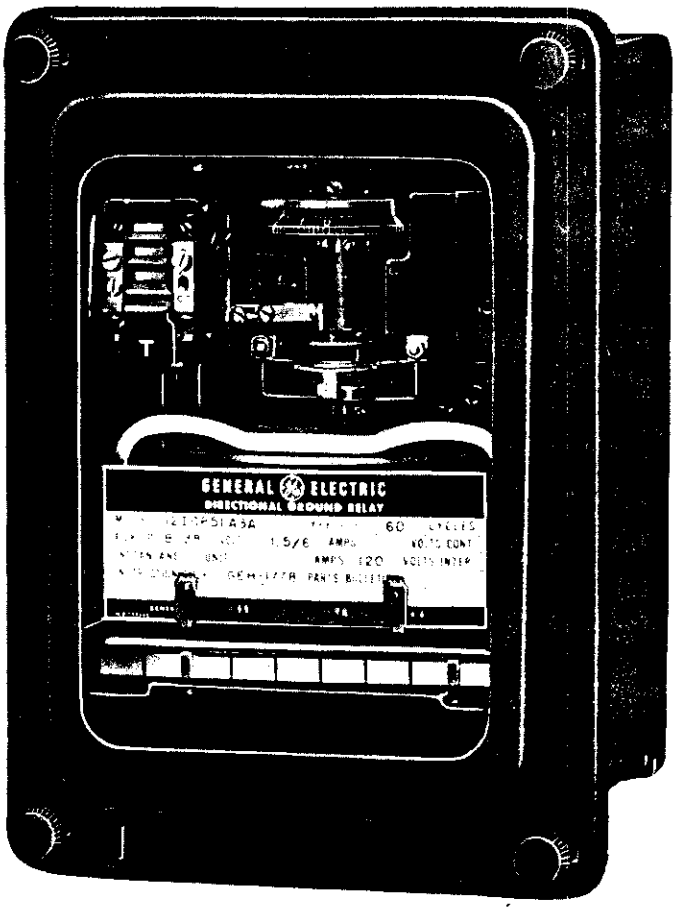
INSTRUCTIONS *Switchgear*

DIRECTIONAL GROUND RELAYS



Types

ICP51A ICP52A
ICP51B ICP52B

GENERAL ELECTRIC

A

CONTENTS

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.

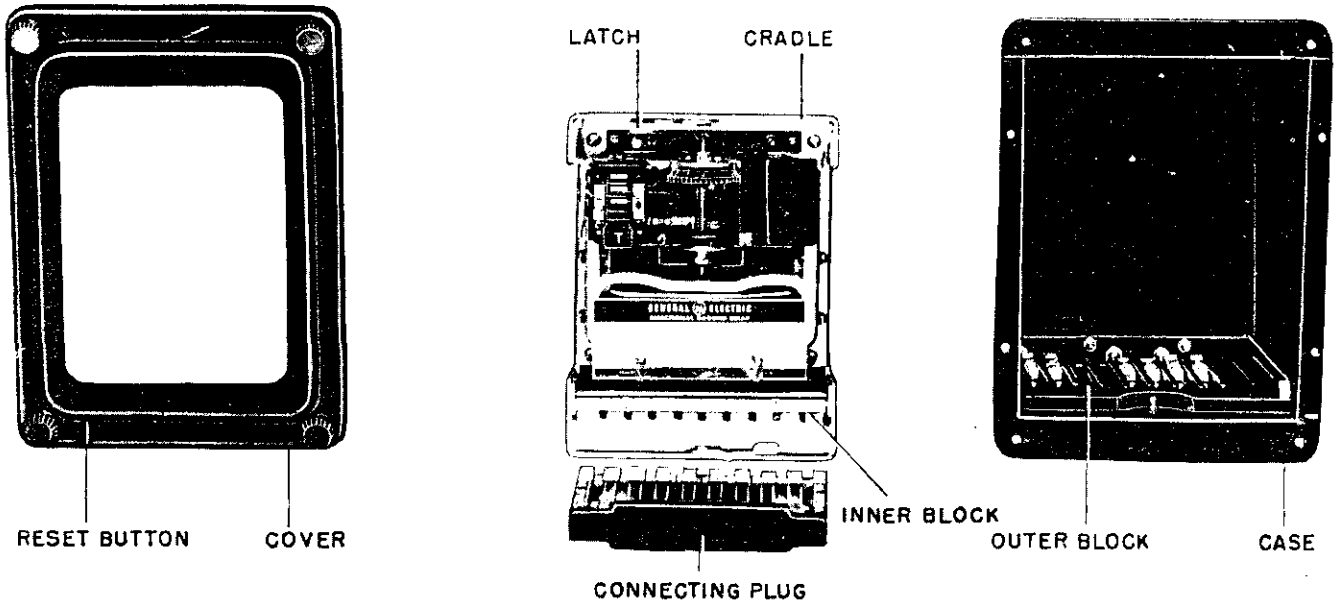


Fig. 1 801308

Fig. 1 Type ICP51A Relay, Disassembled

DIRECTIONAL GROUND RELAYS
TYPE ICP

INTRODUCTION

The Type ICP relays are employed principally to protect transmission lines against ground faults. These relays should be used in locations where the neutral of a power transformer is grounded through a high impedance, or where there is no neutral available.

The Type ICP relay is a potential-polarized directional-ground relay. The polarizing winding is connected across the open corner of the secondary delta (broken delta). Where metering or other requirements make it necessary to connect the transformers wye-wye, an auxiliary potential transformer, Type YT-1557M, must be added. The operating coil receives the residual current from the three-line current transformers. The torque produced in the relay is proportional to the polarizing voltage times the operating current times the cosine of $60^0 - \Theta$, where Θ is the angle by which the operating currents lags the polarizing voltage.

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 is in the contact-opening direction.

APPLICATION

The Type ICP 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 with ground relays as their connections make them independent of load current.

OPERATING CHARACTERISTICS

The Type ICP relay has two coil circuits. The upper coil is the operating coil. It is connected to receive the residual current from the three-line current transformers. The lower coils are potential coils. These coils may be connected in series or in parallel as determined by the minimum fault voltage. The following table shows the available rating and the minimum fault voltage which should be used with each connection:

TABLE I

	120V, intermittent Potential Coils		120V, continuous Potential Coils	
Rated Voltage	Parallel	Series	Parallel	Series
Min. Fault Voltage	8	16	25	50
Max. Fault Voltage	19	38	64	125
Volts for Tap value pickup	12	24	40	80

Example of how to determine the correct relay for a given application:

Assume - minimum fault voltage = 10 volts
- minimum fault current = 2 amperes

Referring to Table I, it can be seen that the relay with the 120-volt intermittent rating with its potential coils connected in parallel is to be used for minimum fault voltages that fall between 8 and 19 volts. As shown in the table, we find that the relay with these connections is calibrated to close its contacts when the polarizing voltage is equal to 12 volts and the operating current is equal to tap value.

Min. Fault I x Min. Fault V = 10 x 2 = 20

Min. current for pickup with 12 volts polarizing $= \frac{20}{12} = 1.67$ amperes.

A relay should therefore be selected that has a lower tap than the minimum current determined above. The three standard current ranges are 0.15 to 0.6, 0.5 to 2, and 1.5 to 6. The 0.5 to 2 current range would be selected for this application.

The time required for the relay to operate will check within $\pm$ 7 per cent of the time shown in Fig. 2 only if the value of K determined from the equation:

$$K = \frac{VT}{V_T I}$$

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

V = voltage applied across studs 7-8
I = current through current coil (studs 5-6)
V_T = Volts for tap-value pickup (see Table I or nameplate)
T = tap used on tap block.

Example:

To determine if time will be within $\pm$ 7 per cent of published value for the following conditions:
Fault Voltage = 50 volts
Fault Current = 10 amperes
V_T = 12 volts for tap value pickup
T = 0.8 ampere tap

$$K = \frac{50 \times 0.8}{12 \times 10} = 0.333$$

Pick-up product = 12 volts x 0.8 amps = 9.6

Fault product = 50 volts x 10 amps = 500

Times pick-up product $= \frac{500}{9.6} = 52$

Referring to Fig. 3, locate the point where times pick-up product is 52 and K = 0.333. The point is found to be within the shaded area so the relay operating time will check within $\pm$ 7 per cent of the published time for the above conditions.

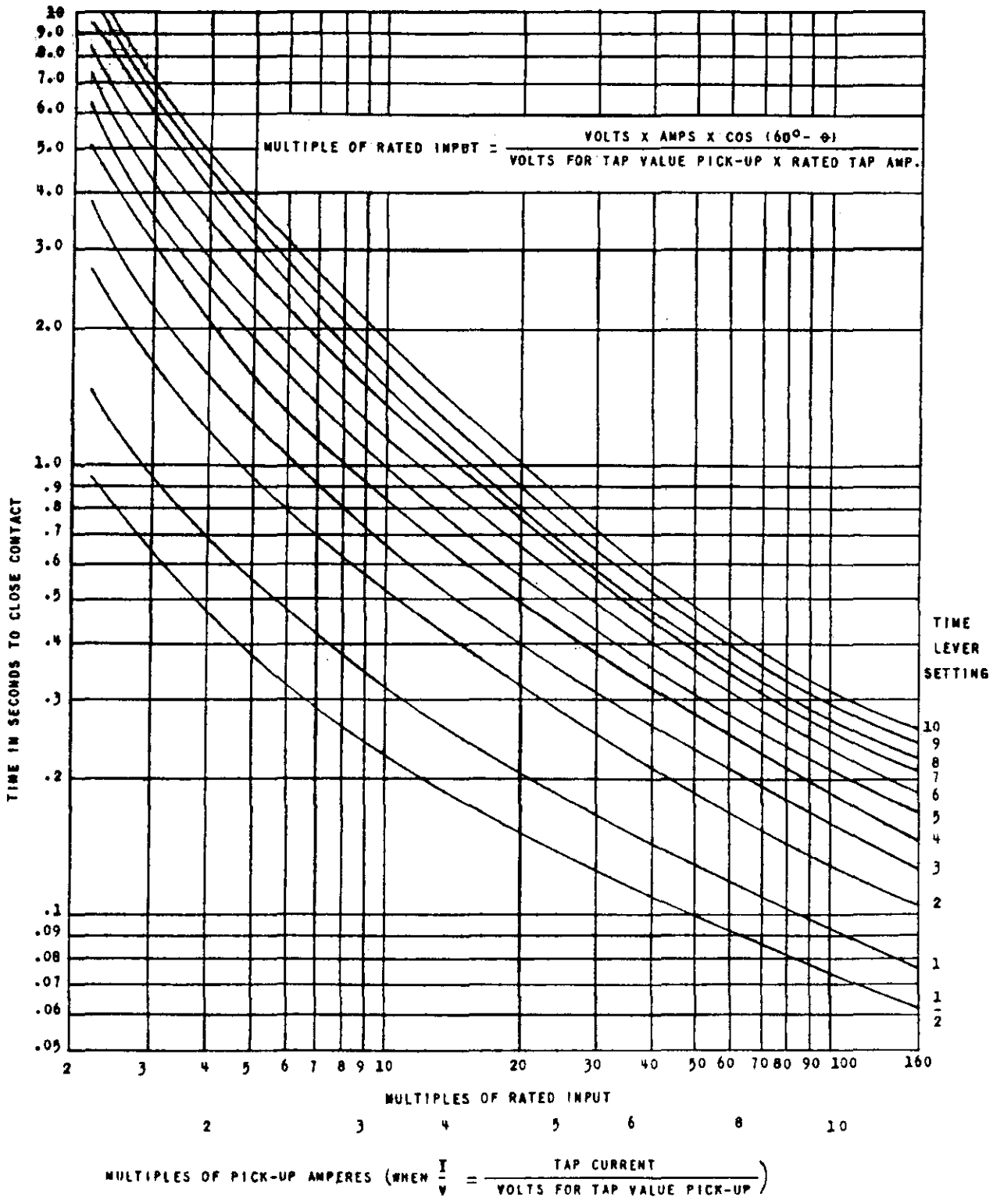


Fig. 2 3764A937

Fig. 2 Time-Current Characteristics of the Type ICP Relays

RATINGS

The current coil carries zero current and there is zero voltage across the potential coils under normal conditions when connected as shown in Fig. 4.

The relay is available with any one of three standard coils. The short time and continuous current rating of the three coils (in amperes) are as follows:

Current Range	One-second rating	Cont. rating
0.15-0.6	60	1.5
0.5-2.0	200	5.0
1.5-6	200	5.0

The one-second rating will be the same for all taps. The continuous rating given above is for the minimum tap; high taps will have a higher continuous rating. The available taps are as follows:

Current Range	Taps on Tap Block
0.15-0.6 amps	0.15-0.20-0.25-0.30-0.40-0.50-0.60
0.5-2.0 amps	0.5-0.6-0.8-1.0-1.2-1.5-2.0
1.5-6.0 amps	1.5-2.0-2.5-3.0-4.0-5.0-6.0-

The relay is available with either one of two ratings of potential coils. With either rating of potential coils, the two potential coils in the relay can be connected either in series or in parallel. The ratings of the potential circuits are as follows:

Voltage Rating, Potential-Coil	120V, intermittent		120V, continuous	
connections	Parallel	Series	Parallel	Series
Continuous voltage rating	60 volts	120V	180	360
Time rating at 360 volts	10 sec.	40 sec.	120 sec.	cont.

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:

Function	Amperes, a-c or d-c	
	2-Amp Tap	0.2-Amp Tap
Tripping Duty	30	5
Carry Continuously	4	0.8

The 2-ampere tap has a d-c resistance of 0.13 ohms and a 60 cycle impedance of 0.53 ohms while the 0.2-ampere tap has a 7 ohm d-c resistance and a 52 ohm 60 cycle impedance. The tap setting used on the seal-in unit is determined by the current drawn by the trip coil.

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 2 amperes, there is a possibility that the 7-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 2 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 the tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

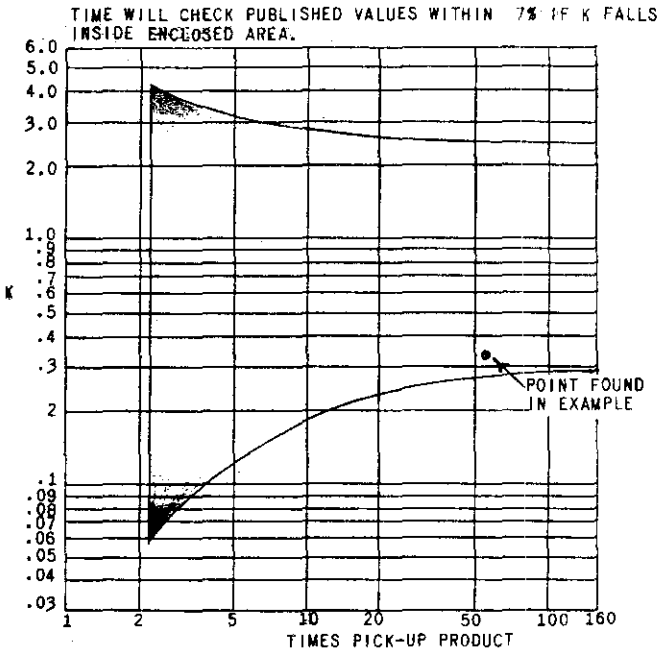


Fig. 3 Area for Equal Product Times Within 7 Percent of Published Time Curve

BURDENS

The burdens imposed on the current and potential transformers at 5 amperes and 120 volts are given in the following tables. Under normal conditions, however, no burden is imposed as both the relay voltage and current are zero.

Current-coil burden at 5 amperes, 60 cycles:

Tap Range	Tap	VA	Impedance	P.F.
0.15-0.6	0.15	325	13.0	0.5
0.5-2.0	0.5	29.2	1.17	0.5
1.5-6.0	1.5	3.25	0.13	0.5

Potential burden at 120 volts, 60 cycles:

Rating	Coil Connections	VA	VARS	WATTS	PF
120 volts intermittent	Parallel	13.9	5.45*	12.8	0.92
120 volts intermittent	Series	3.48	1.36*	3.22	0.92
120 volts continuous	Parallel	5.55	1.98*	5.20	0.93
120 volts continuous	Series	1.39	0.50*	1.30	0.93

* Capacitive

Burden of Instantaneous unit at 5 amperes, 60 cycles:

Pick-up range	VA	Impedance	P.F.
4-16	5.20	0.206	0.95
10-40	0.83	0.033	0.95

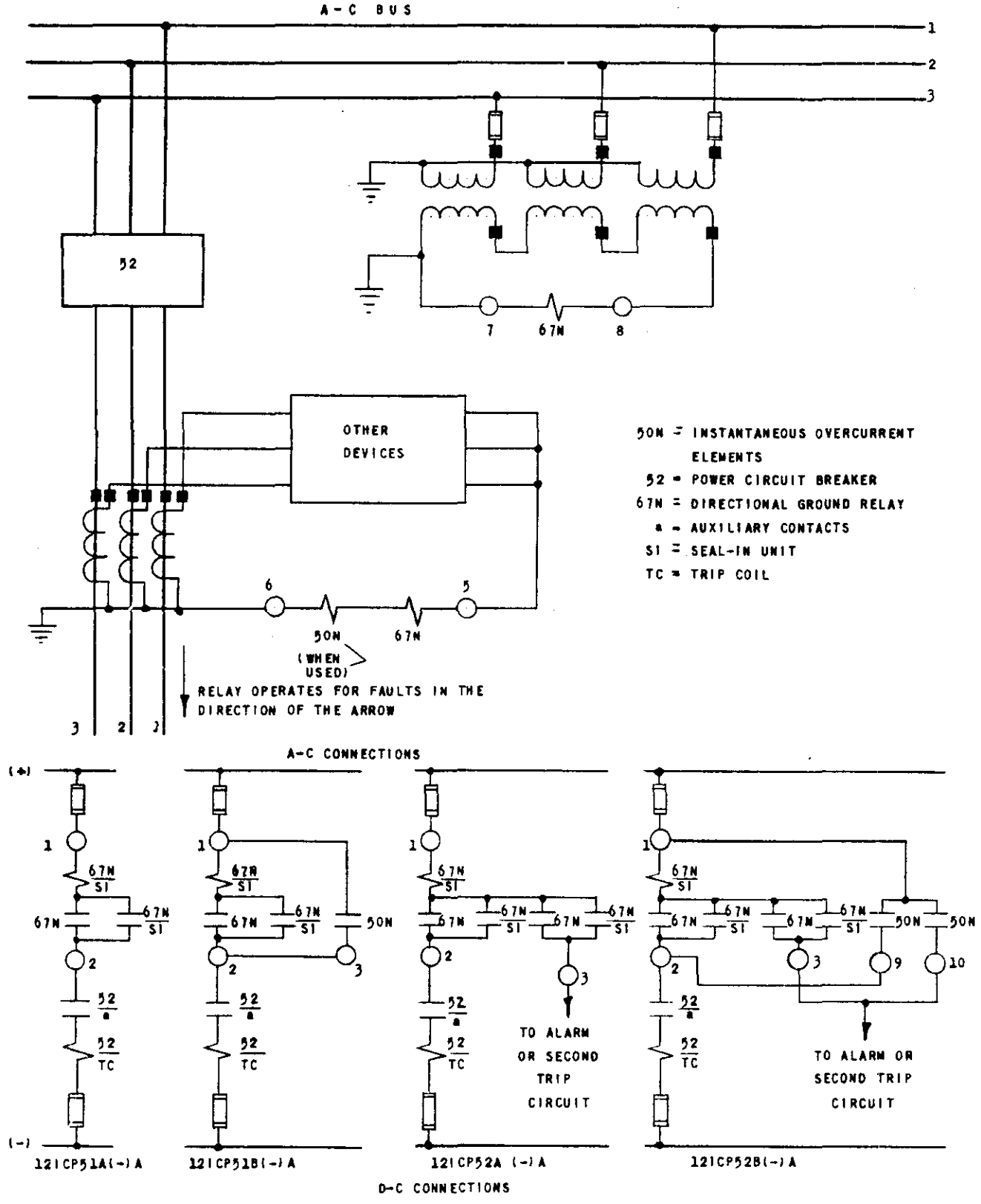


Fig. 4 362A688

Fig. 4 Typical External Connections of the Type ICP Relays

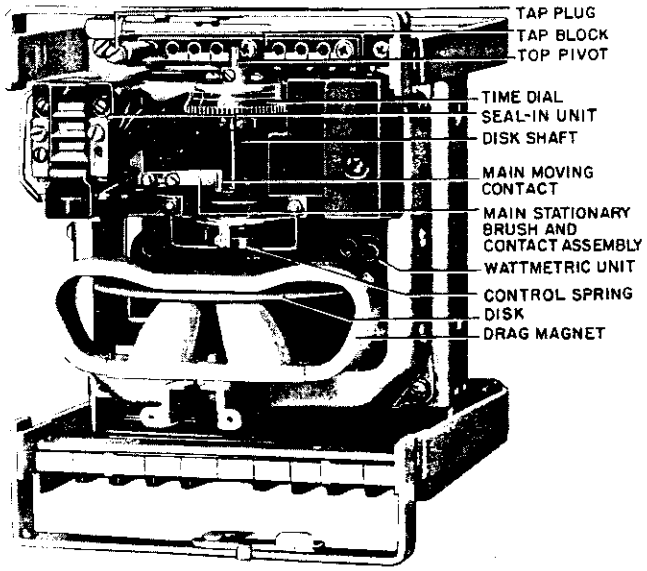


Fig. 5 Type ICP51A Relay-Unit In Cradle (Front View)

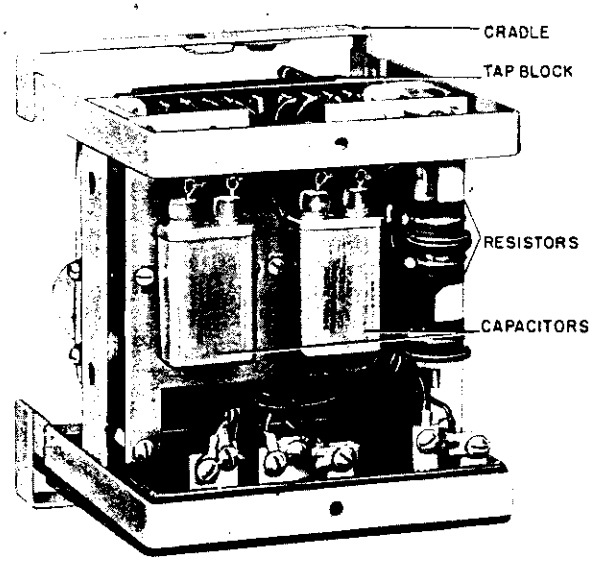


Fig. 6 Type ICP51A Relay-Unit In Cradle (Rear View)

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 with the exception of 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.
12ICP51A(-)A	1	No	Fig. 7
12ICP51B(-)A	1	Yes	Fig. 8
12ICP52A(-)A	2	No	Fig. 9
12ICP52B(-)A	2	Yes	Fig. 10

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.

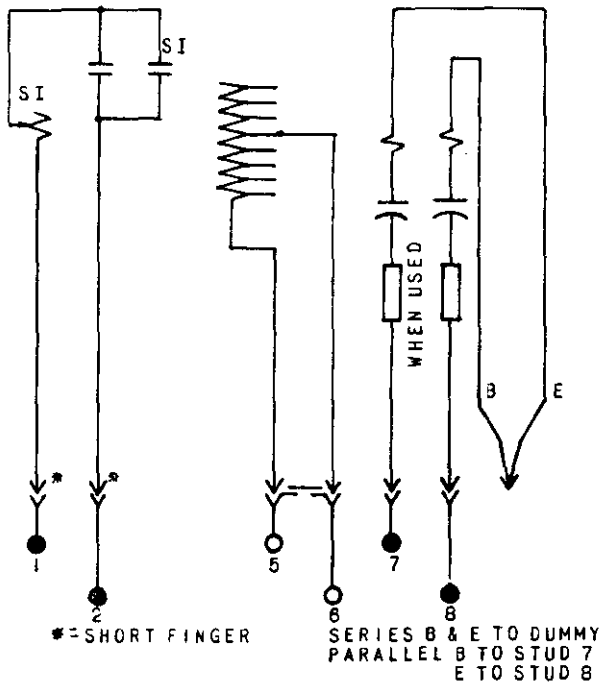


Fig. 7 Internal Connections for the Type ICP51A Relay (Front View)

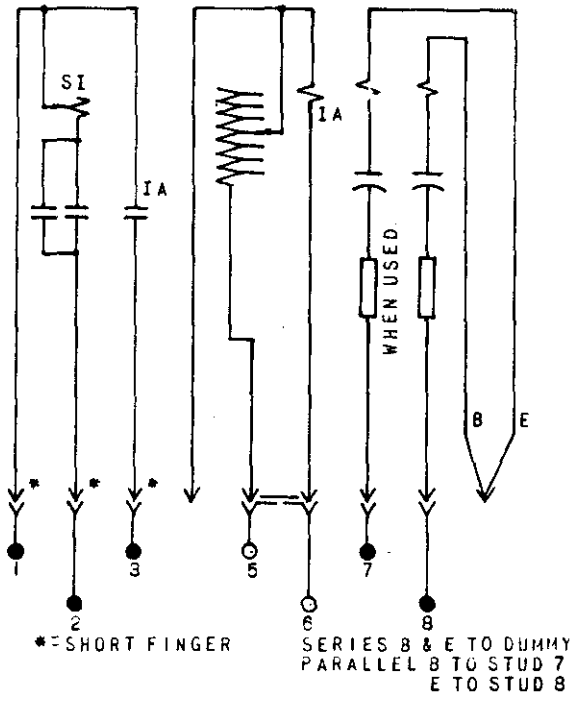


Fig. 8 Internal Connections for the Type ICP51B Relay (Front View)

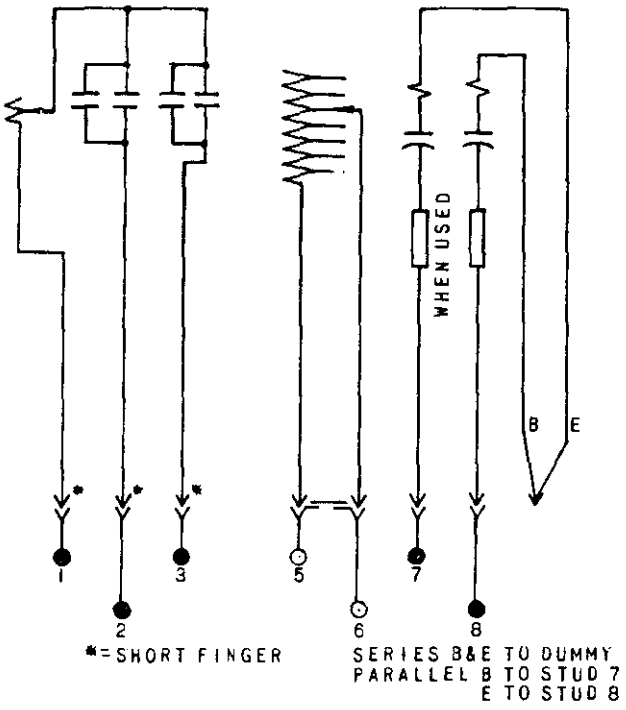


Fig. 9 Internal Connections for the Type ICP52A Relay (Front View)

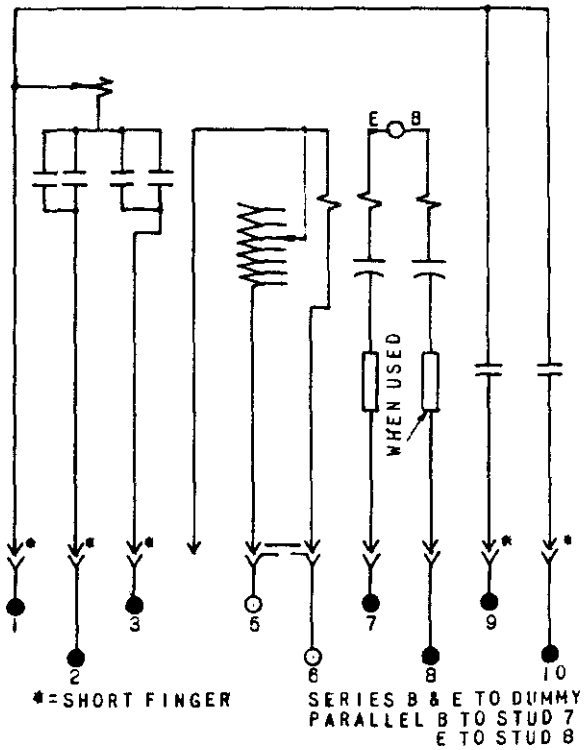


Fig. 10 Internal Connections for the Type ICP52B Relay (Front View)

Fig. 7 362A515
Fig. 8 362A516
Fig. 9 362A517
Fig. 10 362A518

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.

INSTALLATION

LOCATION

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. 14.

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 overall polarity of the relay and its connections to the current and potential transformers can be checked by using load current and voltage from the same phase. The voltage is obtained by removing phase one from the primary of the broken-delta transformer and shorting the phase-one primary winding. Current is obtained by shorting the current transformers in phases two and three and opening their circuits to the relay. This permits the current transformer in phase one to supply the current. These connections are shown in Fig. 12. If the load current is above the pickup of the relay and in the tripping direction, the contacts of the relay should close.

The polarity of the relay unit alone can be checked by connecting studs 5 and 7 to one side of a source of rated voltage. Connect stud 6 through a resistor to the other side of power. The resistor should permit a current to flow that is five to ten times the tap value. Connect stud 8 to the same side of power as the resistor in the current circuit. The contacts of the induction unit 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 distrubed. 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 pick-up 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 properly adjusted before leaving the factory and it is advisable not to disturb these adjustments. If, for any reason, they have been disturbed the following points should be observed 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

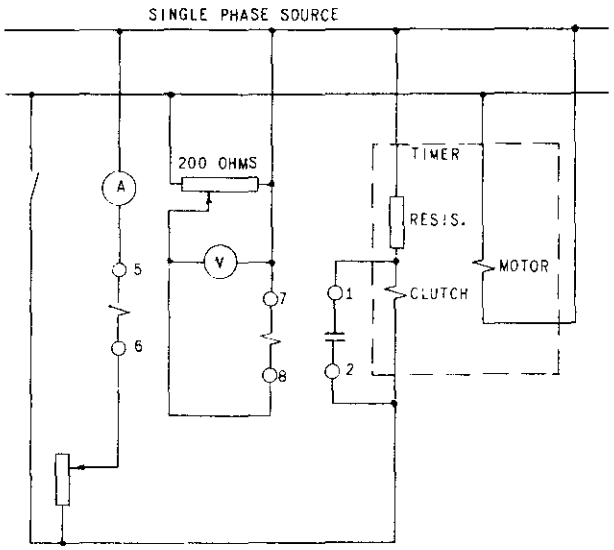


Fig. 11 Test Connections for the Type ICP Relays

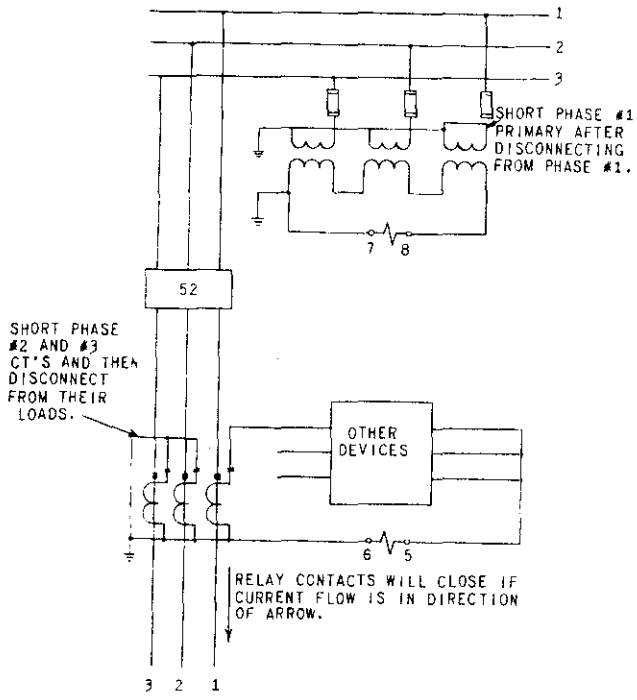


Fig. 12 Overall Polarity Check of Relay and Relay Connections

Fig. 11 362A687

Fig. 12 376A938

currents ranging from 2 to 30 amperes at the minimum control voltage, place the tap plug in the 2-ampere tap.

The tap plug is the screw holding the right-hand stationary contact of the seal-in unit. To change the 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 d-c will be the higher tap value and a-c 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 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 required for the unit to close its contacts when the current and voltage are at 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 it. 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. 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. The operating time is shown in Fig. 2.

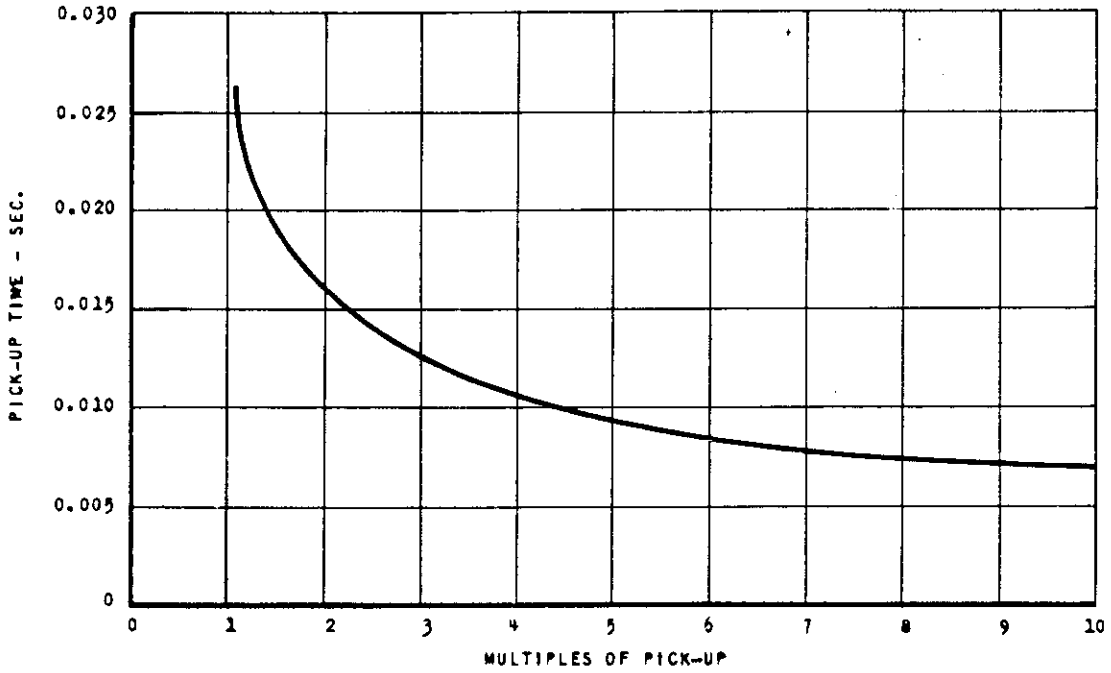


Fig. 13 Time-Current Characteristic of the Instantaneous Unit

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. 13.

MAINTENANCE

DISK 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.

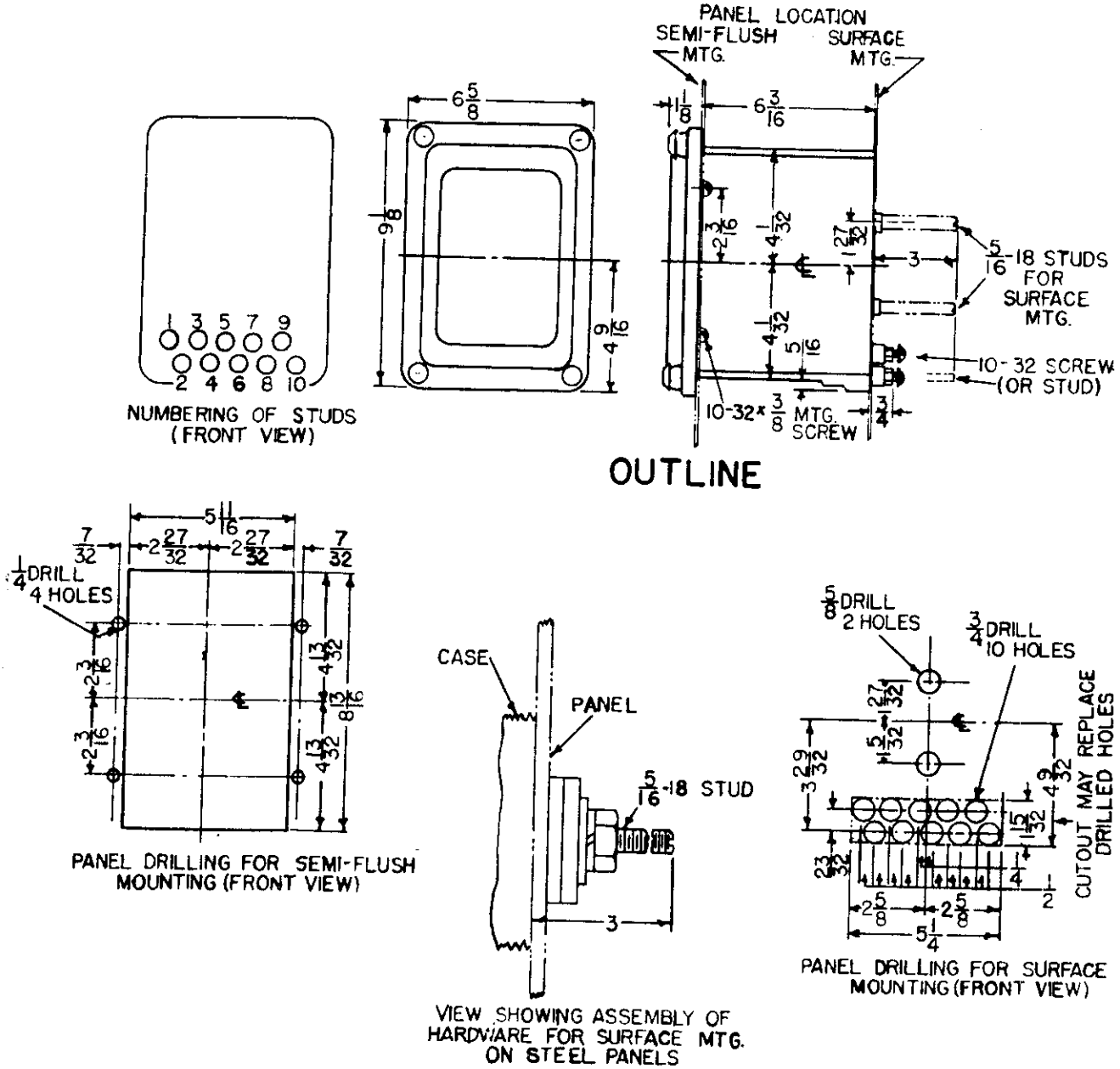


Fig. 14 K-6209271

Fig. 14 Outline And Panel Drilling Dimensions For The Type ICP Relays

WHEN YOU NEED SERVICE

GEZ-85L

IF YOU NEED TO REPAIR, recondition, or rebuild any electric apparatus, a G-E service shop near you is available day and night, seven days a week, for work in the shops or on your premises. Latest factory methods and genuine G-E renewal parts are used to maintain the original performance of your electric equipment.

When you need parts only, to replenish those you stock as "production insurance," your General Electric representative will service your request. Plan to stock and order far enough in advance to assure an adequate supply to meet normal requirements.

The services of G-E factories and engineering divisions are always available to help you with your electrical problems. For full information about these services, contact the nearest service shop or sales office listed below:

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Augusta, Ga. . . . . 202 13th St.
Bakersfield, Calif. . . . . 211 E. 18th St.
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Bluefield, W. Va. P.O. Box 447, Appalachian Bldg.
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Buffalo 3, N. Y. . . . . 535 Washington St.
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Canton 2, Ohio . . . . . 700 Tuscarawas St., W.
Cedar Rapids, Iowa . . . . . 203 Second St., S.E.
Charleston 28, W. Va. . 306 MacCorkle Ave., S.E.
Charlotte 1, N. C. . . . . 200 S. Tryon St.
Charlottesville, Va. . . . . 123 E. Main St.
Chattanooga 2, Tenn. . . . . 832 Georgia Ave.
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Denver 2, Colo. . . . . 650 Seventeenth St.
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El Paso, Texas . . . . . 109 N. Oregon St.
Erie 2, Pa. . . . . 1001 State St.
Eugene, Ore. . . . . 29 W. Eleventh St.
Evansville 19, Ind. . . . . 123 N.W. Fourth St.
Fairmont, W. Va. . . . . 310 Jacobs Bldg., P.O. Box 1626
Fergus Falls, Minn. . . . . 102 W. Lincoln St., P.O. Box 197
Flint, Mich. . . . . 653 S. Saginaw St.
Fort Wayne 2, Ind. . . . . 127 W. Berry St.
Fort Worth 2, Texas . . . . . 408 W. Seventh St.
Fresno 1, Calif. . . . . Tulare and Fulton St.
Grand Rapids 2, Mich. . 148 Monroe Ave., N.W.
Greensboro, N. C. . . . . 301 S. Elm St.
Greenville, S. C. . . . . 108 W. Washington St.
Hagerstown, Md. . . . . Professional Arts Bldg.
Harrisburg, Pa. . . . . 300 N. Second St.
Hartford 3, Conn. . . . . 410 Asylum St.
Houston 1, Texas . . . . . 1312 Live Oak St.
Indianapolis 4, Ind. . . . . 110 N. Illinois St.
Jackson, Mich. . . . . 120 W. Michigan Ave.
Jackson 1, Miss. . . . . 203 W. Capitol St.
Jacksonville 2, Fla. . . . . 700 E. Union St.
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Johnstown, Pa. . . . . 841 Oak St.
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Norfolk 10, Va. . . . . 229 W. Butte St.
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Oklahoma City 2, Okla. . . . 119 N. Robinson St.
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Waterloo, Iowa . . . . . 206 W. 4th St.
Wheeling, W. Va. . . . . 40 Fourteenth St.
Wichita 2, Kan. . . . . 200 E. First St.
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Worcester 8, Mass. . . . . 507 Main St.
York, Pa. . . . . 56 N. Harrison St.
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