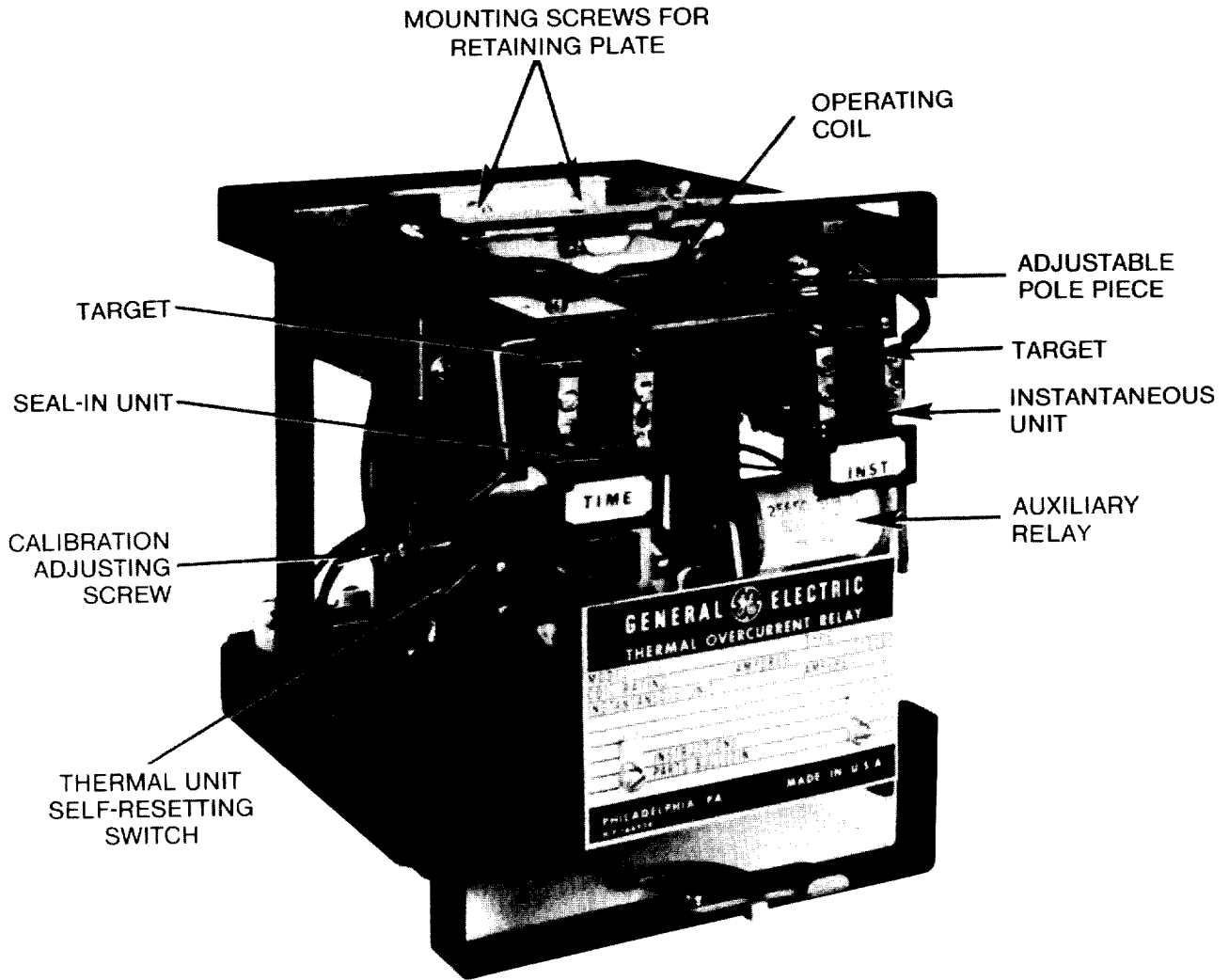


FIG. 1 (8043499) TMC24B RELAY, FRONT VIEW - COVER REMOVED

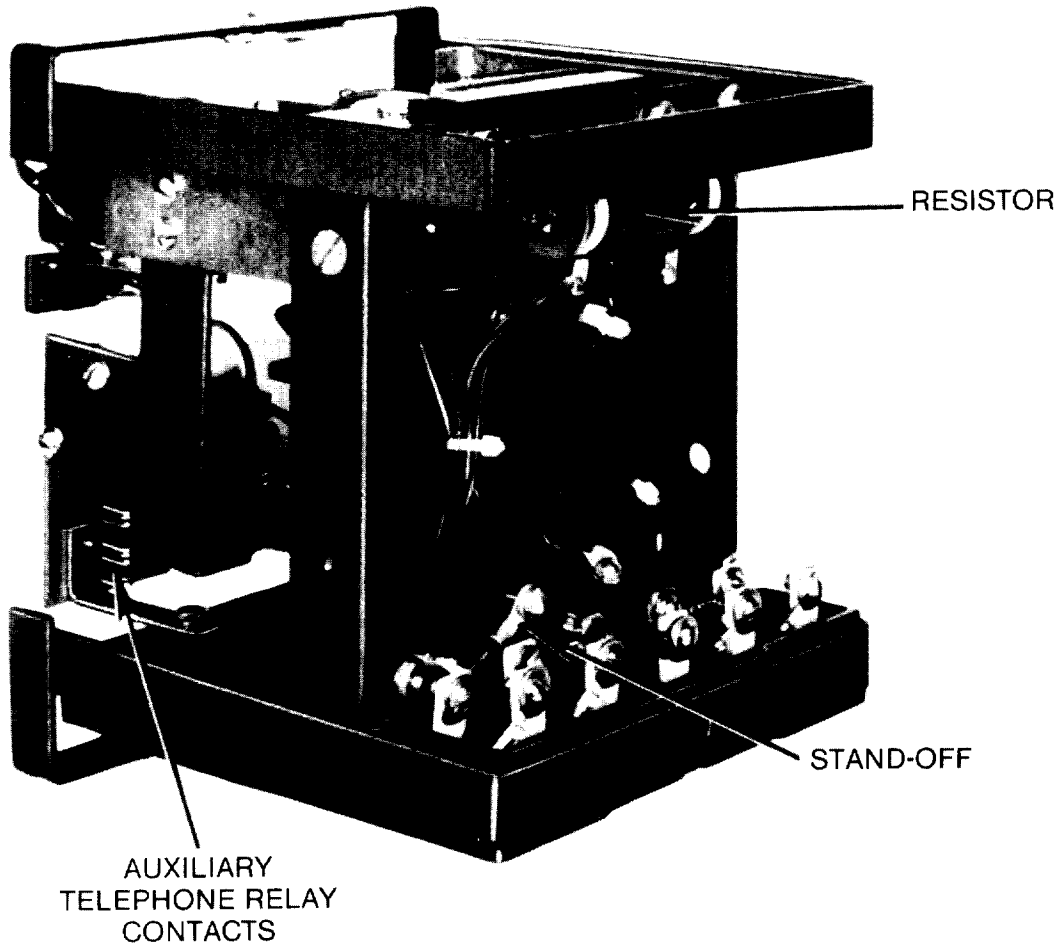
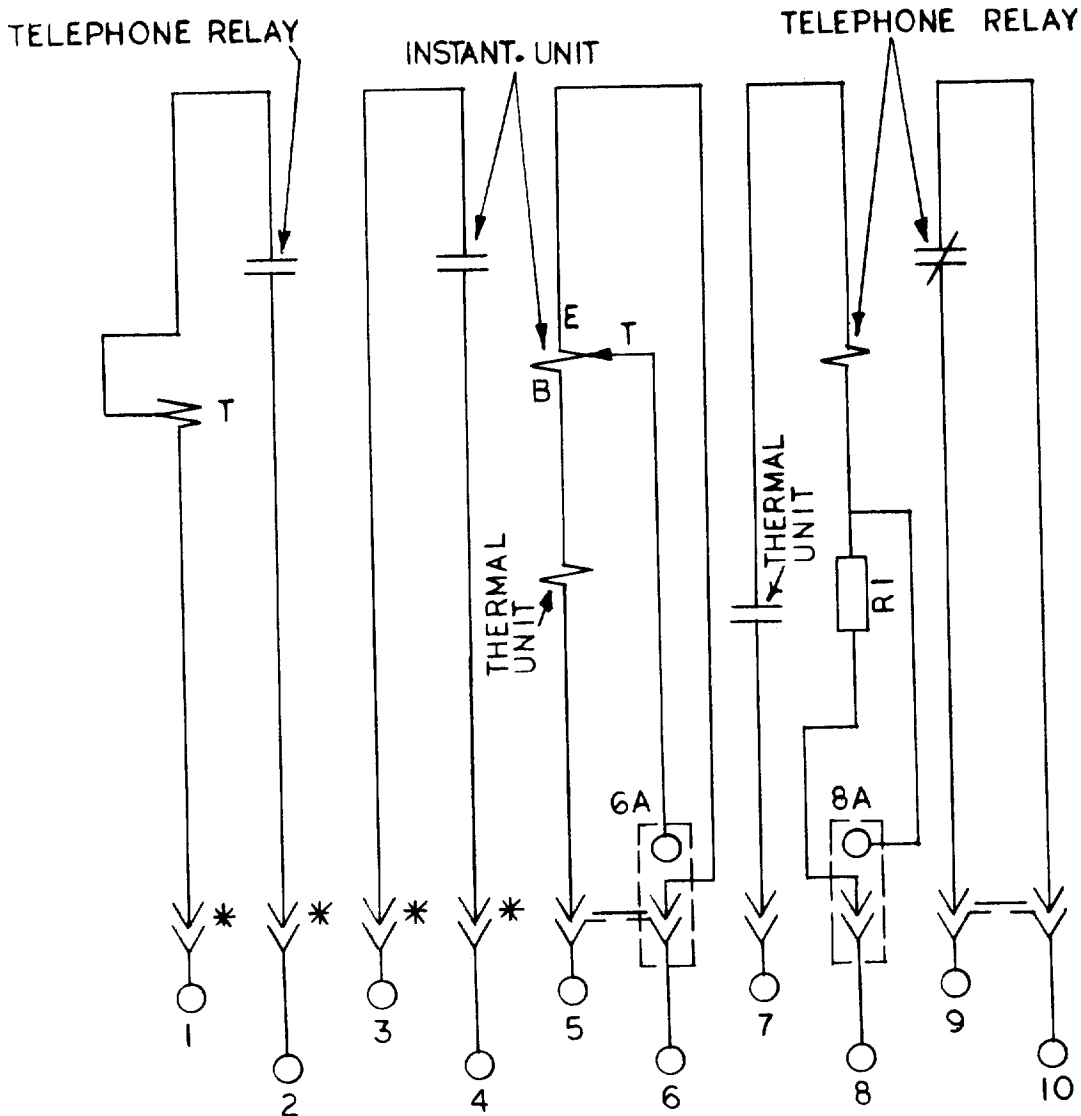


FIG. 2 (8043500) TMC24B RELAY, REAR VIEW

INSTANTANEOUS SETTINGS:
 SHOWN IN LOW RANGE,
 CONNECT "E" TO 6A AND
 "T" TO 6 FOR HIGH RANGE.

NOTE:

RI IS CONNECTED FOR 125VDC
 OPERATION. SHORT RI BY MOVING
 LEAD FROM 8A TO 8 FOR 48VDC
 OPERATION.



* = SHORT FINGERS

FIG. 3 (0273A9557-0) INTERNAL CONNECTIONS FOR TYPE TMC24B RELAY

RELAY USES HERMETICALLY SEALED MICRO SWITCH
& HERMETICALLY SEALED TELEPHONE RELAY

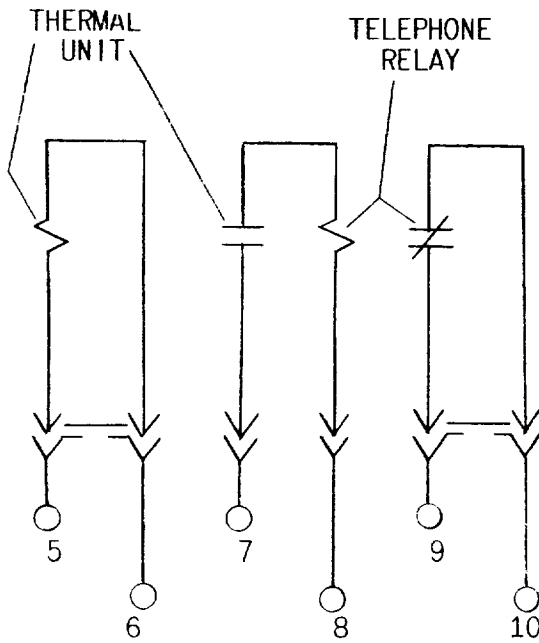


FIG. 4 (0165A7627-0) INTERNAL CONNECTIONS FOR TYPE TMC24D RELAY

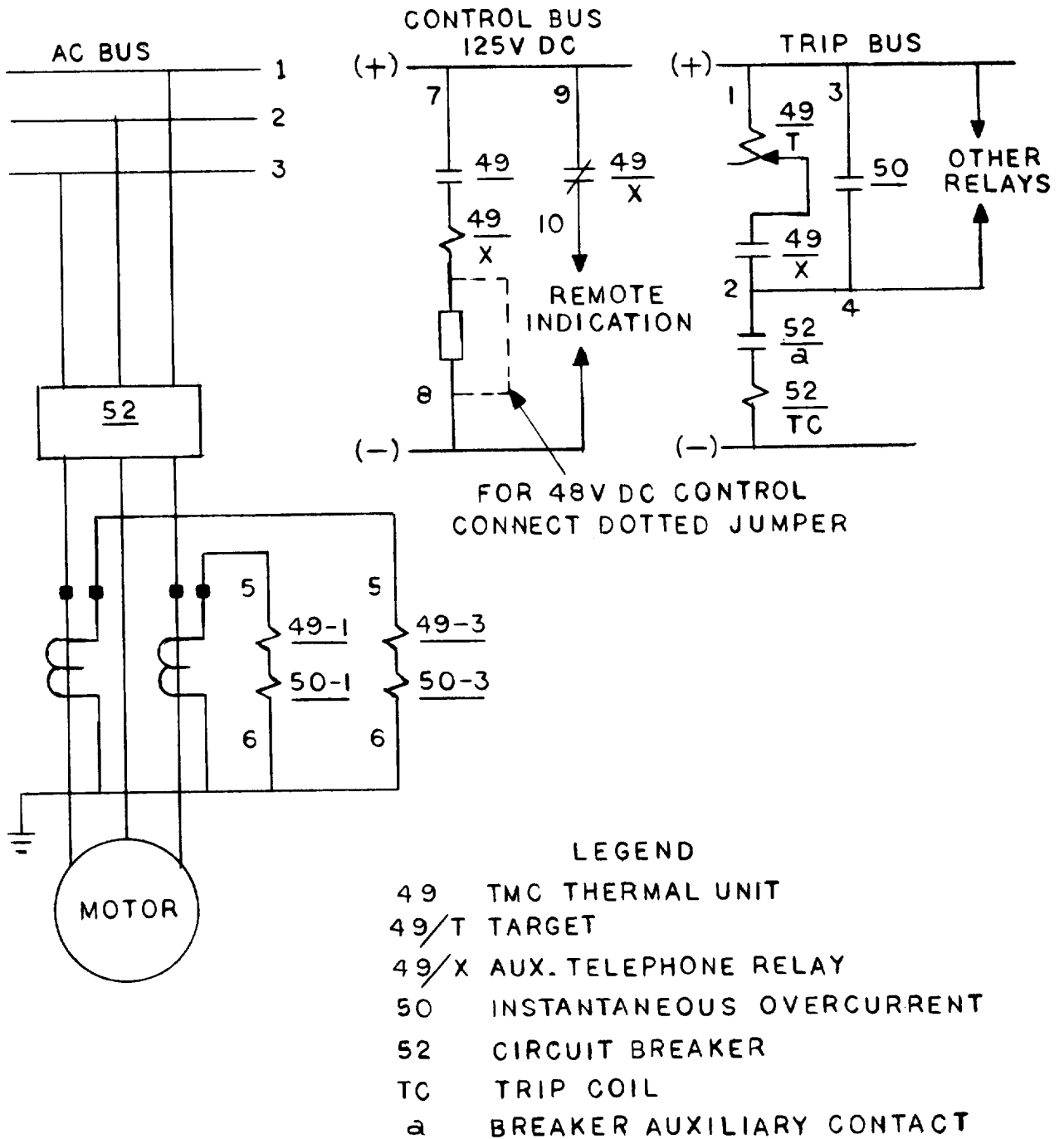


FIG. 5 (0275A4444-0) TYPICAL EXTERNAL CONNECTIONS FOR TYPE TMC RELAY

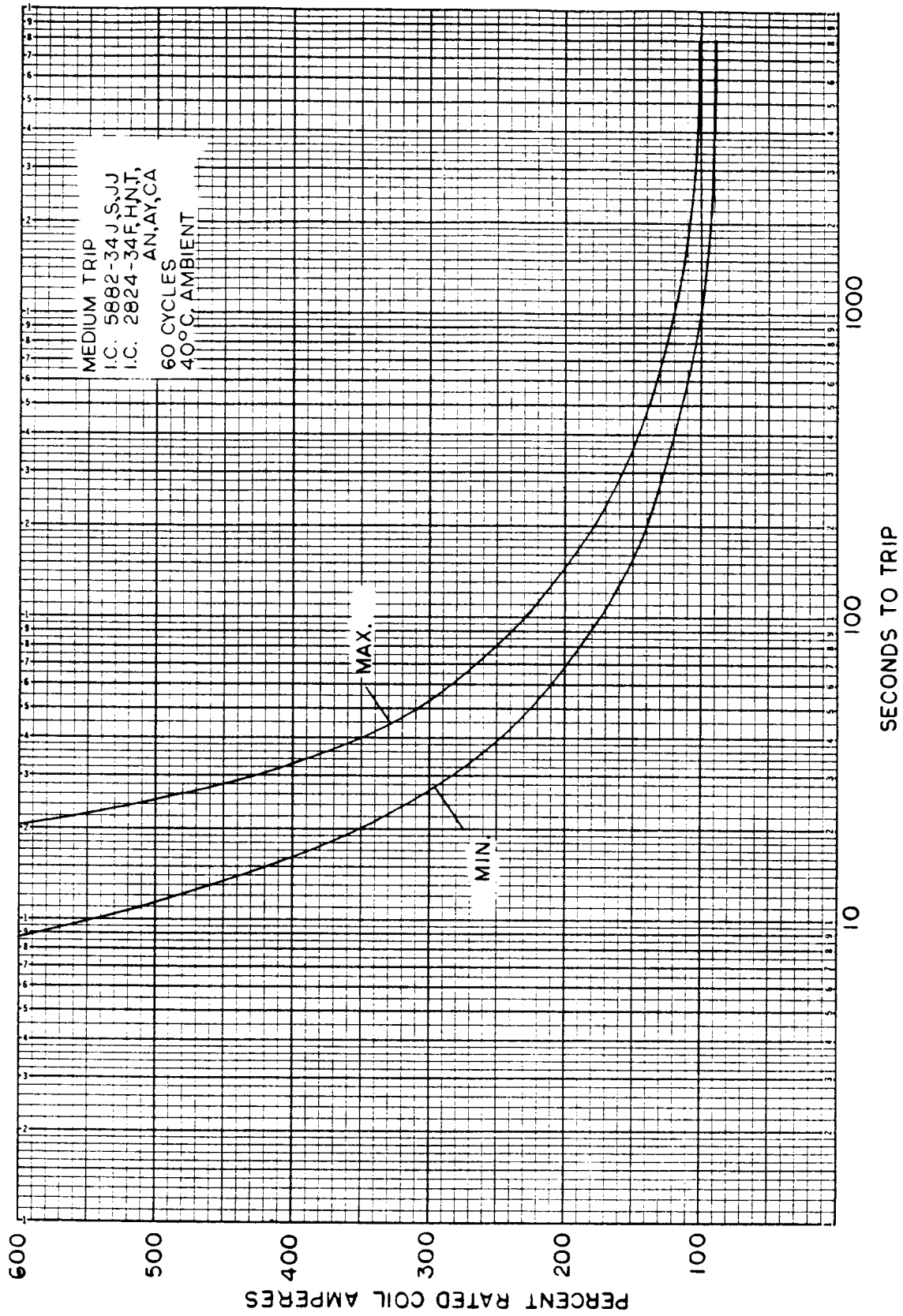


FIG. 6 (0285A8975) TIME-CURRENT CHARACTERISTIC CURVE FOR TYPE TMC24B AND TMC24D RELAYS

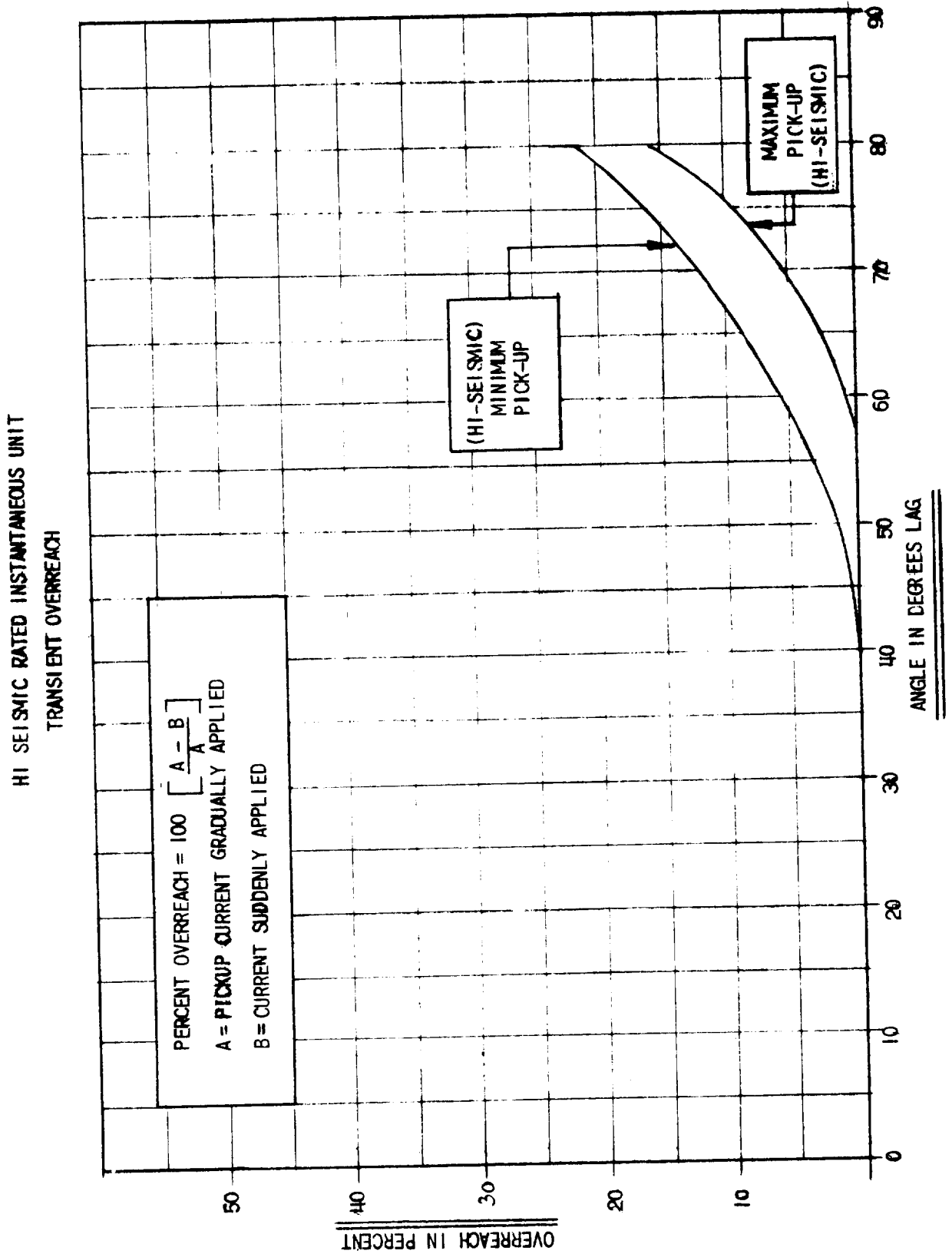


FIG. 7 (0208A8694-2) TRANSIENT OVERREACH CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT

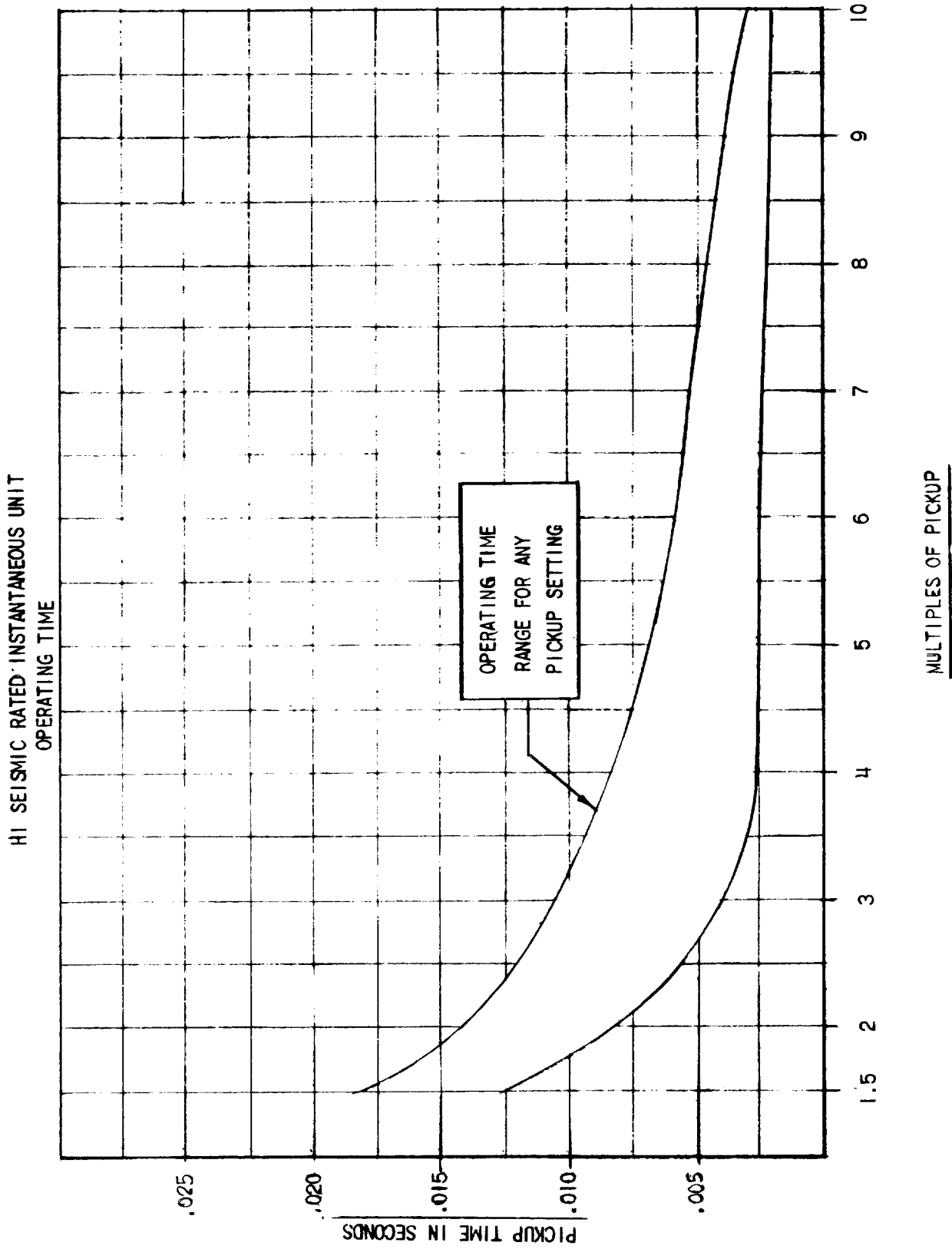


FIG. 8 (0208A8695-1) TIME-CURRENT CHARACTERISTICS OF THE HI-SEISMIC INSTANTANEOUS UNIT

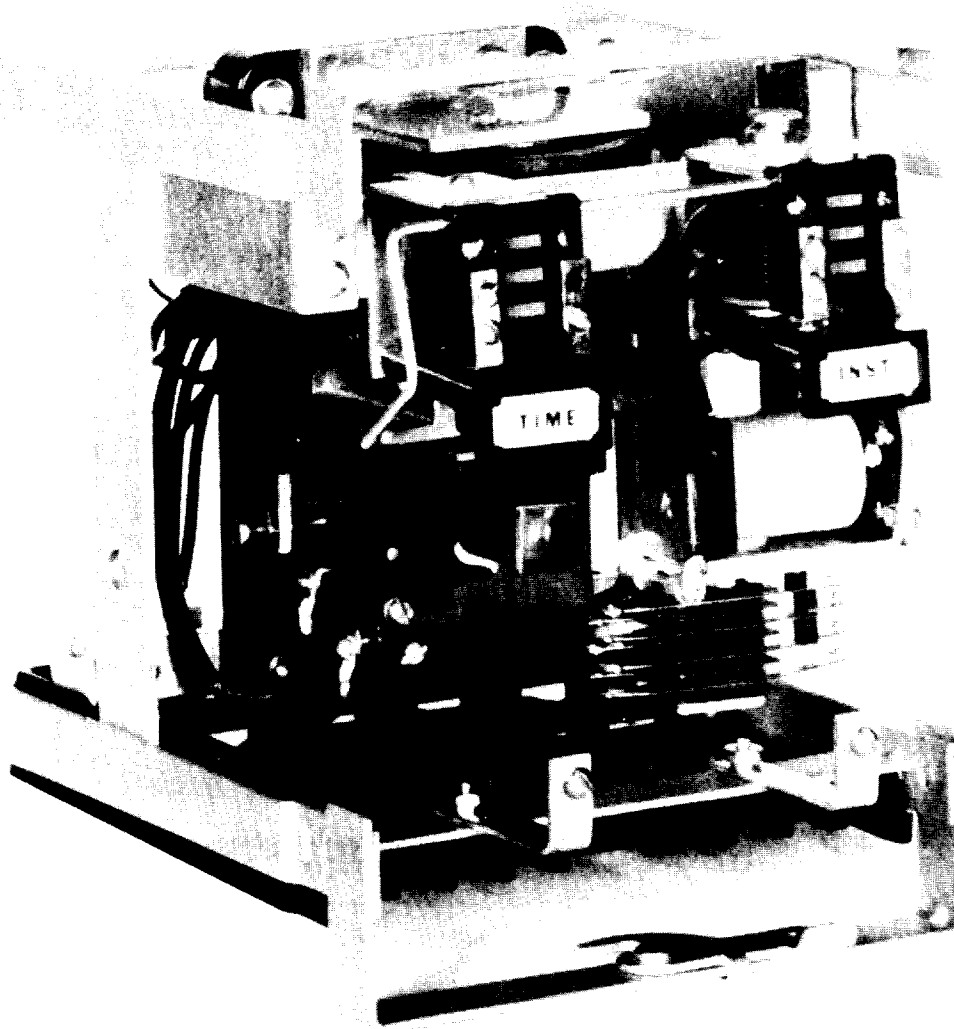
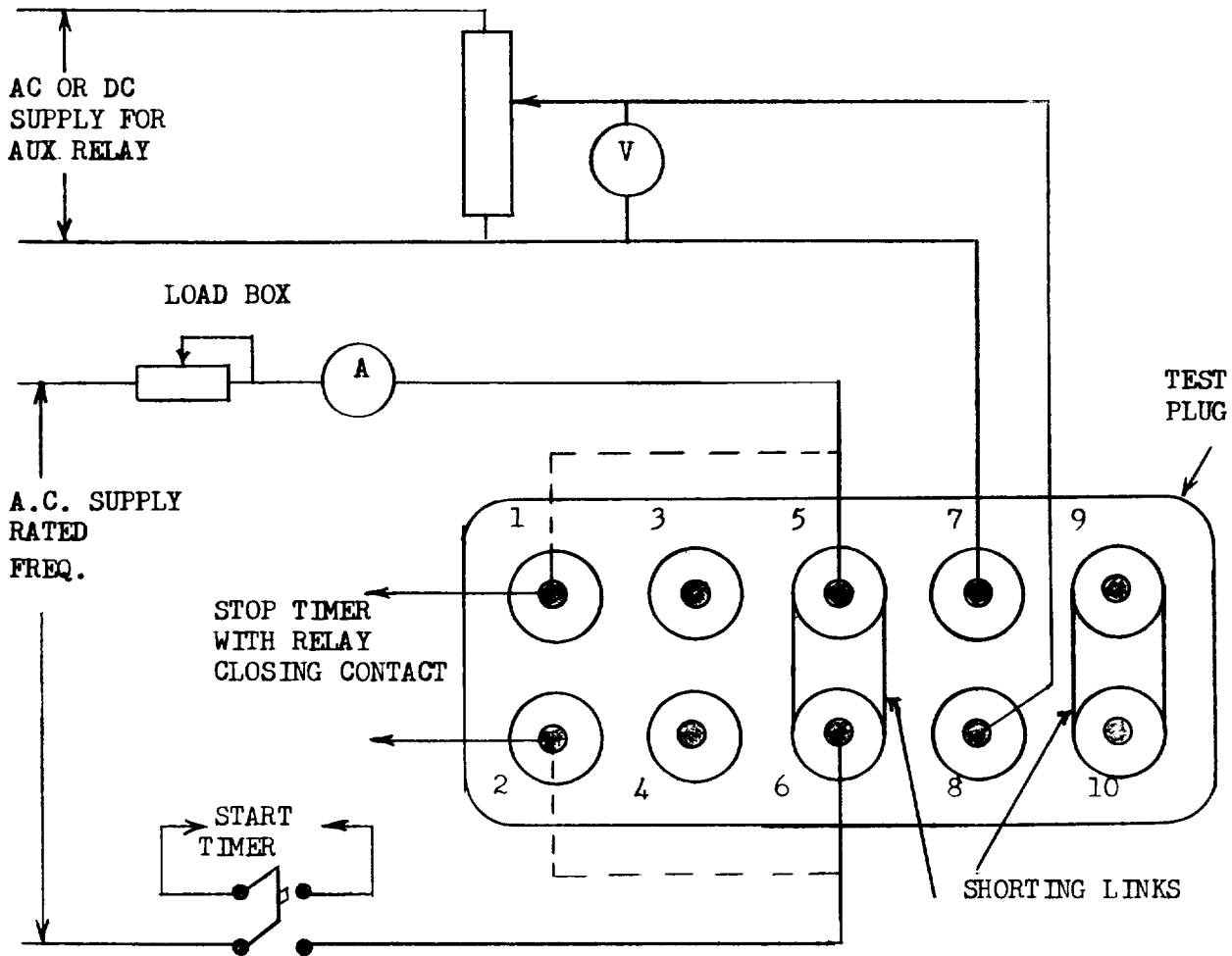


FIG. 9 (8035945) THERMAL UNIT SELF RESETTING SWITCH



CURRENT CONTROL FOR TIMING THERMAL UNIT OR CHECKING PICK-UP OF INSTANTANEOUS UNIT.

VOLTAGE CONTROL FOR CHECKING PICK-UP OF AUX TELEPHONE RELAY.
 AFTER TIMING TESTS, LEADS TO TERMINALS 5&6 MAY BE TRANSFERRED TO TERMINALS 1&2 TO CHECK PICK-UP OF TARGET UNIT AS SHOWN IN DOTTED LINES.

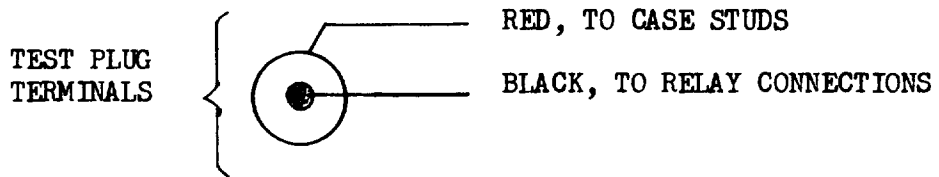


FIG. 10 (0165A6084-2) TEST CONNECTIONS FOR RELAY TYPE TMC24B USING A TEST PLUG

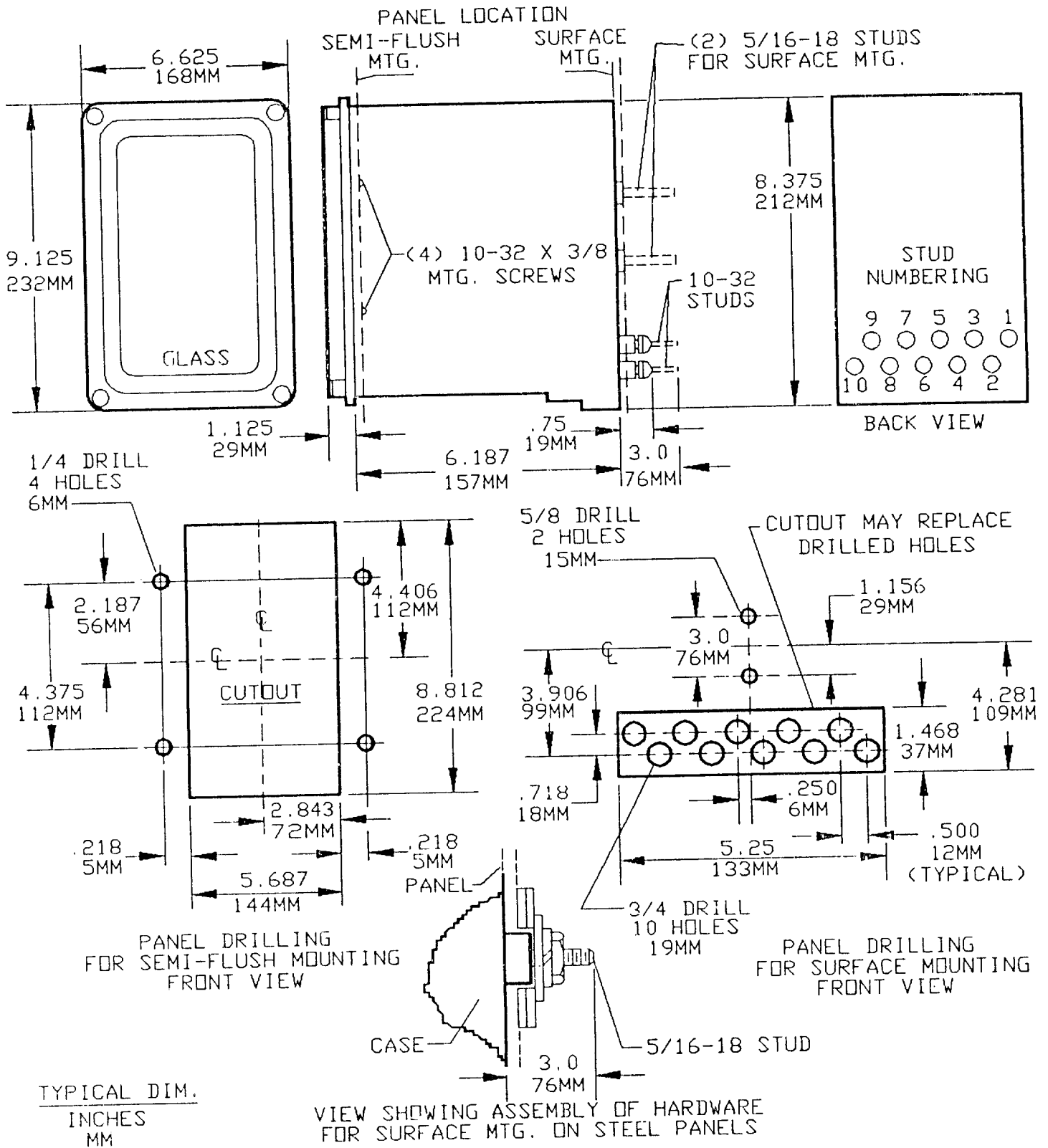


FIG. 11 (K-6209271 [8]) OUTLINE AND PANEL DRILLING FOR TYPE TMC24B AND TMC24D RELAYS



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