



# INSTRUCTIONS

GEH-1779D  
SUPERSEDES GEH-1779C

## DIRECTIONAL GROUND RELAYS

### TYPES

ICC51A	ICC52A
ICC51B	ICC52B

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GENERAL  ELECTRIC

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## DIRECTIONAL GROUND RELAYS

## TYPE ICC

INTRODUCTION

The Type ICC relays are employed principally to protect transmission lines against ground faults. These relays should be used where power transformer neutrals are solidly grounded, or grounded through a low impedance.

The Type ICC relays is a current-polarized directional-ground relay. The polarizing winding is connected to the current transformer in the neutral lead of the power transformer. The operating coil is connected to receive the residual current from the three-line current transformers. The torque produced in the relay is proportional to the product of the current in the polarizing winding, the current in the operating winding and the cosine of the angle between the two currents. For faults in the tripping direction, the torque produced in the relay is in the contact-closing direction. For faults in the non-tripping direction, the torque produced in the relay is in the contact-opening direction.

APPLICATION

The Type ICC ground relays are recommended for use with phase relays for the protection of lines in grounded neutral systems. They generally provide faster and more sensitive protection for ground faults without jeopardizing selectivity. Greater sensitivity is obtained by ground relays as they are connected in a manner to be unaffected by load current.

OPERATING CHARACTERISTICS

The Type ICC relay has two coil circuits. Either coil circuit may be connected in the neutral of the current transformer, the other coil circuit being connected to receive the residual current from the three-line current transformers.

The time required for the relay to operate will check within plus or minus seven percent of the time shown in Fig. 2 if the value of K determined from the equation

$$K = \frac{I_{5-6} T^2}{I_{7-8} M^2}$$

falls within the shaded area of the curve shown in Fig. 3.

$I_{5-6}$  = current through coil circuit connected to studs 5-6

$I_{7-8}$  = current through coil circuit connected to studs 7-8

T = Tap value

\* M = multiplier x minimum tap x 2

*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 not such assurance is given with respect to local codes and ordinances because they vary greatly.*

\* Indicates revision

The following two examples show how in some cases the relay will have operating times that will check the published time curve if one coil is used for the polarizing coil, but would not check if the other coil was used as the polarizing coil.

\* EXAMPLE 1

Relay Range 0.5-2 Amperes  
 T = Tap = 0.6  
 Multiplier = 2  
 M = 2 x 0.5 x 2 = 2  
 Pick up Product = (0.6 x 2)<sup>2</sup> = 1.44  
 Assume I<sub>5-6</sub> = 2  
 Assume I<sub>7-8</sub> = 10  
 Product = 10 x 2 = 20  
 Times Pick up Product = 20/1.44 = 13.9  

$$K = \frac{I_{5-6} \times T^2}{I_{7-8} \times M^2} = \frac{2 \times 0.6^2}{10 \times 2^2} = 0.018$$

EXAMPLE 2

Assume same relay and tap setting as in Example 1  
 Assume I<sub>5-6</sub> = 10  
 Assume I<sub>7-8</sub> = 2  
 Pick up Product = (0.6 x 2)<sup>2</sup> = 1.44  
 Product = 2 x 10 = 20  
 Times Pick up Product = 20/1.44 = 13.9  

$$K = \frac{I_{5-6} \times T^2}{I_{7-8} \times M^2} = \frac{10 \times 0.6^2}{2 \times 2^2} = 0.45$$

Referring to curve of Fig. 3, locate the point where times pickup product is 13.9 and K is - 0.18. This point is outside the shaded area, therefore, the time of operation of the relay will not check within plus or minus seven percent of the published time curve. However, the point where times pickup product is 13.9 and K is 0.45 falls inside the shaded area and the operating time of the relay will check with plus or minus seven percent of the published time curve.

RATINGS

The current coils of these relays when connected as shown in Fig. 4 will normally carry no current. The short-time rating and continuous-current ratings (in amperes) for the three standard current ranges are given as follows:

\*

CURRENT RANGE-AMPS	ONE SECOND RATING-AMPS	CONTINUOUS RATING-AMPS
0.125-0.5	20	0.5
0.15 -0.6	20	0.6
0.5 -2.0	80	2.5
1.0 -4.0	110	5.0
1.5 -6.0	200	6.8

\*Indicates revision

The one-second rating will be the same for all taps on any one current range. The continuous rating given above is for the minimum tap. The continuous rating will be higher for high taps. There are two tap plates on the tap block. The plate at the left-hand end has four taps as given below:

\*

CURRENT RANGE	TAPS ON TAP BLOCK			
0.125-0.5	0.125	0.15	0.20	0.25
0.15 -0.6	0.15	0.20	0.25	0.30
0.5 -2.0	0.5	0.6	0.8	1.0
1.0 -4.0	1.0	1.3	1.6	2.0
1.5 -6.0	1.5	2.0	2.5	3.0

On all current ranges there is a short tap plate on the right-hand end of the tap block with two taps marked X1 and X2. When the tap plug is in the X1 tap, the pickup is equal to the tap-plug setting on the left-hand end of tap block. When the tap plug is in the X2 tap the pickup is twice the tap-plug setting on the left-hand end of the tap block.

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying ratings are affected by the selection of the tap on the target and seal-in coil as indicated in the following table:

\*

	TAP	
	0.2	2.0
Carry 30 amps for (Sec)	0.05	2.2
Carry 10 amps for (Sec)	0.45	2.0
Carry continuously (Amp)	0.37	2.3
Minimum operating (Amp)	0.2	2.0
Minimum dropout (Amp)	0.05	0.5
DC resistance (Ohms)	8.3	0.24
60 Hertz impedance (Ohms)	50	0.65
50 Hertz impedance (Ohms)	42	0.54
DC resistive Interrupting rating (Amps)	2.5 Amp @125 VDC	

The 0.2-ampere tap is for use with trip coils that operate on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage. If this tap is used with trip coils requiring more than two amperes, there is a possibility that the 8.3-ohm resistance will reduce the current to so low a value that the breaker will not be tripped.

The 2-ampere tap should be used with trip coils that take two amperes or more at minimum control voltage, provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes, an auxiliary relay should be used; the connections being such that tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

BURDENS

\* The burdens imposed on the current transformers at five amperes 60 hertz by these relays are given in the table below. Under normal conditions, however, no burdens are imposed, as no current flows in the relay coils. Neither coil circuit saturates at 20 times pickup value. The burden for 50 hertz relays is approximately the same as the corresponding 60 hertz relay.

\*Indicates revision

\*

CURRENT RANGE	COIL CIRCUIT	TAP	FREQ	VA	Z	P.F.
0.125-0.5	Studs 5-6	X1	60	150	6	0.57
0.125-0.5	Studs 7-8	0.125	60	465	18.6	0.88
0.15-0.6	Studs 5-6	X1	60	105	4.2	0.57
0.15-0.6	Studs 7-8	0.15	60	326	13	0.88
0.5-2	Studs 5-6	X1	60	12.2	0.49	0.57
0.5-2	Studs 7-8	0.5	60	23.8	0.95	0.88
1-4	Studs 5-6	X1	60	3.05	0.122	0.57
1-4	Studs 7-8	1.0	60	5.55	0.222	0.88
1.5-6	Studs 5-6	X1	60	1.62	0.065	0.57
1.5-6	Studs 7-8	1.5	60	2.45	0.098	0.88

Burden of instantaneous unit at five amperes,  
60 cycles:

Pickup Range	VA	Impedance	P.F.
4-16	5.20	0.206	0.95
10-40	0.83	0.033	0.95
20-80	0.21	0.008	0.95

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.

DESCRIPTION

The relays covered by these instructions are identified by model numbers. These models are similar in description except for the number of contacts and having an instantaneous unit. The similarity of the relays is shown in the following table:

Model	No. of Contacts	Inst. Unit	Int. Conn.
12ICC51A(-)A	1	No	Fig. 7
12ICC51B(-)A	1	Yes	Fig. 8
12ICC52A(-)A	2	No	Fig. 9
12ICC52B(-)A	2	Yes	Fig. 10

\*Indicates revision

CASE

The 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 when one is required. Each cover screw has provision for a sealing wire.

The case has studs or screw connections at both ends or 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 blocks, attached to the case, have the studs for the external connections, and the inner blocks have 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 cradle 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 cases and cradles 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 and voltage, or from other sources. Or, the relay unit can be drawn out and replaced by another which has been tested in the laboratory.

INSTALLATIONLOCATION

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel diagram is shown in Fig. 13.

CONNECTIONS

Internal connection diagrams for the various relays are shown in Figs. 7 to 10 inclusive. A typical wiring diagram is given in Fig. 4.

One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gage copper wire or its equivalent.

INSPECTION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under ADJUSTMENTS and MAINTENANCE.

Polarity Check

The polarity of the relay unit can be checked by connecting stud 6 to stud 7 and passing a current through the two coils in series. If the current is above tap values, the contacts of the relay should close.

OPERATION

Before the relay is put into service it should be given a partial check to determine that factory adjustments have not been disturbed. The time-dial will be set at zero before the relay leaves the factory. It is necessary to change this setting in order to open the relay contacts (see TIME SETTING).

The pickup current should be checked on one or more of the taps and the time should be checked for one or more dial settings.

Recommended test connections for the above test are shown in Fig. 11.

ADJUSTMENTS

The relays have been adjusted at the factory and it is advisable not to disturb these adjustments. If, for any reason, they have been disturbed, the following points should be followed in restoring them:

TARGET AND SEAL-IN UNIT

For trip coils operating on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage, set the target and seal-in tap plug in the 0.2-ampere tap. For trip coils operating on currents ranging from 2 to 30 amperes at the minimum control voltage, place the tap plug in the two-ampere tap.

The tap plug is the screw holding the right-hand stationary contact of the seal-in unit. To change tap setting, first remove the connecting plug. Then take a screw from the left-hand stationary contact and place it in the desired tap. Next, remove the screw from the other tap and place it in the left-hand contact. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Screws should not be in both taps at the same time as pickup for DC will be the higher tap value and AC pickup will be increased.

Current Setting

The current at which the contacts operate may be changed by changing the position of the tap plug in the tap block at the top of the relay. Screw the tap plug firmly into the tap marked for the desired current (below which the unit is not to operate).

When changing the current setting of the unit, remove the connecting plug to short circuit the current-transformer secondary circuit. Next, screw the tap plug into the tap marked for the desired current and then replace the connecting plug.

The pickup of the unit for any current tap is adjusted by means of a spring-adjusting ring. The ring may be turned by inserting a tool in the notches around the edge. By turning the ring, the operating current of the unit may be brought into agreement with the tap setting employed, if for some reason this adjustment has been disturbed. This adjustment also permits any desired setting intermediate between the various tap settings to be obtained.

Time Setting

The setting of the time dial determines the length of time the unit requires to close its contacts when the current reaches a predetermined value. The contacts are just closed when the dial is set on zero. When the dial is set on 10, the disk must travel the maximum amount to close the contacts and therefore this setting gives the maximum time setting.

These relays produce a strong torque in the reverse direction for faults in the non-tripping direction. For this reason it is necessary to lock the time dial to prevent the disk torque from moving the time dial. The time dial is locked by tightening the two screws on the shelf from which the time dial is supported.

The primary adjustment for the time of operation of the unit is made by means of the time dial. However, further adjustment is obtained by moving the permanent magnet along its supporting shelf; moving the magnet in toward the back of the unit decreases the time, while moving it out increases the time.



INSTANTANEOUS UNIT

Select the current above which it is desired to have the instantaneous unit operate and set the adjustable pole piece so that its hexagon head is even with the desired calibration on the scale. To raise or lower the pole piece, loosen the locknut and turn it up or down and then tighten in position.

The contacts should be adjusted to make at about the same time and to have approximately 1/8 inch wipe. This adjustment can be made by loosening the screws holding the stationary contacts and moving the contacts up or down as required. The operating time is shown in Fig. 12.

MAINTENANCEDISK AND BEARINGS

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle. The jewel should be turned up until the disk is centered in the air gaps, after which it should be locked in this position by the set screw provided for this purpose.

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. Sometimes an ordinary file cannot reach the actual points of contact because of some obstruction from some other part of the relay.

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 and thus prevent closing.

The burnishing tool described is included in the standard relay tool kit obtainable from the factory.

PERIODIC TESTING

An operation test and inspection of the relay at least once every six months are recommended. Test connections are shown in Fig. 11.

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 part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company requisition number on which the relay was furnished.

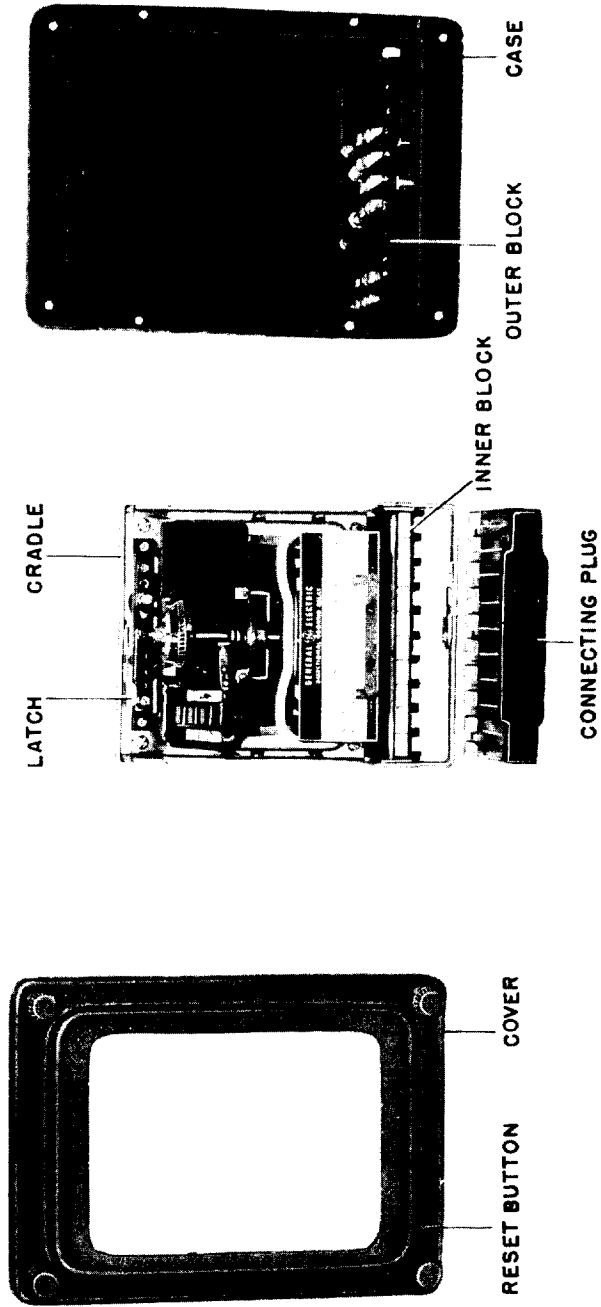


Fig. 1 (8014207) Type ICC51A Relay, Disassembled

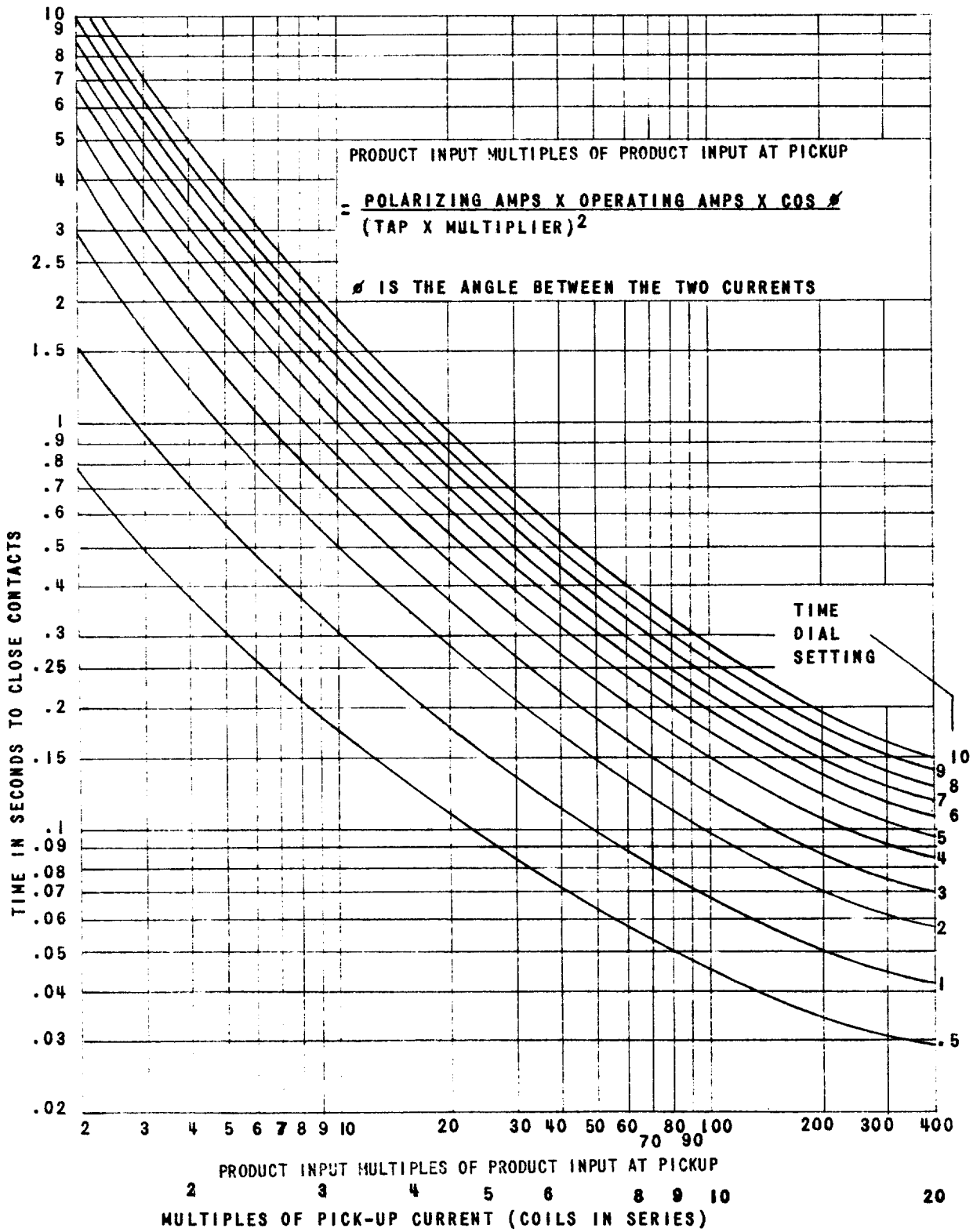


Fig. 2 (376A939-6) Time-current Characteristics of the Type ICC Relays

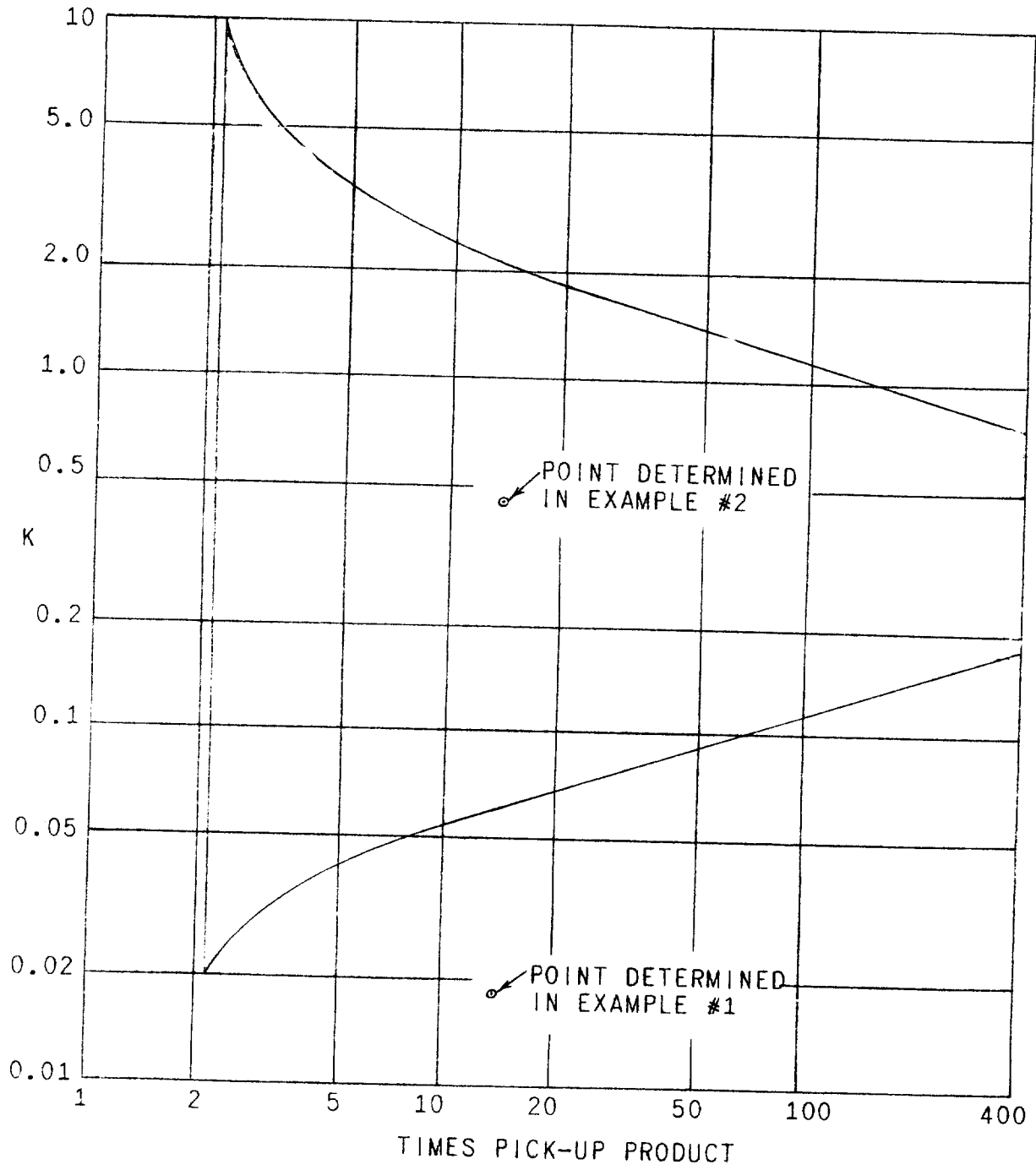


Fig. 3 (376A936-0) Area for Equal Product Times within Seven Percent of Published Time Curve

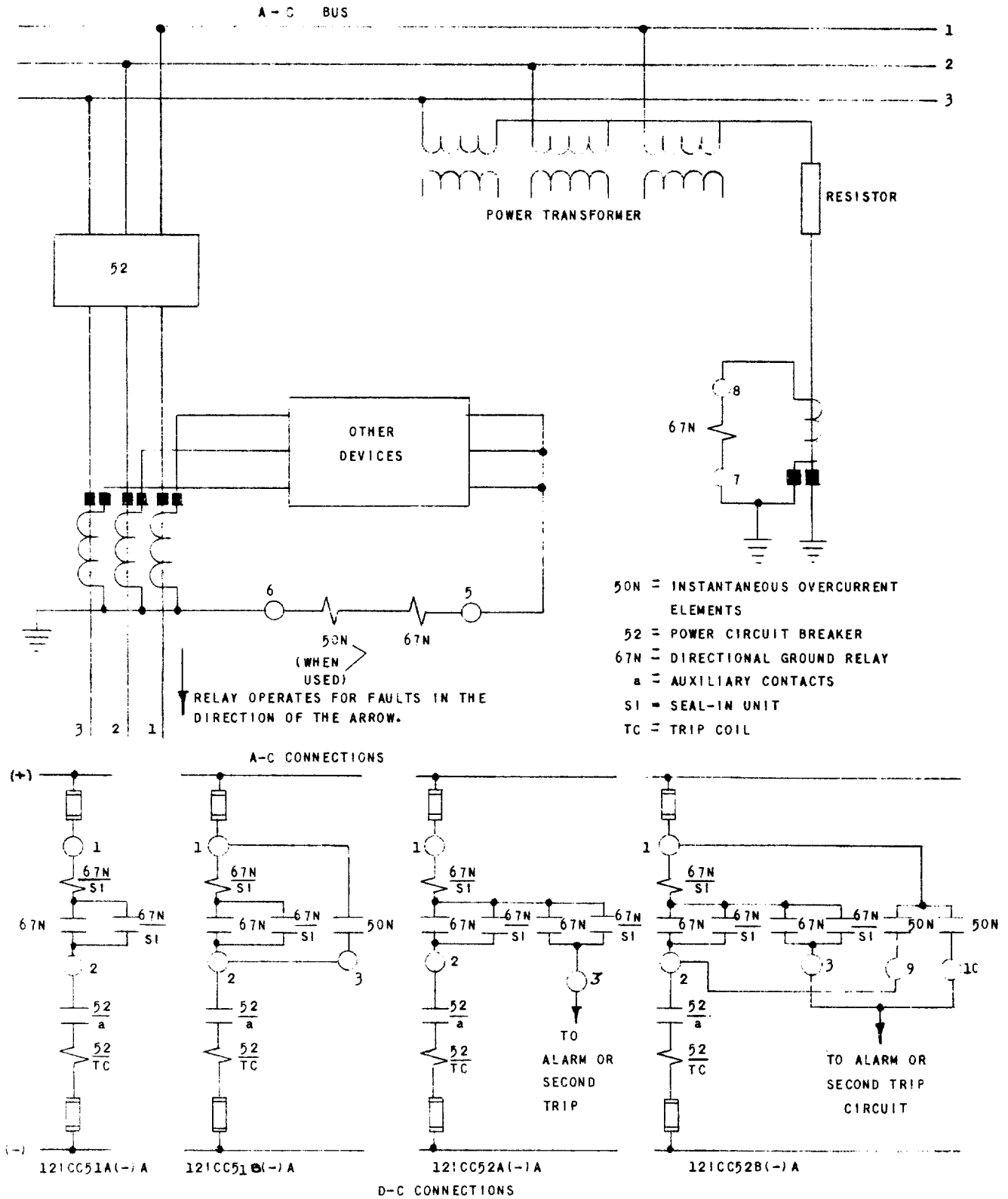


Fig. 4 (362A685) Typical External Connections of the Type ICC Relays

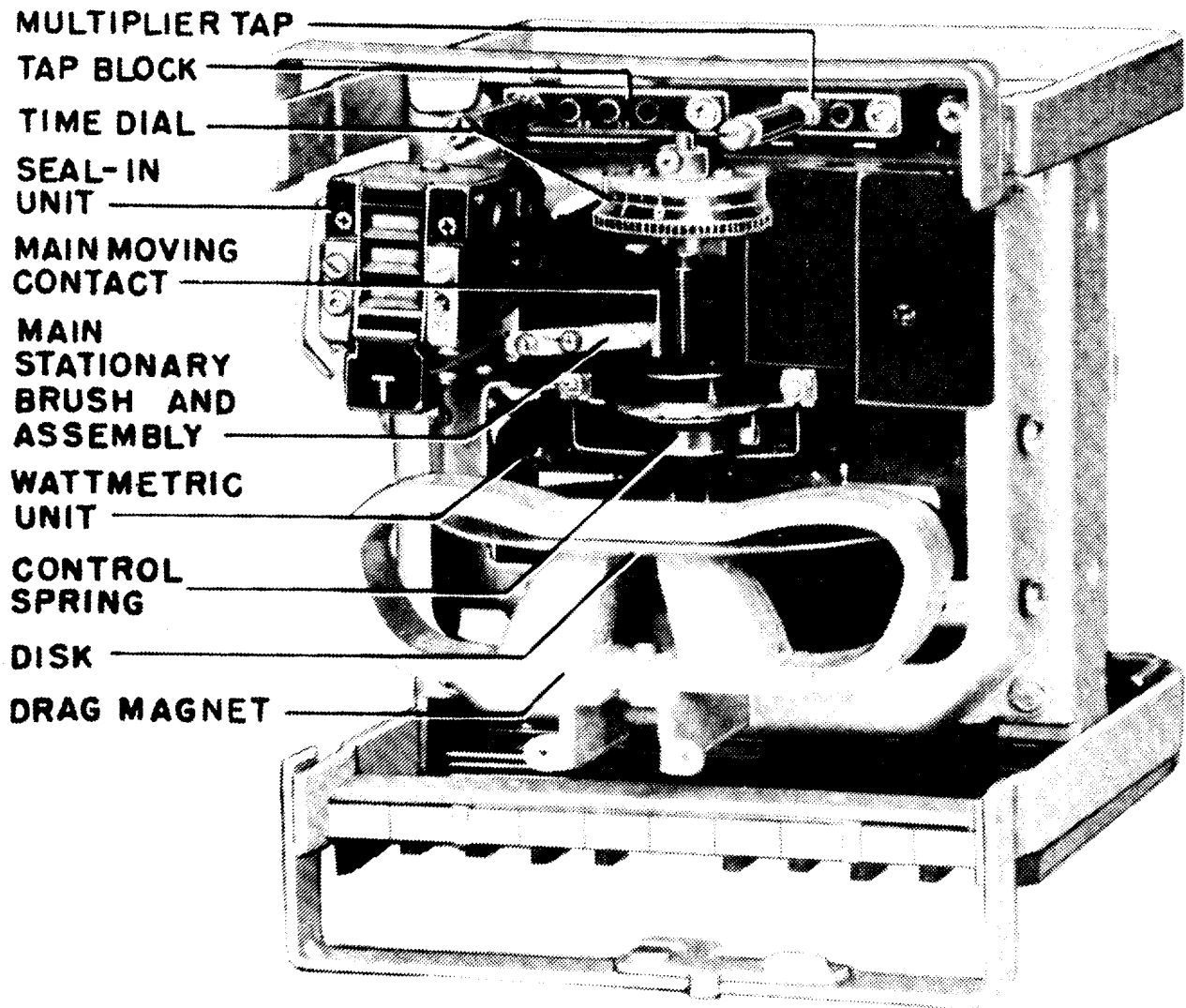


Fig. 5 (8013437) Type ICC51A Relay, Unit in Cradle (Front View)

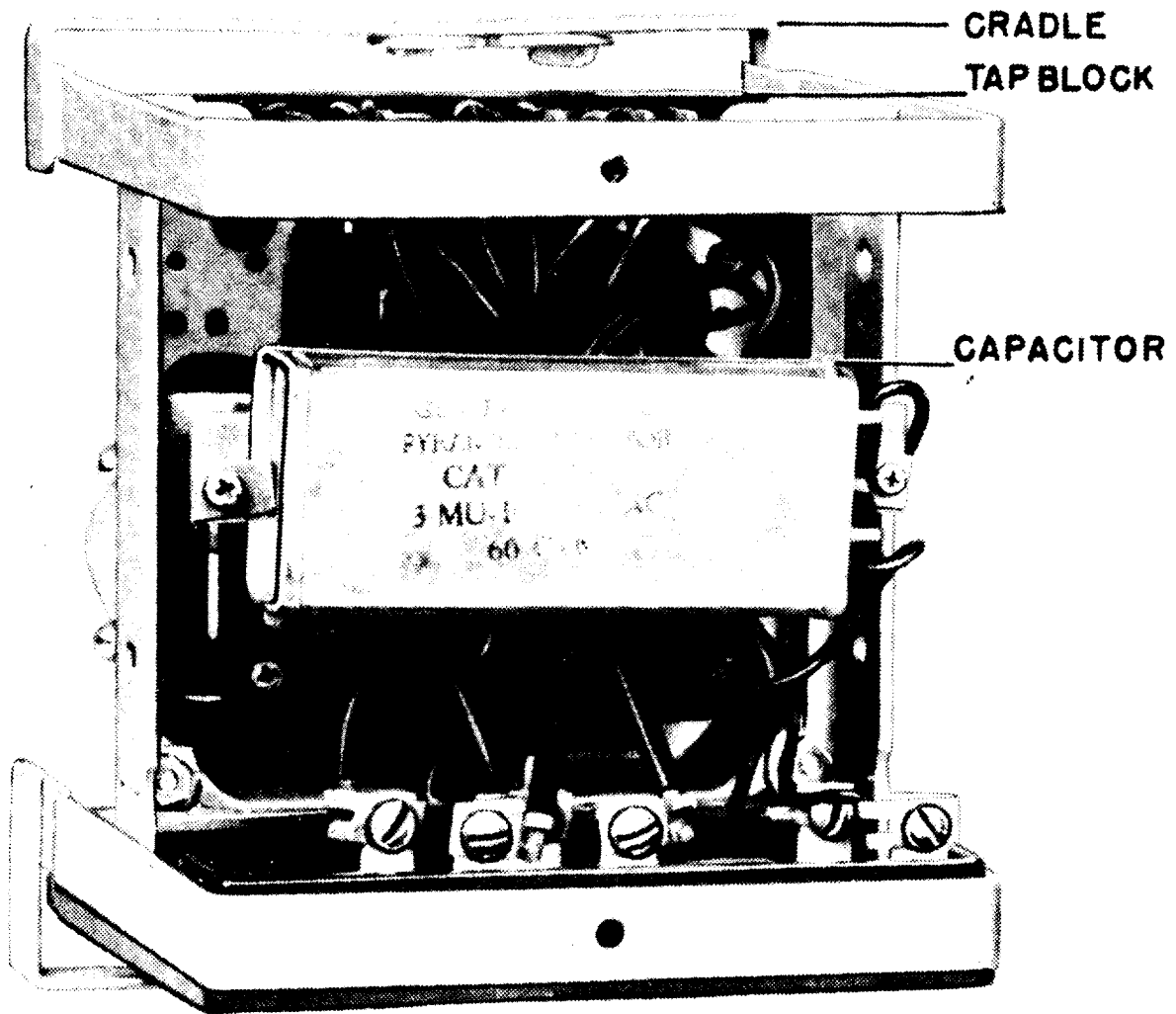


Fig. 6 (8013436) Type ICC51A Relay, Unit in Cradle (Rear View)

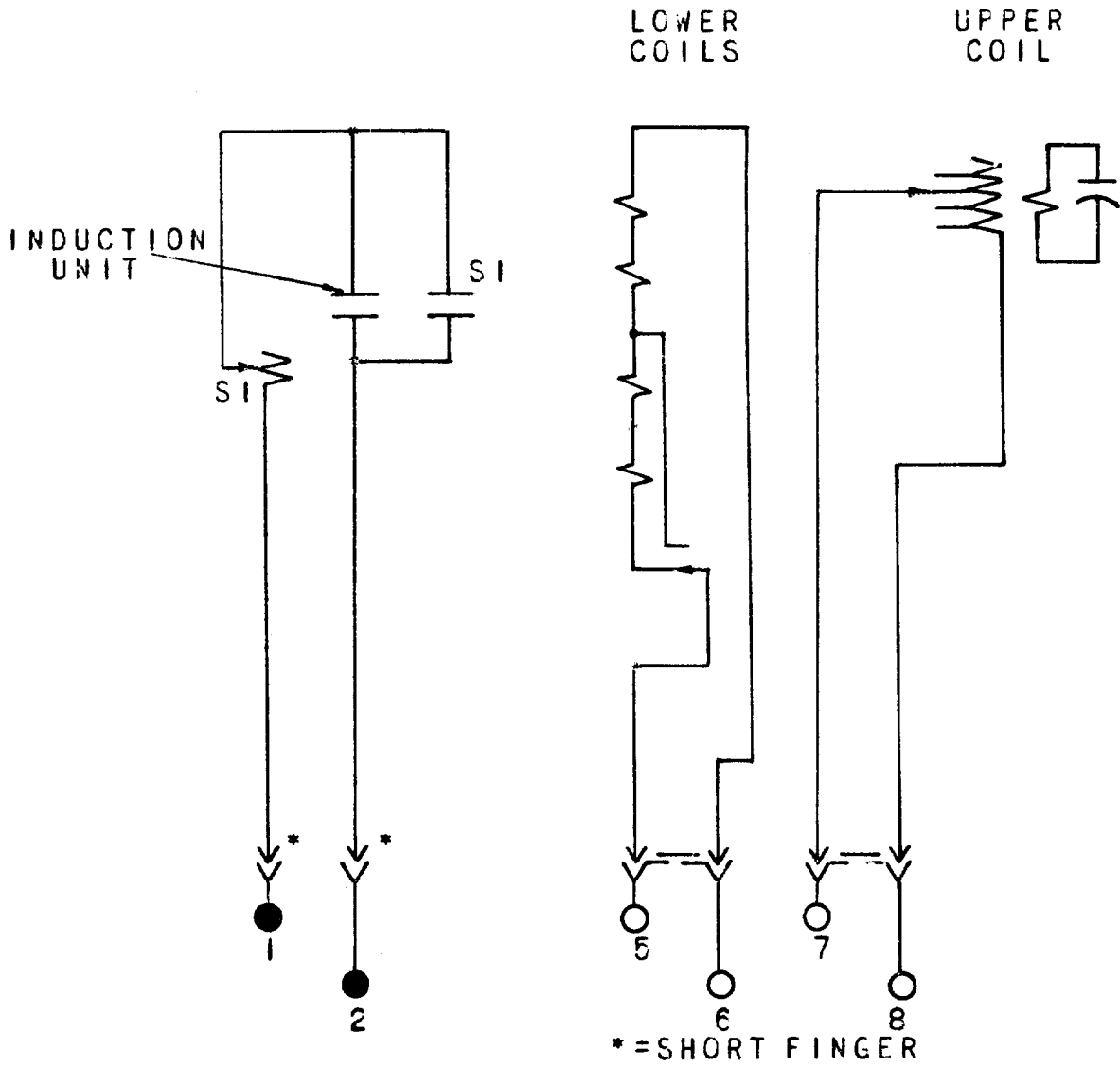


Fig. 7 (K-6556536-1) Internal Connections for the Type ICC51A Relay (Front View)



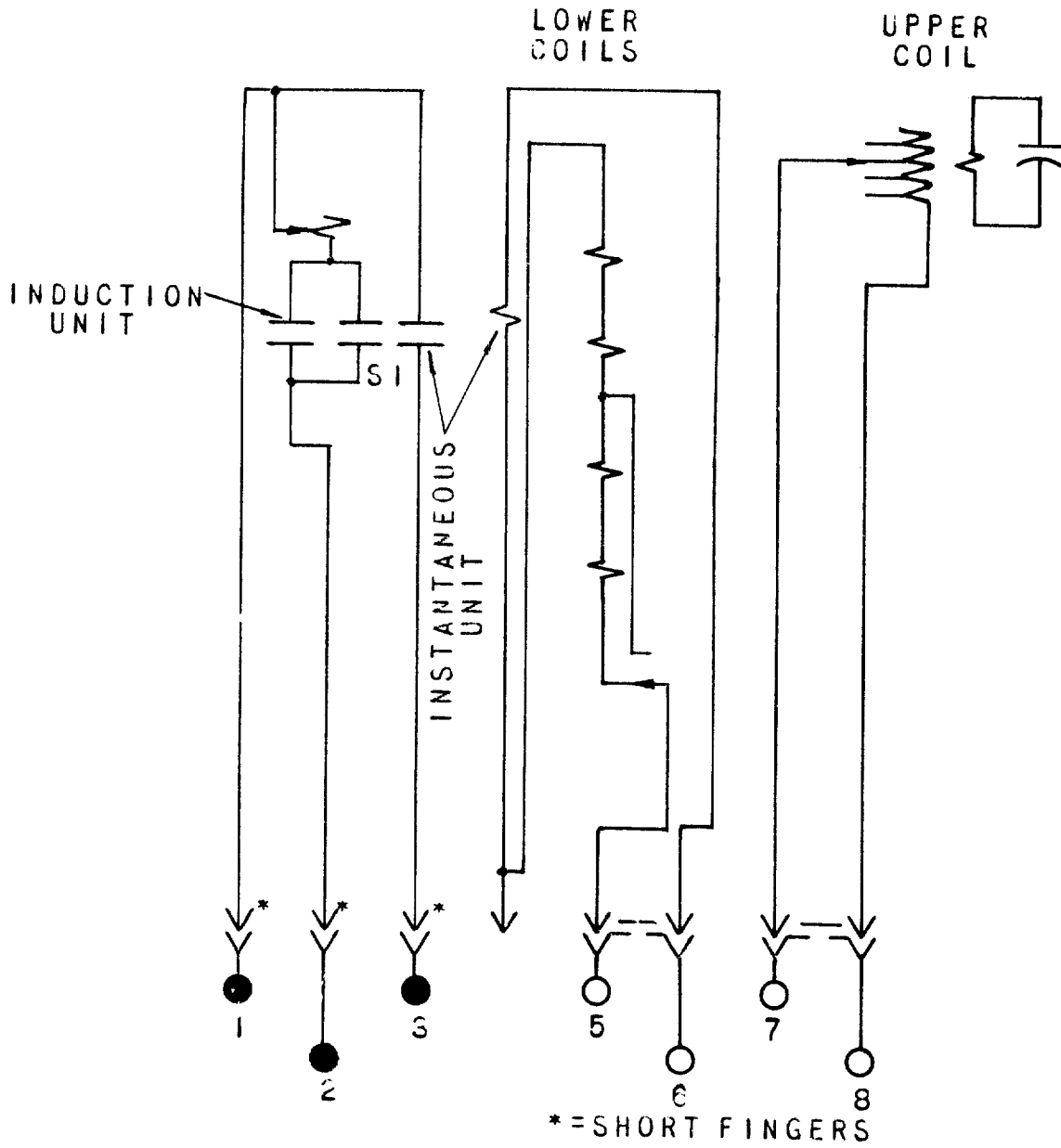


Fig. 8 (K-6556537) Internal Connections for the Type ICC51B Relay (Front View)

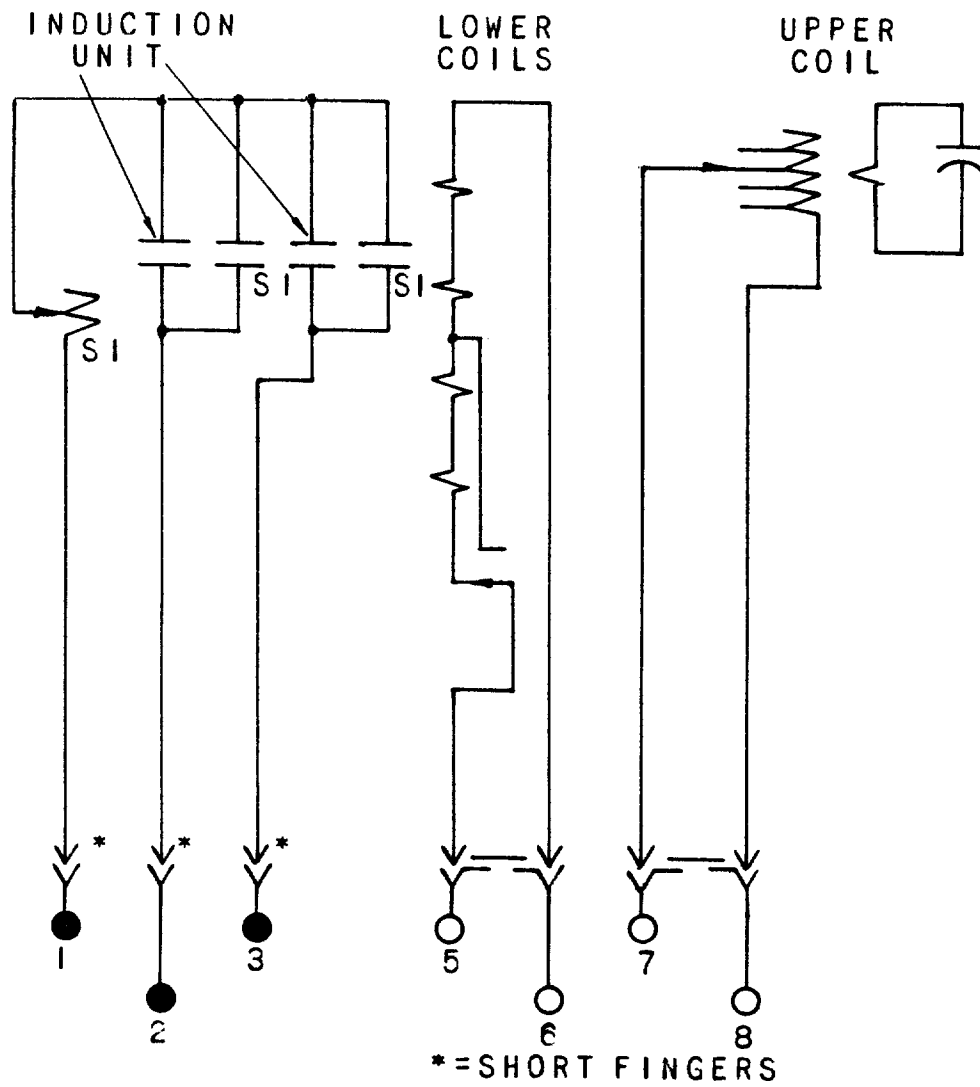


Fig. 9 (K-6556538) Internal Connections for the Type ICC52A Relay (Front View)

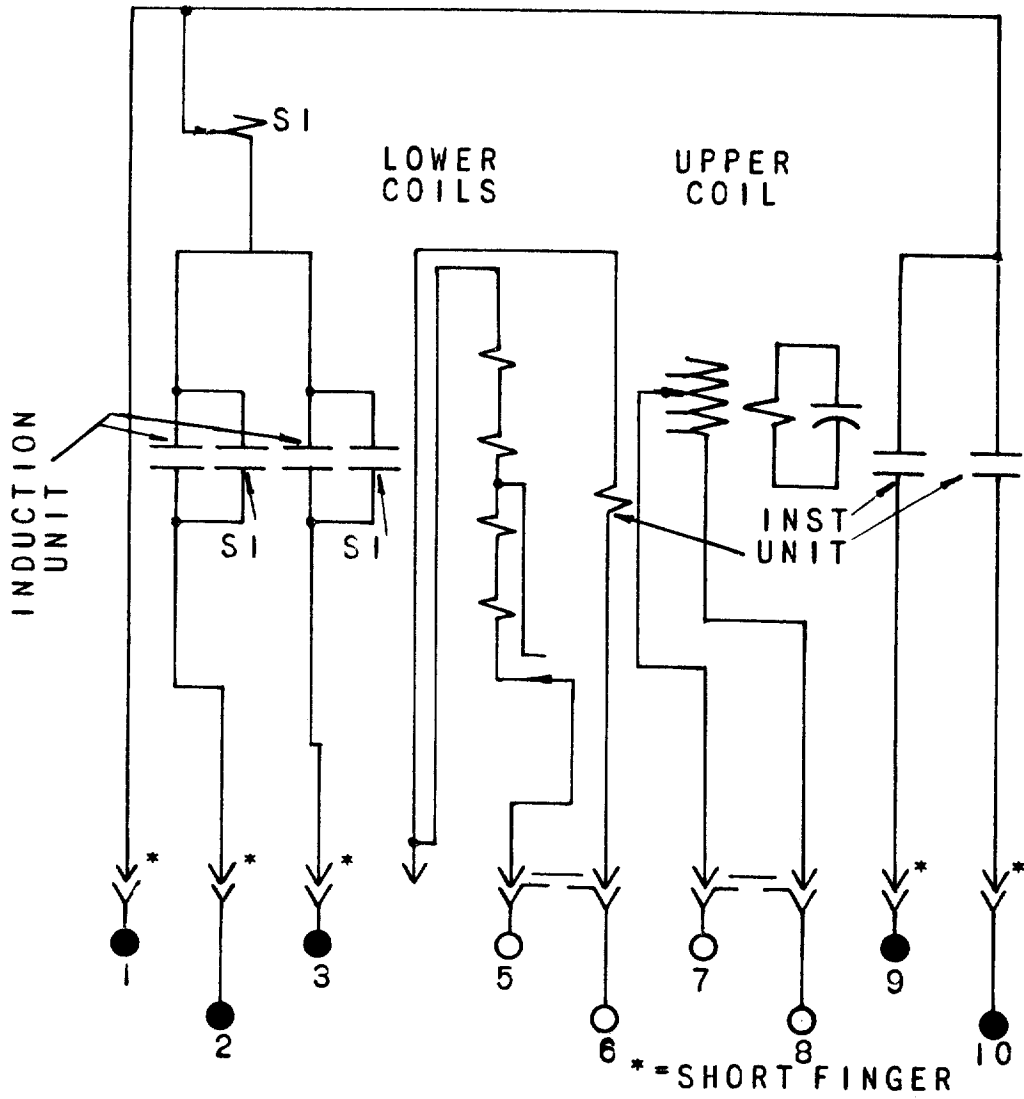


Fig. 10 (K-6556539) Internal Connections for the Type ICC52B Relay (Front View)

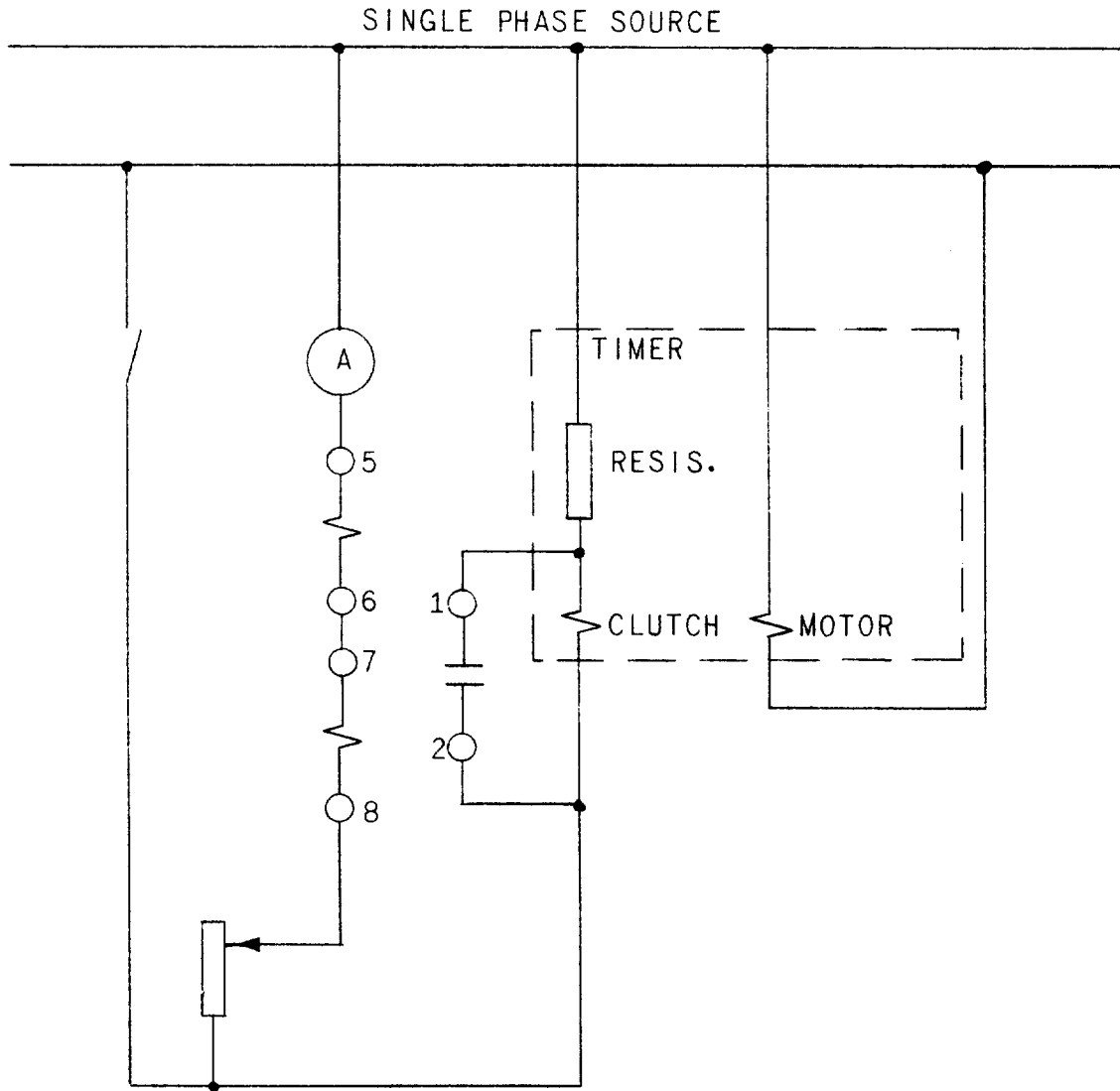


Fig. 11 (362A686) Test Connections for the Type ICC Relays

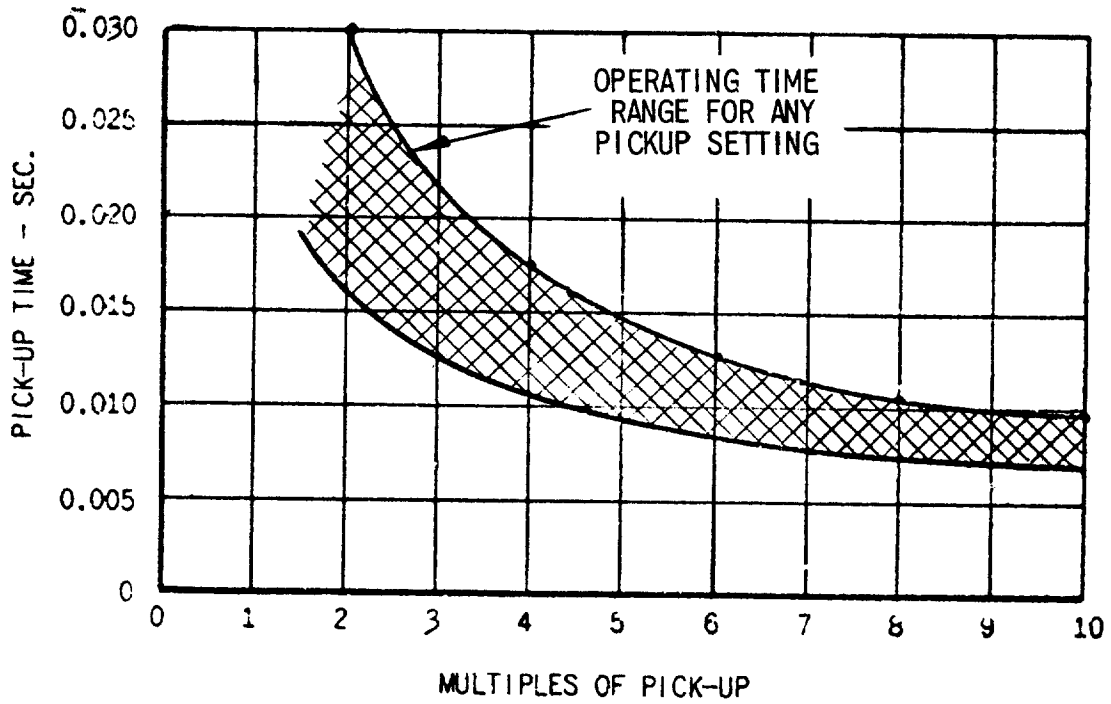


Fig. 12 (K6306872-5) Time-current Characteristic of the Instantaneous Unit

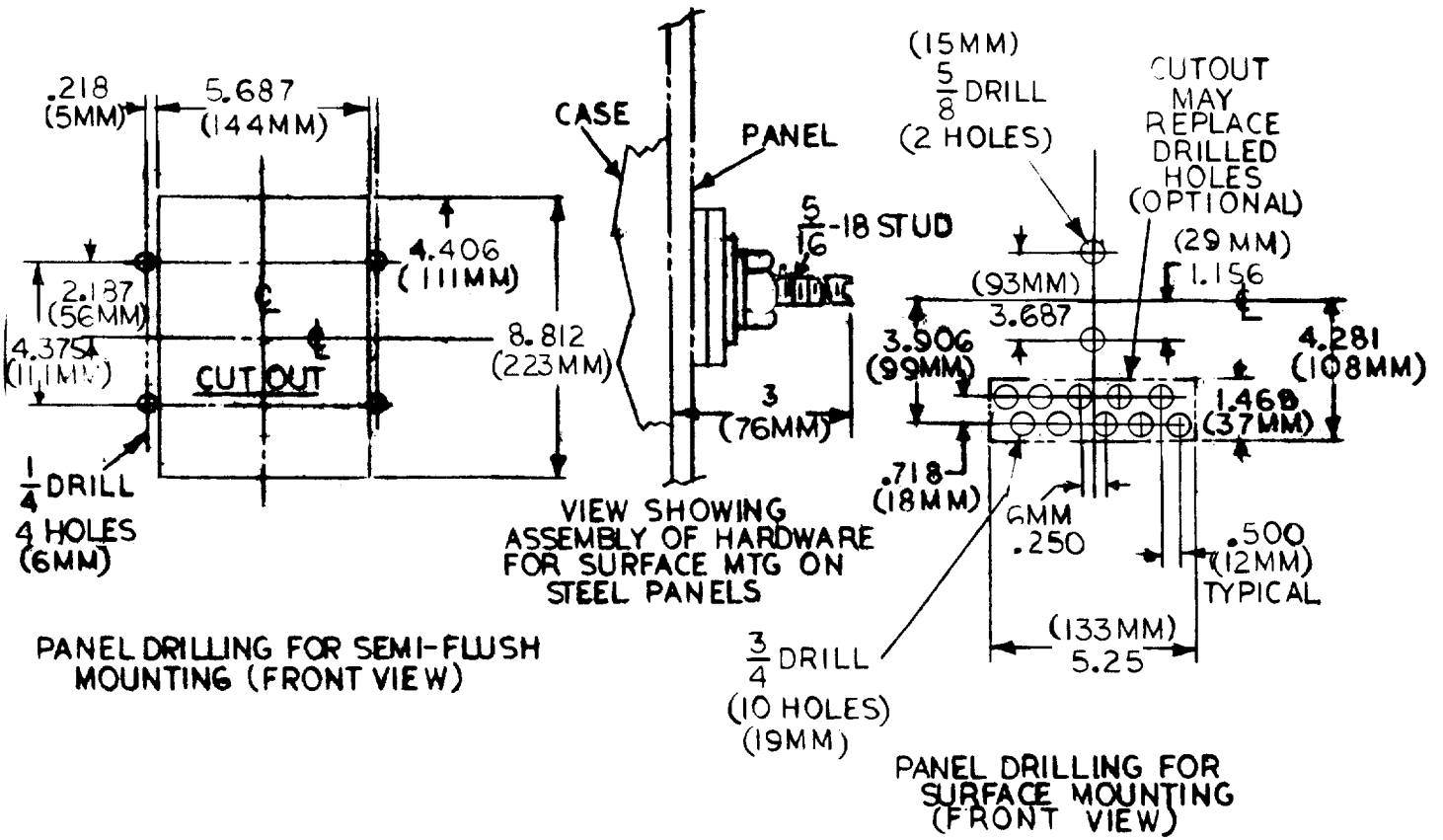
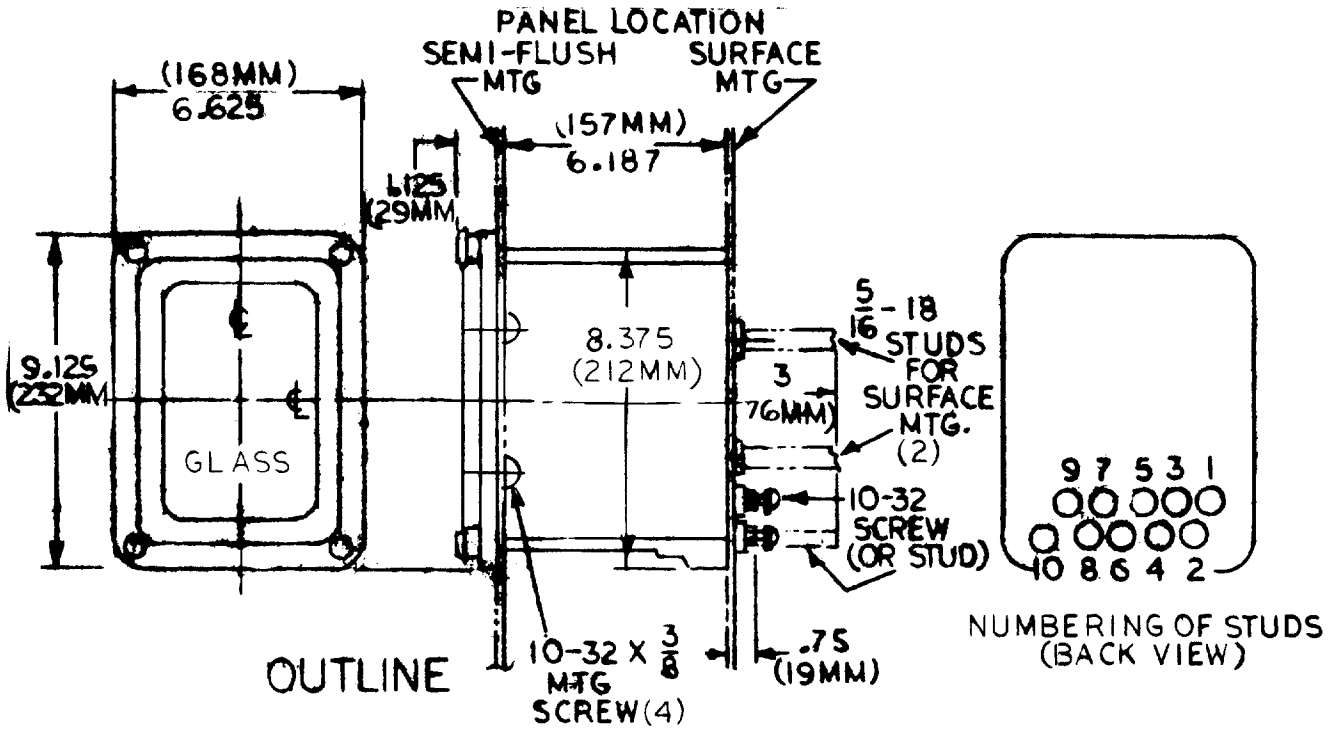


Fig. 13 (K-6209271-5) Outline and Panel Drilling Dimensions for the Type ICC Relays





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***GE Power Management***

**215 Anderson Avenue  
Markham, Ontario  
Canada L6E 1B3  
Tel: (905) 294-6222  
Fax: (905) 201-2098  
[www.ge.com/indsys/pm](http://www.ge.com/indsys/pm)**