INSTRUCTIONS

Directional Overcurrent Relays

CJC15M

CJCG16M

GE Protection and Control
205 Great Valley Parkway
Malvern, PA 19355-1337

CONTENTS

DIRECTIONAL OVERCURRENT RELAYS

CJC15M
CJCG16M

DESCRIPTION

The relays covered by these instructions are directional overcurrent relays consisting of a high-speed directional unit and an instantaneous overcurrent unit. Contacts of the directional unit are internally connected to torque control the instantaneous overcurrent unit. Both units are of the induction cup type. A target seal-in unit is also included.

The CJC15M relay is a phase relay which is mounted in an M1-size drawout case. Internal connections for the relay are shown in Figure 5, and the outline and mounting dimensions in Figure 17.

The CJCG16M relay is intended for ground fault protection of transmission lines. The relay is mounted in an M2-size drawout case. Internal connections are shown in Figure 6, and the outline and mounting dimensions in Figure 18.

APPLICATION

CJC15M PHASE RELAY

The CJC15M is a directional overcurrent relay that can be applied to provide direct tripping for phase-to-phase faults on a transmission line. Typical external connections for this application are shown in Figure 7. The quadrature connection shown in the figure provides a reliable potential supply for the directional unit. With this connection, the current at unity power factor leads the polarizing voltage by 90 degrees. The directional unit has an approximate maximum torque angle of 45 degrees lead (current leads voltage). Hence, maximum torque will be developed when the current lags its unity power factor position by 45 degrees. Since fault currents are generally highly lagging, the maximum torque condition will be approached during fault conditions.

CJCG16M RELAY

The CJCG16M relay is a directional overcurrent relay which can be used for ground fault protection of transmission lines. It can be applied to provide direct tripping of the local breaker as shown in the typical external connections in Figure 8, or it can be used in a permissive overreaching transfer tripping scheme as shown in the typical external connections of Figure 8A.

The directional unit of the CJCG16M relay is dual-polarized. It may be polarized by current alone, by voltage alone, or by both simultaneously. The simultaneous use of

both sets of polarizing coils is advantageous on applications where current and potential polarizing sources are both available and there is a possibility that one or the other source may be temporarily lost.

When potential is polarized, the potential coils of the relay are connected to a set of potential transformers, which is connected wye-broken delta. (Broken delta means a complete delta with one corner left open, and should not be confused with the open-delta of V-connection of two potential transformer windings.) If the potential transformers are connected wye-wye, auxiliary wye-broken delta potential transformers should be used to obtain the zero sequence polarizing voltage. Current polarization is obtained by connecting the CJCG16M current polarization circuits to a current transformer in the neutral of a suitable power transformer, as shown in the external connection diagrams.

The instantaneous overcurrent unit torque control circuit is provided with a movable red lead, as shown in Figue 6. When the unit is shipped from the factory, this red lead is connected to point A, providing torque control of the overcurrent unit by the directional unit contacts. The red lead can be reconnected to point B to permit independent operation of the overcurrent unit.

CONSTRUCTION

The Type CJC15M relay is mounted in an M1-size case, and the Type CJCG16M relay in a M2-size case. These cases have terminals in the rear for external connections.

The electrical connections between the relay units and the case terminals are made through stationary molded inner and outer blocks, between which nests a removable connection plug, that completes the circuits. The outer blocks attached to the case have studs for the external connections and the inner blocks have terminals for the internal connections.

Every circuit in the drawout case has an auxiliary brush, as shown in Figure 16, to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars (see internal connections in Figures 5 and 6), and on those circuits it is especially important that the auxiliary brush makes contact with adequate pressure to prevent the opening of interlocking circuits, as indicated in Figure 16.

The relay mechanism is mounted in a steel framework, called a cradle, and is a complete unit with all leads terminated at the inner block. The cradle is held firmly in the case with a latch at both top and bottom, and by a guide pin at the back of the case. 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 drawn to the case by thumbscrews, holds the connecting plug in place.

The relay case is suitable for either semi-flush or surface mounting on all panels up to two inches thick. Appropriate hardware is available; however, panel thickness must be indicated on the requisition to insure that proper hardware will be included. The relay consists of two induction cylinder units, a directional unit and an instantaneous overcurrent unit.

The directional unit is of induction-cylinder construction, with a laminated stator having eight poles projecting inward and arranged symmetrically around a stationary central core. The cup-like aluminum induction rotor is free to operate in the annular air gap between the poles and the core. The poles are fitted with current operating coils and potential or current polarizing coils.

The principle by which torque is developed is the same as that of an induction disk relay with a wattmetric element, although in arrangement of parts, the unit is more like a split-phase induction motor. The induction-cylinder construction provides higher torque and lower rotor inertia than the induction-disk construction, resulting in a faster and more sensitive relay.

The instantaneous unit is similar in construction to the directional unit described above, differing only in coil turns and connections. The four corner coils consist of two windings: an inner winding consisting of a large number of turns of fine wire, and an outer winding having a few turns of heavy wire. The outer windings of the corner coils are connected either in series or in parallel with the four side coils by tap links provided on the relay. These series or parallel combinations are connected in series with the operating coil of the directional unit. The inner windings of the corner coils are all connected in series, and in turn are connected in series with a capacitor and the contacts of the directional unit. This circuit thus controls the torque of the instantaneous overcurrent unit. When the directional unit contacts are open, the instantaneous unit will not develop torque. When the directional unit contacts are closed, the instantaneous unit will develop torque in proportion to the square of the current.

The contacts of both units shown in Figure 14 are specially constructed to suppress bouncing. The stationary contact (G) is mounted on a flat spiral spring (F) backed up by a thin diaphragm (C). These are both mounted in a slightly inclined tube (A). A stainless steel ball (B) is placed in the tube before the diaphragm is assembled. When the moving contact hits the stationary contact, the energy of the former is imparted to the latter and then to the ball, which is free to roll up the inclined tube. Thus, the moving contact comes to rest with substantially no rebound or vibration. To change the stationary contact mounting spring, remove the contact barrel and sleeve as a complete unit after loosening the screw at the front of the contact block. Unscrew the cap (E). The contact and its flat spiral mounting spring may then be removed. This low gradient contact is shown in Figure 15.

A hi-seismic target and seal-in unit is mounted on the left side of the directional unit. When the hi-seismic target and seal-in unit picks up, a target is raised into view and latched. The target will remain exposed until released by the reset mechanism located at the lower left hand corner of the cover assembly.

RATINGS

The CJC relays are rated for 60 hertz. Ratings of the operating current cicuits of the instantaneous overcurrent and directional unit are shown individually. However, since all operating current circuits are normally connected in series, the operating coil ratings of all three units should be considered in determining the rating of the entire operating circuit.

INSTANTANEOUS UNIT

Ranges and ratings of the instantaneous units, relay terminals 4 and 6, are shown in Table I.

TABLE I

TOTAL RANGE (AMPS)	CONNECTIONS	PICKUP RANGE (AMPS)	CONTINUOUS RATING (AMPS)	ONE SECOND RATING (AMPS)
0.5-4	SERIES	0.5- 2	1.9	60
	PARALLEL	1 - 4	3.0	120
2-16	SERIES	2 - 8	5.0	200
	PARALLEL	4 -16	10.0	260
10-80	SERIES	10-40	9.0	220
	PARALLEL	20-80	18.0	260

DIRECTIONAL UNIT - CJC15M

The directional unit operating relay terminals 4 and 5 has a six ampere continuous rating, and a 200 ampere one second rating. The potential polarizing circuit, terminals 7 and 8, is continuously rated.

DIRECTIONAL UNIT - CJCG16M

The directional unit operating relay terminals 4 and 5 has a six ampere continuous rating, and a 200 ampere one second rating. The current polarizing circuit, terminals 7 and 8, has a five ampere continuous rating, and a 150 ampere one second rating. The potential polarizing coil, terminals 9 and 10, will withstand 120 volts continuously, and 360 volts for 60 seconds.

HI-SEISMIC TARGET AND SEAL-IN UNIT

The hi-seismic target and seal-in unit ratings are shown in Table II.

TABLE II

		TAP		
		0.2	0.6	2.0
DC Resistance (±10%)	(ohms)	8.0	0.78	0.24
Minimum Operating	(amperes)	0.2	0.6	2.0
Carry Continuously	(amperes)	0.3	1.2	3.0
Carry 30 amps for	(seconds)	0.03	0.5	4.0
Carry 10 amps for	(seconds)	0.25	5.0	30.0
60 Hz Impedance	(ohms)	68.6	6.2	0.73

If the tripping current exceeds 30 amperes, an auxiliary relay should be used. The connections should be such that the tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

BURDENS

CJC15M

The potential circuit of the directional unit at 60 hertz and rated voltage is ten volt-amperes at 0.89 power factor. Table III gives the total burden of the current circuit, terminals 5 and 6, at five amperes, 60 hertz, at the minimum tap. Volt-amperes = I^2Z, I = five amperes, Z at minimum tap.

TABLE III

CURRENT RANGE (AMPS)	IOC UNIT CONNECTIONS	IMPEDANCE (OHMS)	VOLT (I^2Z) AMPERES	POWER FACTOR
0.5 - 4	0.5 - 2 1 - 4	10.36 2.59	259.0 64.75	0.39 0.39
2 - 16	2 - 8 4 - 16	1.07 0.57	26.75 14.27	0.45 0.50

CJCG16M

The capacitive burden of the potential polarizing circuit of the directional unit at 60 hertz and 120 volts is ten volt-amperes at 0.87 power factor. Table IV gives the polarizing current circuit burdens of the directional unit at five amperes and 60 hertz.

TABLE IV

CIRCUIT (TERMINALS)	Z (OHMS)	VA	PF	WATTS
Operating	0.46	12.0	0.52	6.24
Polarizing (7-8)	0.24	6.0	0.95	5.7

Table V gives the total burden of the current circuit, terminals 5 and 6, at five amperes, 60 hertz. Volt amperes = I^2Z, I = five amperes, Z at minimum tap.

TABLE V

CURRENT RANGE (AMPS)	IOC UNIT CONNECTIONS	IMPEDANCE (OHMS)	VOLT (I^2Z) AMPERES	POWER FACTOR
0.5 - 4	0.5 - 2	18.54	464.0	0.41
	1 - 4	4.64	116.0	0.43
2 - 16	2 - 8	1.16	29.0	0.41
	4 -16	0.659	16.47	0.437
10 - 80	10 -40	0.16	4.0	0.496
	20 -80	0.040	1.0	0.496

CHARACTERISTICS

DIRECTIONAL UNIT - CJC15M

At the maximum torque angle, the directional unit will pick up at one percent of rated voltage with two amperes current. The time curve is shown in Figure 9.

DIRECTIONAL UNIT - CJCG16M

The directional unit is rated for a minimum pickup from 3.6 to 14.4 volt-amperes when potentially polarized, and produces maximum torque when the current lags the voltage by 60 degrees. When current polarized, the product pickup of amperes times amperes is 0.25 to 1.0. With current polarization, the directional unit produces maximum torque when the operating and polarizing currents are in phase.

If dual polarization is used, the directional unit pickup may be explained by the following equation for pickup at the minimum setting:

$$3.6 = I_O V_p \cos (0- - 60^o) + 14.4\ I_O I_p \cos 0/$$

where:

I_O = operating current (amperes)

V_p = polarizing voltage (volts)

I_p = polarizing current (amperes)

0- = angle by which I_O lags V_p

0/ = angle beween I_O and I_p

The time curve for the directional unit is shown in Figure 9A.

INSTANTANEOUS UNIT

The pickup of the directionally controlled instantaneous unit can be adjusted over an eight-to-one range. The time curves are shown in Figure 10.

HI-SEISMIC TARGET AND SEAL-IN UNIT

The hi-seismic target and seal-in unit has two tap selectors located on the front of the unit (see Figures 1 and 3).

RECEIVING, HANDLING AND STORAGE

These relays, when not included as 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

GENERAL

The relays should be examined and tested upon delivery to ensure that no damage has been sustained in shipment and that they function properly. If the examination or test indicates that readjustment is necessary, refer to the section on **SERVICING.**

The following tests may be performed as part of the installation of the relay 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 the relays.

VISUAL INSPECTION

Check the nameplate stamping to ensure 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 molded parts or other signs of physical damage, and that all the screws are tight.

MECHANICAL INSPECTION

Instantaneous Unit

1. Rotating shaft end play should be 0.015-0.020 inch.
2. Contact gap should be 0.028-0.036 inch.
3. There should be no noticeable friction in the rotating structure.
4. The contact should be open and should reset against the backstop when the relay is well leveled and in its upright position.

Directional Unit

1. Rotating shaft end play should be 0.015-0.020 inch.
2. Contact gap should be 0.015-0.025 inch on the low gradient front contact.
3. The front contact should close approximately 0.005-0.010 inch before the rear contacts.

Hi-Seismic Target and Seal-in Unit

1. The armature and contacts should move freely when operated by hand.
2. The target should latch into view when the armature is raised, and should unlatch when the target release arm is operated.

DRAWOUT RELAYS, GENERAL

Since all drawout relays in service operate in their cases, it is recommended that they be tested in their cases or an equivalent steel case. In this manner, any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a 12XLA13A test plug. This plug makes connections only with the relay and does not disturb any shorting bars in the case. The 12XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it also requires CT shorting jumpers and the exercise of greater care since connections are made to both the relay and the external circuitry.

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 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, RL or RC networks, or saturating electromagnets (such as time overcurrent relays), would be essentially affected by non-sinusoidal waveforms.

DIRECTIONAL UNIT - CJC15M

Polarity Check

The polarity of the external connections to the directional unit may be verified by observing the direction of contact armature torque when the line is carrying load at unity power factor, or slightly lagging power factor. Note that in most directional overcurrent relay applications, the desired directions are contact closing for power flow away from the bus, and contact opening for power flow toward the bus. Refer to Figure 11 for a more accurate method of checking the polarity of the external connections.

Figure 12 shows the test connections for checking the polarity of the directional unit.

DIRECTIONAL UNIT - CJCG16M

Current Polarization

Connect the relay per the test connections of Figure 19. The unit should close its contacts within five percent of 0.5 amperes. The clutch should slip between 8-18 amperes. CAUTION: THIS LEVEL OF CURRENT CAN OVERHEAT THE COIL IF APPLIED TOO FREQUENTLY OR FOR TOO LONG A PERIOD OF TIME.

Potential Polarization

Connect the relay per the test connections of Figure 19. The unit should close its contacts between 0.75-1.75 amperes, with V set for five volts at terminals 9 and 10.

INSTANTANEOUS OVERCURRENT UNIT (DIRECTIONALLY CONTROLLED)

Pickup Setting

The pickup of the instantaneous overcurrent unit can be adjusted over an eight-to-one range, as indicated in Table I, by varying the tension of the spiral control spring and by selection of the appropriate series or parallel connections. The outside end of this spring is fastened to a post on the adjusting ring above the moving contact, and the ring is in turn clamped in position by a hexagonal-head locking screw. If this screw is loosened, the ring can be slipped to vary the spring tension.

Make test connections as shown in Figure 19 for the applicable relay type . When adjusting pickup, the desired pickup current should be passed through the coils and the control spring should be adjusted until the contact just closes. The adjusting ring should then be locked in position and the pickup current rechecked. Note that the directional unit contacts must be held closed during this adjustment.

HI-SEISMIC TARGET AND SEAL-IN UNITS

The target and seal-in unit has an operating coil tapped at 0.2 and 2.0 amperes.

The target and seal-in tap screw should be set in the 0.2 ampere tap when used with trip coils operating on currents ranging from 0.2 to 2.0 amperes at the minimum control voltage. When the trip coil current ranges from two to 30 amperes at the minimum control voltage, the tap screw should be placed in the 2.0 ampere tap.

The seal-in tap screw 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 back in the left-hand contact. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Tap screws should never be left in both taps at the same time.

Pickup and Dropout Tests

1. Connect relay studs 1 and 2 (see internal connections diagram) to a DC source, ammeter and load box, so that the current can be controlled over a range of 0.1 to 2.0 amperes.

2. Close or jumper the contact(s) that parallel the seal-in unit contact.

3. Increase the current slowly until the seal-in unit picks up. See Table VI.

4. Open the parallel contact circuit of step 2; the seal-in unit should remain in the picked up position.

5. Decrease the current slowly until the seal-in unit drops out. See Table VI.

TABLE VI

Target and Seal-in Unit Operating Currents

TAP	PICKUP CURRENT	DROPOUT CURRENT
0.2	0.115 - 0.195	0.05 or more
2.0	1.15 - 1.95	0.50 or more

INSTALLATION

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

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Figures 17 and 18. The internal connection diagrams for the relays are shown in Figures 5 and 6. Typical external connections diagrams are shown in Figures 7, 8 and 8A.

DIRECTIONAL UNIT - CJC15M

Check directional unit polarity see section on **ACCEPTANCE TESTS.**

DIRECTIONAL UNIT - CJCG16M

Check the directional unit for pickup as follows:

1. Connect per Figure 19, if current or dual polarized, and adjust the control spring for 0.5 amperes.

2. Connect per Figure 19, if potential polarized, and adjust the control spring for 3.6 volt-amperes plus or minus ten percent. Ten volts and 0.36 amperes are recommended values for this test.

INSTANTANEOUS OVERCURRENT UNIT

Check pickup setting, see **ACCEPTANCE TESTS.**

HI-SEISMIC TARGET AND SEAL-IN UNIT

1. Make sure that the tap screw is in the desired tap.

2. Perform pickup and dropout tests as outlined in the section on **ACCEPTANCE TESTS.**

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. 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 points listed under ACCEPTANCE TESTS be checked at an interval of from one to two years.

SERVICING

These relays were adjusted at the factory, and their adjustments should not be disturbed. If they are, or if the relay is found to be out of limits during installation or periodic testing, then the checks and adjustments outlined in the following paragraphs should be performed in the laboratory.

DIRECTIONAL UNIT

Bearings

The lower jewel bearing should be screwed all the way in until its head engages the end of the threaded core support. The upper bearing should be adjusted to allow about 1/64 inch end play in the shaft.

To check the clearance between the iron core and the inside of the rotor cup, press down on the contact arm near the shaft, thus depressing the spring-mounted jewel until the cup strikes the iron. The shaft should move about 1/16 inch.

Cup and Stator

Should it be necessary to remove the cup-type rotor from the directional unit, the following procedure should be followed:

All leads to the unit should first be disconnected and tagged for identification when reconnected. The unit can then be removed from the cradle with its mounting plate still attached.

The upper of the three flat-head screws holding the unit to the plate should now be removed. On some models, it may be necessary to remove a resistor or capacitor to expose this screw. The four corner screws clamping the unit together should next be removed, and the entire top structure lifted off. This gives access to the cup assembly and exposes the stator assembly, which should be protected to keep it free from dust and metallic particles until the unit is reassembled.

To remove the shaft and rotor from the contact head assembly, pull out the spring clip at the top of the shaft, and take the clutch adjusting screw out of the side of the molded contact arm. The shaft and cup can now be pulled out of the molding. The rotor must be handled very carefully while it is out of the unit.

Contact Adjustments

Refer to Figures 14 and 15 for identification of low gradient and barrel contact parts respectively, and proceed as follows:

Slightly loosen the locknut which secures the backstop screw (located at the right front corner of the unit) to its support. Unwind the barrel backstop screw so that the moving contact arm is permitted to swing freely. Adjust the tension of each low gradient contact brush so that one-to-two grams of pressure are required at the contact tip in order to cause the end of the brush to separate from the inner face of its respective brush retainer. Adjust the spiral spring until the moving contact arm is in a neutral position, i.e., with the arm pointing directly forward. Loosen the locknut which secures the low gradient stationary contact mounting screw to the stationary contact support. Wind the mounting screw inward until the low gradient stationary and moving contact members just begin to touch. Unwind the mounting screw until the stationary contact brush is vertical with the stationary contact brush retainer down. Then tighten the locknut which secures the mounting screw to the stationary contact support.

Slightly loosen the screw which secures the barrel contact to its support. This screw should be only loose enough to allow the barrel to rotate in its sleeve, but not so loose as to allow the sleeve to move within the support. Wind the backstop screw in until the low gradient moving and stationary contact members just begin to touch. Wind the barrel contact in until the barrel contacts just begin to touch. Unwind the barrel

contact one-quarter turn. Tighten the screw which secures the barrel contact to its support. Unwind the backstop screw two-thirds of a turn. Tighten the locknut screw which secures the backstop screw to its support. Finally, adjust the tension on the low gradient stationary contact brush such that, when the low gradient contacts are made and fully wiped in, there is approximately an equal deflection on each brush.

Torque Adjustment

The directional unit is provided with a notched core which is used to minimize the torque produced on the rotor by current in the operating coils with the polarizing circuits de-energized. This adjustment is made at the factory, and may be checked as follows:

First, short out the potential polarizing circuit, CJC - studs 7 and 8; CJCG - studs 9 and 10. Adjust the control spring so that the moving contact structure is balanced between the stationary contact and the stop. This can be done by loosening the hexagonal-head locking screw, which clamps the spring adjusting ring in position, and turning the ring to the left until the balance point is reached.

Energize the operating circuit with 30 amperes and check that the contact arm does not move. The core should be turned in small steps until a point is reached where there is no "bias" torque from current alone. The core can be turned by loosening the large hexagonal nut on the bottom of the unit and turning the core by means of the slotted bearing screw. This screw should be held securely in position when the nut is retightened. Keep in mind that currents of these magnitudes will cause the coils to overheat if left on for too long. Leave the test current on only for short intervals and allow sufficient time between tests for the coils to cool.

After the torque adjustment has been made, the spiral spring should be set to have barely enough tension to swing the moving contact arm against the stop screw when the unit is de-energized. Sufficient tension will be obtained if the adjusting ring is rotated about one-half inch from the neutral position in the counterclockwise direction, as measured on the periphery of the ring.

Clutch Adjustment

The connections shown in Figure 12 for the polarity check can also be used in making the clutch adjustment. The 50 ohm fixed resistor should be replaced with an adjustable resistor capable of providing the current range listed in Table VI for the relay type and rating in question. A screw projecting from the side of the moving contact arm controls the clutch pressure, and consequently, the current value which will cause the clutch to slip. With rated frequency and at rated volts, the clutch should be set to slip within the limits listed in Table VII. In all cases, the current is in phase with the voltage.

TABLE VII

Directional Unit Clutch Adjustment

IOC UNIT RATING	SUDDENLY APPLIED CURRENT CLUTCH MUST NOT SLIP (AMPS)	SUDDENLY APPLIED CURRENT CLUTCH MUST SLIP (AMPS)
0.5 - 4.0	9	11
2.0 - 16.0	9	11
10 - 80	Adjust/bottom clutch screw and lock	

Note that too frequent or too long applications of these currents will overheat the coils.

INSTANTANEOUS OVERCURRENT UNIT (DIRECTIONALLY CONTROLLED)

Bearings

The section "Bearings," under DIRECTIONAL UNIT, also applies to the bearings of the instantaneous overcurrent unit.

Cup and Stator

The section "Cup and Stator," under DIRECTIONAL UNIT, also applies to the cup and stator of the instantaneous overcurrent unit.

Contact Adjustments

The contact gap may be adjusted by slightly loosening the screw at the front of the contact support. The screw should be only loose enough to allow the contact barrel to rotate in its sleeve.

The backstop screw, fastened with a locknut, should hold the moving contact arm in a neutral position, i.e., with the arm pointing directly forward. By rotating the barrel, advance the stationary contact until it just touches the moving contact. Next, back it away two-thirds of a turn to obtain approximately 0.020 inch gap. Last, tighten the screw which secures the barrel.

The moving contact may be removed by loosening the screw which secures it to the contact arm and sliding it from under the screw head.

CLUTCH ADJUSTMENT

The clutch on the instantaneous overcurrent unit can be adjusted by means of the screw located on the right-hand side of the moving contact arm. If the locknut is loosened and the screw turned in, the current at which the clutch will slip will be increased.

Place the tap plugs in the lower range taps (series). Hold the directional unit contacts closed. Adjust the clutch so that the current at which the cup just starts to slip falls within the limits listed in Table VIII.

TABLE VIII

Directionally Controlled IOC Unit Clutch Adjustment

IOC RANGE	PICKUP RANGE SERIES CONN.	SUDDENLY APPLIED CURRENT CLUTCH MUST NOT SLIP (AMPS)	SUDDENLY APPLIED CURRENT CLUTCH MUST SLIP (AMPS)
0.5 - 4	0.5 - 2	3	4
2 - 16	2 - 18	12	15
10 - 80	10 - 40	60+	--

Note that too frequent or too long application of these currents will overheat the coils.

CONTACT CLEANING

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. 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 and thus prevent closing.

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

RENEWAL PARTS

Sufficient quantities of renewal parts should be kept in stock for 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 the name of the part wanted, quantity required, and complete nameplate data, including the serial number, of the relay.

Since the last edition, Figure 9A has been added, and Figures 8, 9, 17, and 18 have been changed.

Figure 1 (Later) CJC15M Relay, Front View, Removed from Case

Figure 2 (Later) CJC15M Relay, Back View, Removed from Case

Figure 3 (Later) CJCG16M Relay, Front View, Removed from Case

Figure 4 (Later) CJCG15M Relay, Back View, Removed from Case

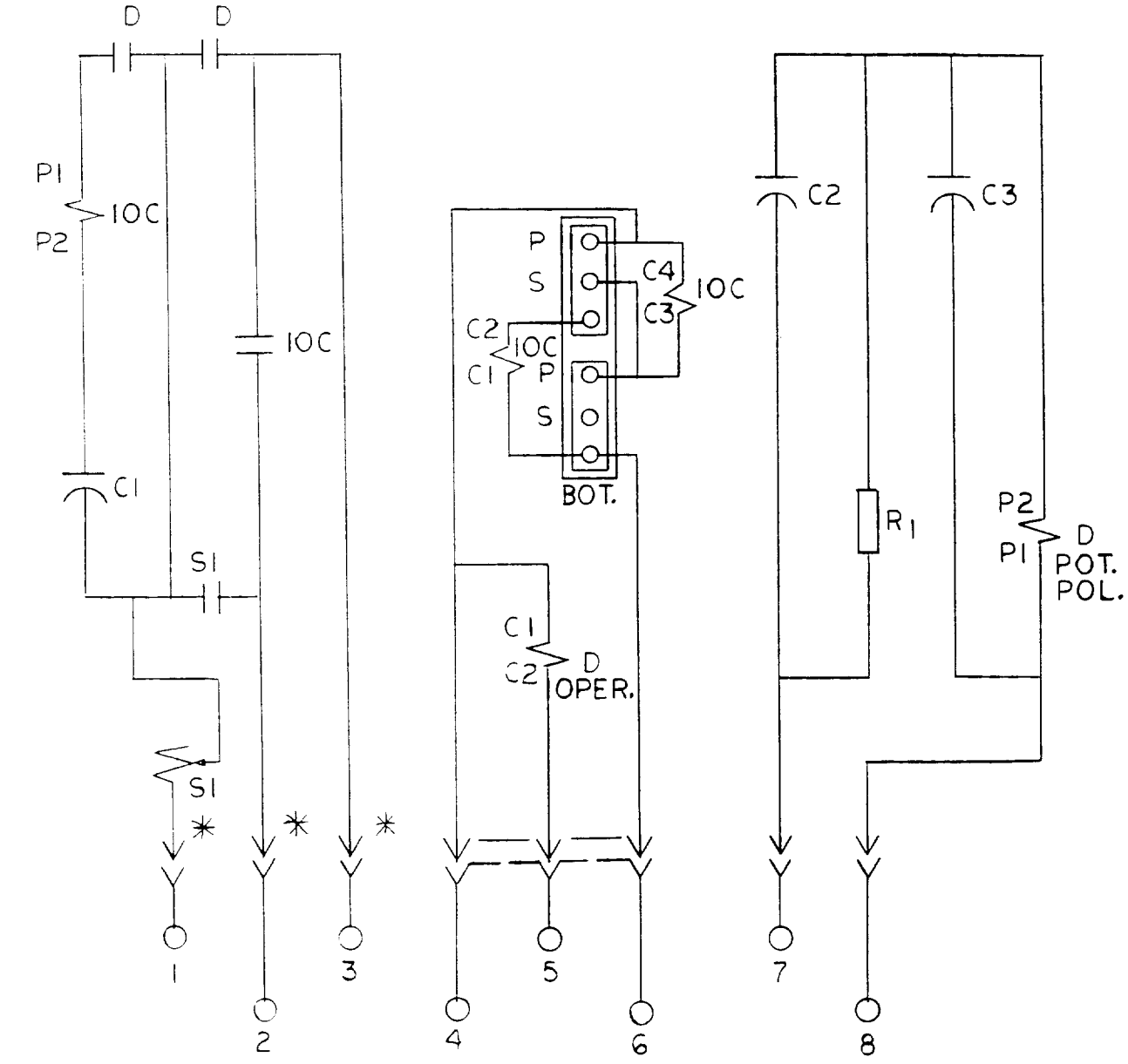


Figure 5 (0275A4374) Internal Connections Diagram for the Type CJC15M Relay

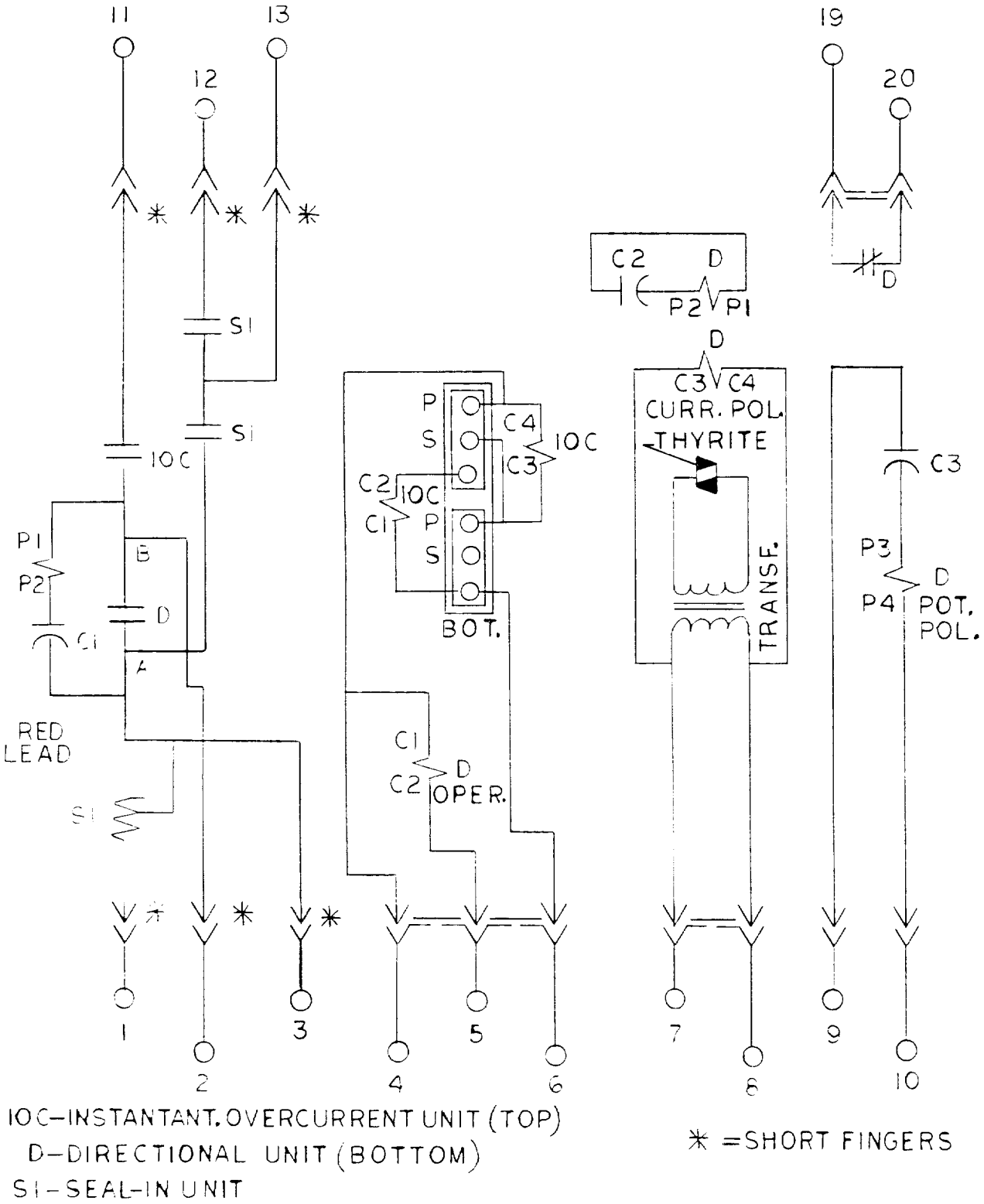
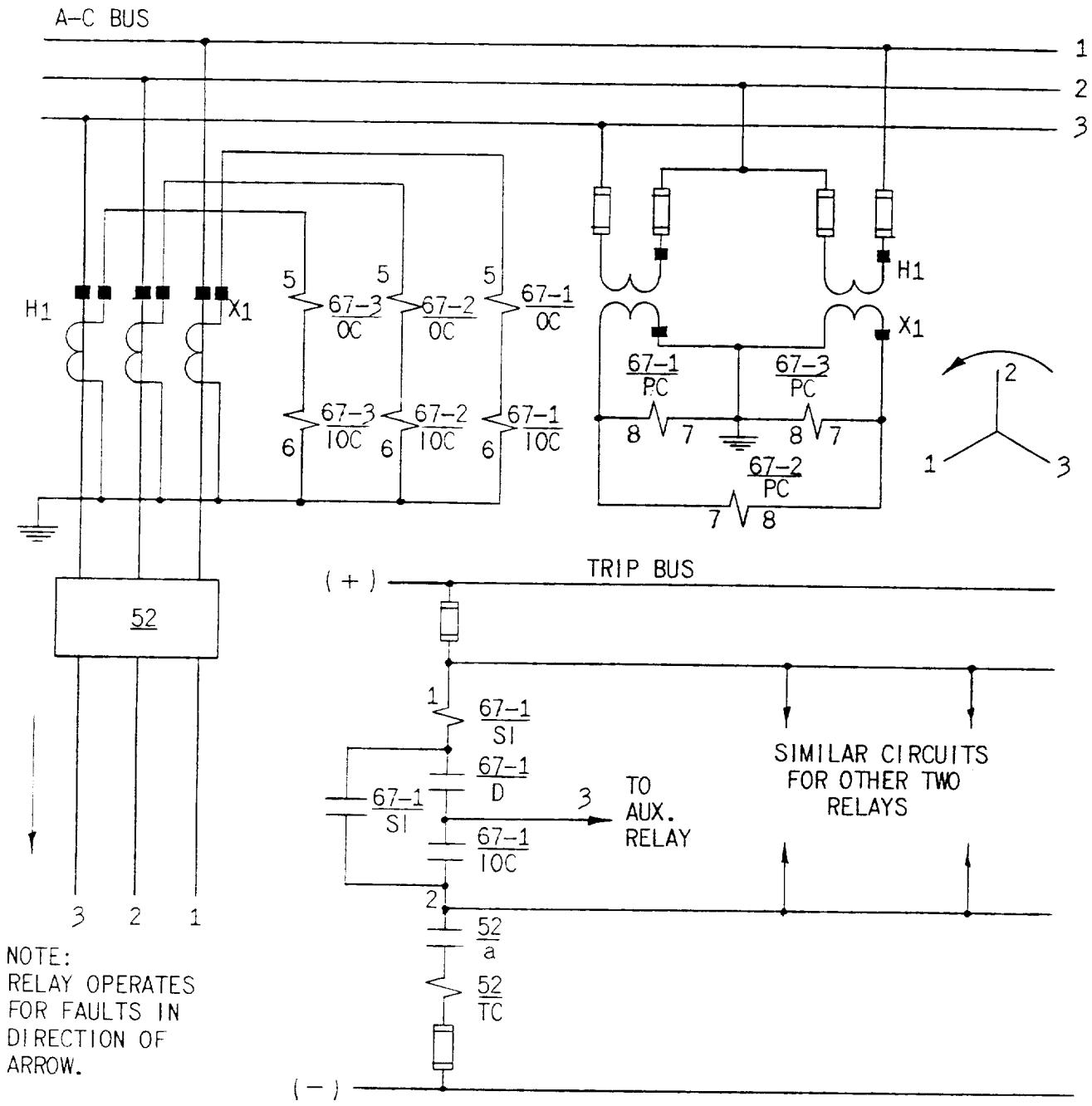


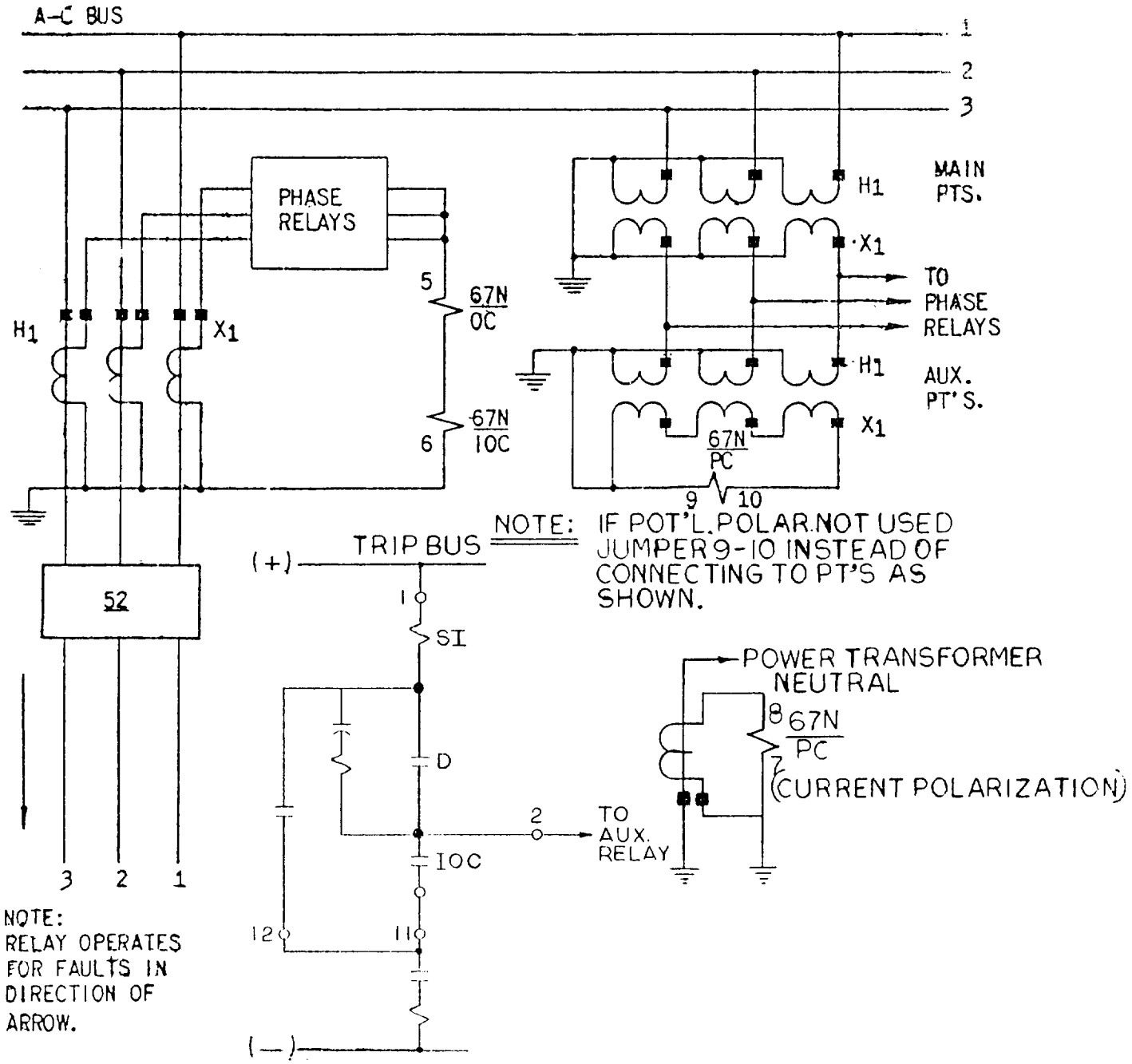
Figure 6(0275A4344) Internal Connections Diagram for the Type CJCG16M Relay



67 - PHASE DIRECTIONAL OVERCURRENT RELAY	
IOC - INSTANTANEOUS OVERCURRENT UNIT D - DIRECTIONAL UNIT SI - SEAL-IN WITH TARGET	OC - DIRECTIONAL UNIT OPERATING COIL PC - DIRECTIONAL UNIT POLARIZING COIL

52 - POWER CIRCUIT BREAKER	
TC - TRIP COIL	a - AUXILIARY SWITCH, CLOSED WHEN BREAKER IS CLOSED

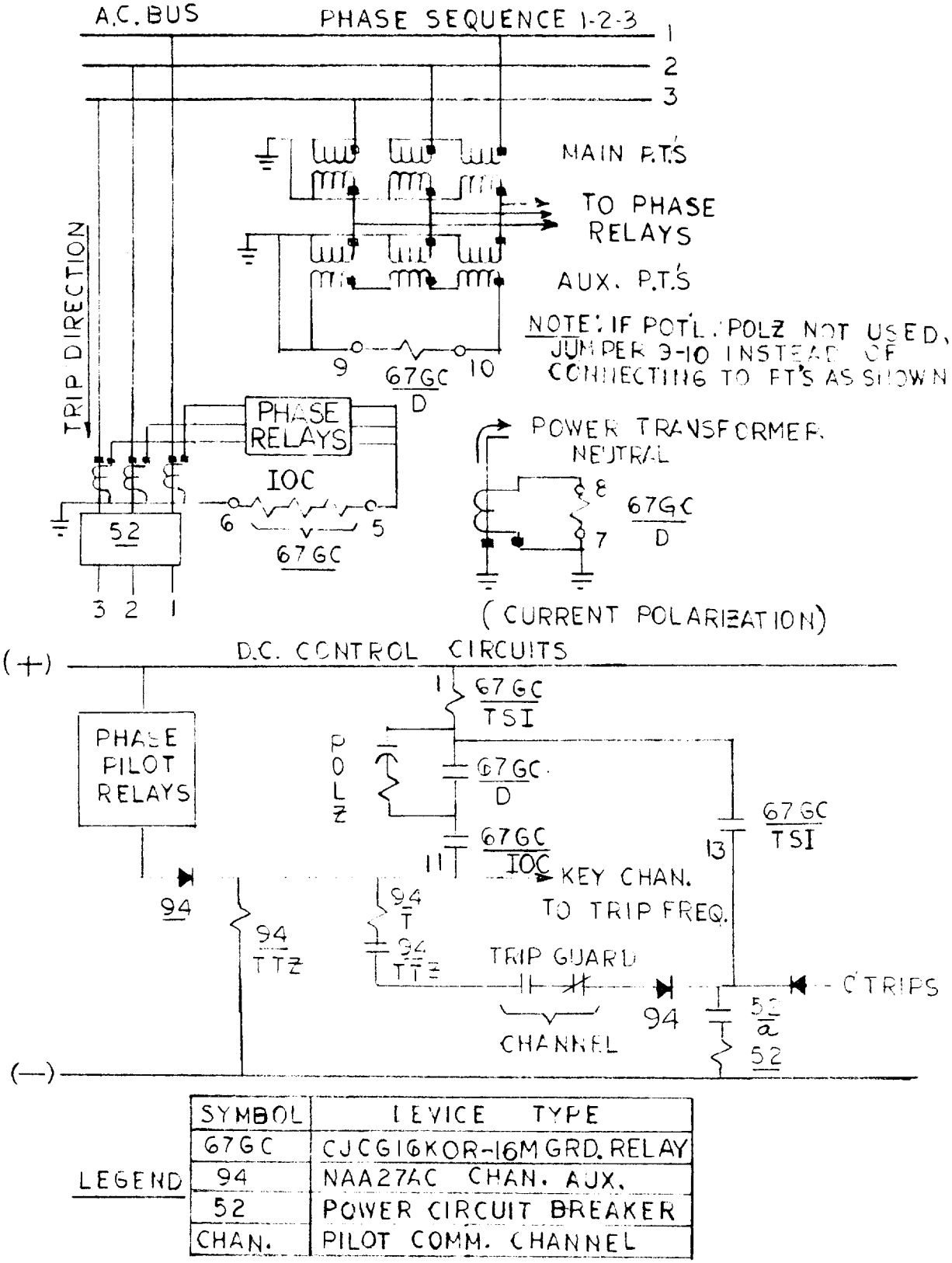
Figure 7 (0418A0929) Typical External Connections Diagram for the Type CJC15M Relay



-CJCG16M(67N)- GROUND DIRECTIONAL OVERCURRENT RELAY	
IOC - INSTANTANEOUS OVERCURRENT UNIT D - DIRECTIONAL UNIT SI - SEAL-IN WITH TARGET	OC - DIRECTIONAL UNIT OPERATING COIL PC - DIRECTIONAL UNIT POLARIZING COIL

52 - POWER CIRCUIT BREAKER	
TC - TRIP COIL	a - AUXILIARY SWITCH, CLOSED WHEN BREAKER IS CLOSED.

Figure 8 (0286A5427) Type CJCG16M Relay - Typical External Connections Diagram for Directional Ground Protection of a Transmission Line



SYMBOL	DEVICE TYPE
67GC	CJCG16KOR-16M GRD. RELAY
94	NAA27AC CHAN. AUX.
52	POWER CIRCUIT BREAKER
CHAN.	PILOT COMM. CHANNEL

LEGEND

Figure 8A (0257A8393 [1]) Type CJCG16M Relay - Typical External Connections Diagram for Permissive Overreaching Transferred Tripping of Transmission Line Protection

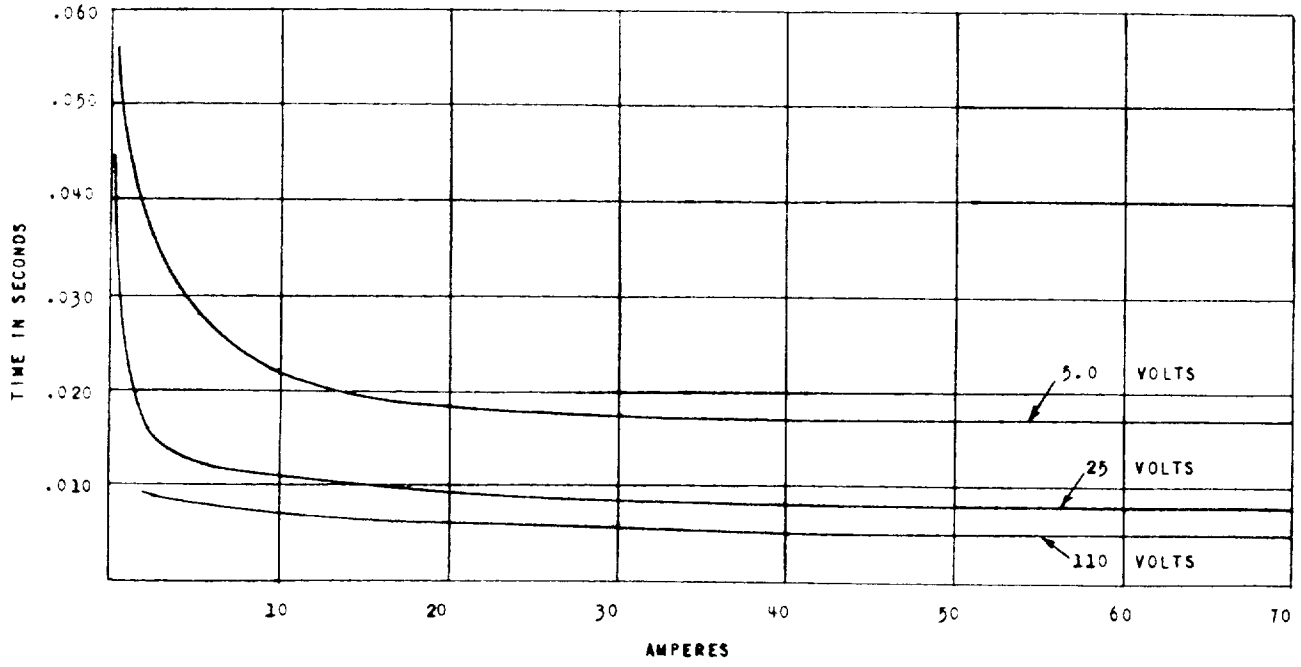


Figure 9 (0286A5416) Directional Unit Time-Current Characteristic of CJC for Voltage Applied in Phase with Current

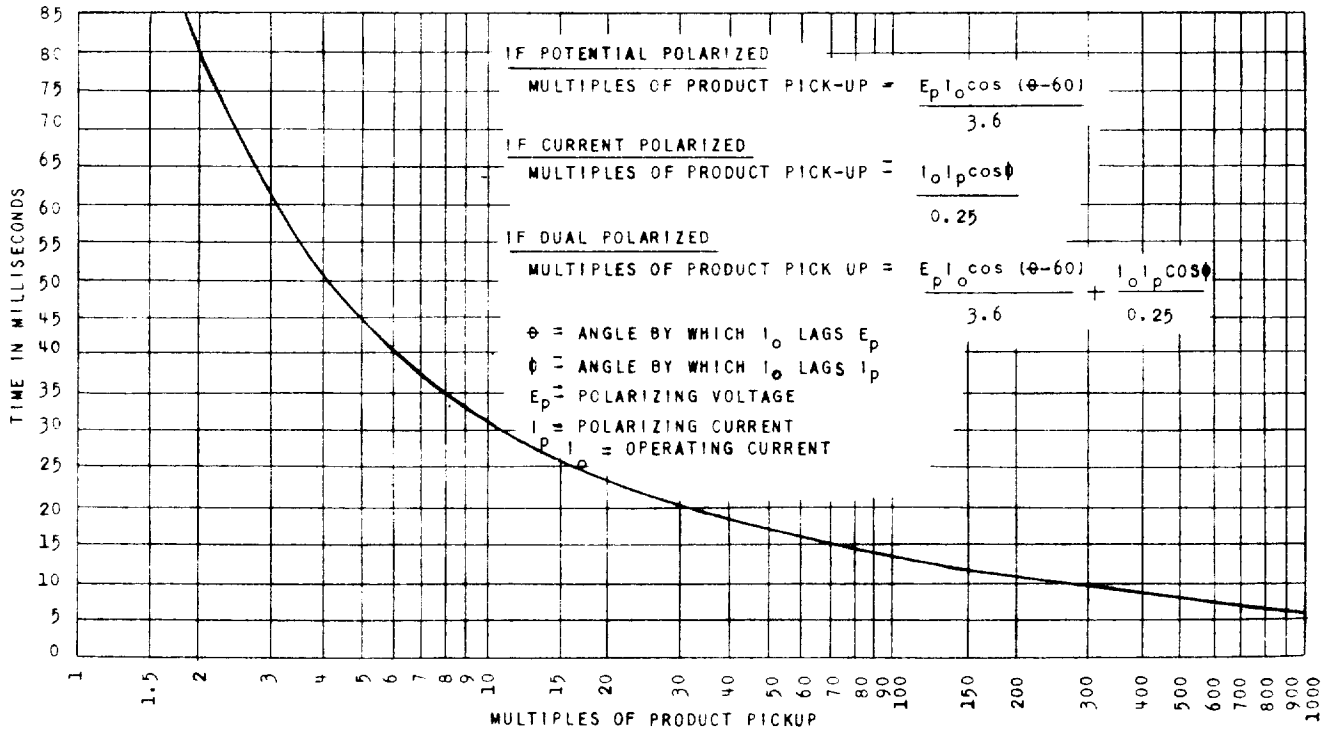


Figure 9A (0376A0934) Directional Unit Time-Current Characteristic of CJCG for Voltage Applied in Phase with Current

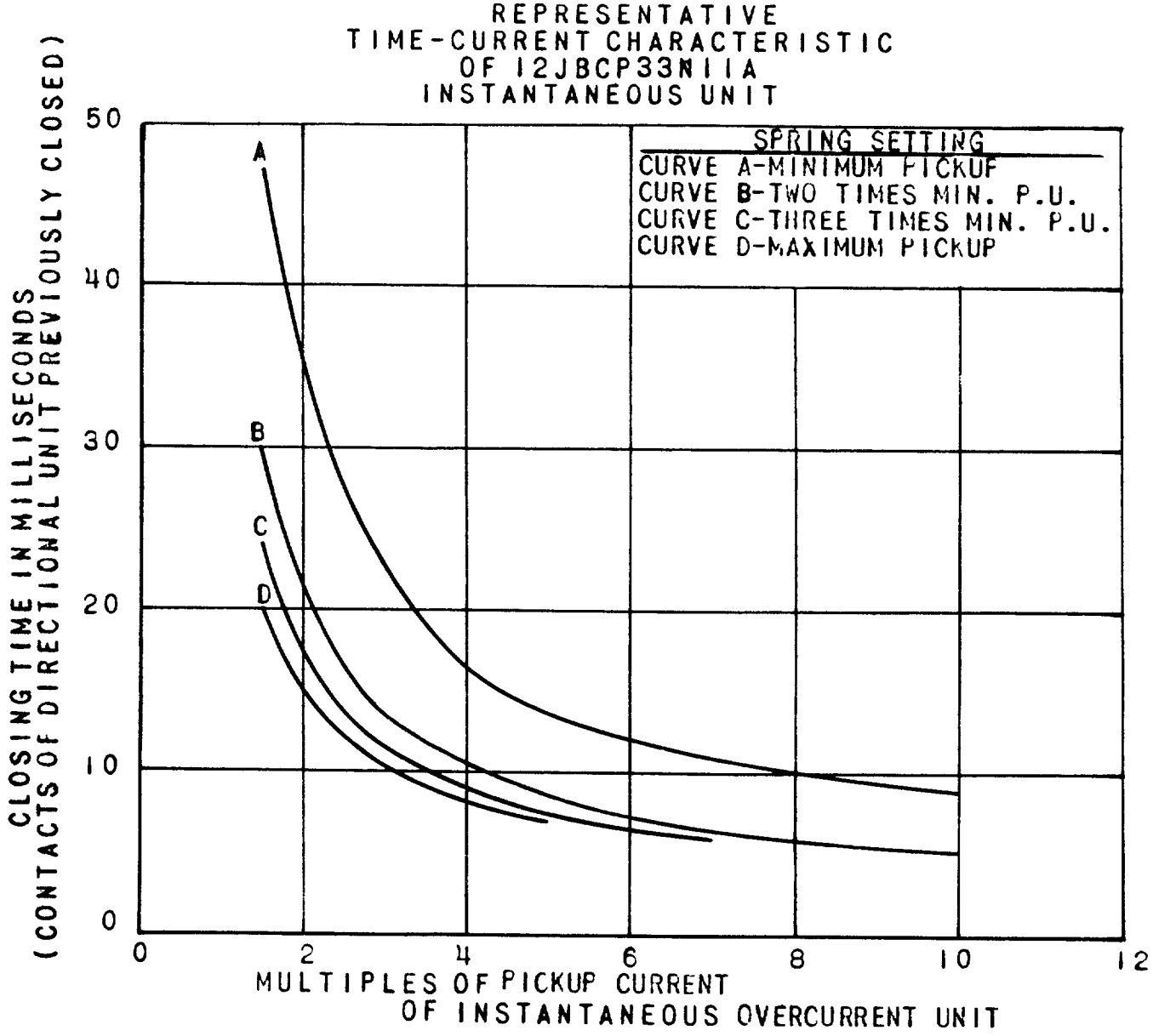
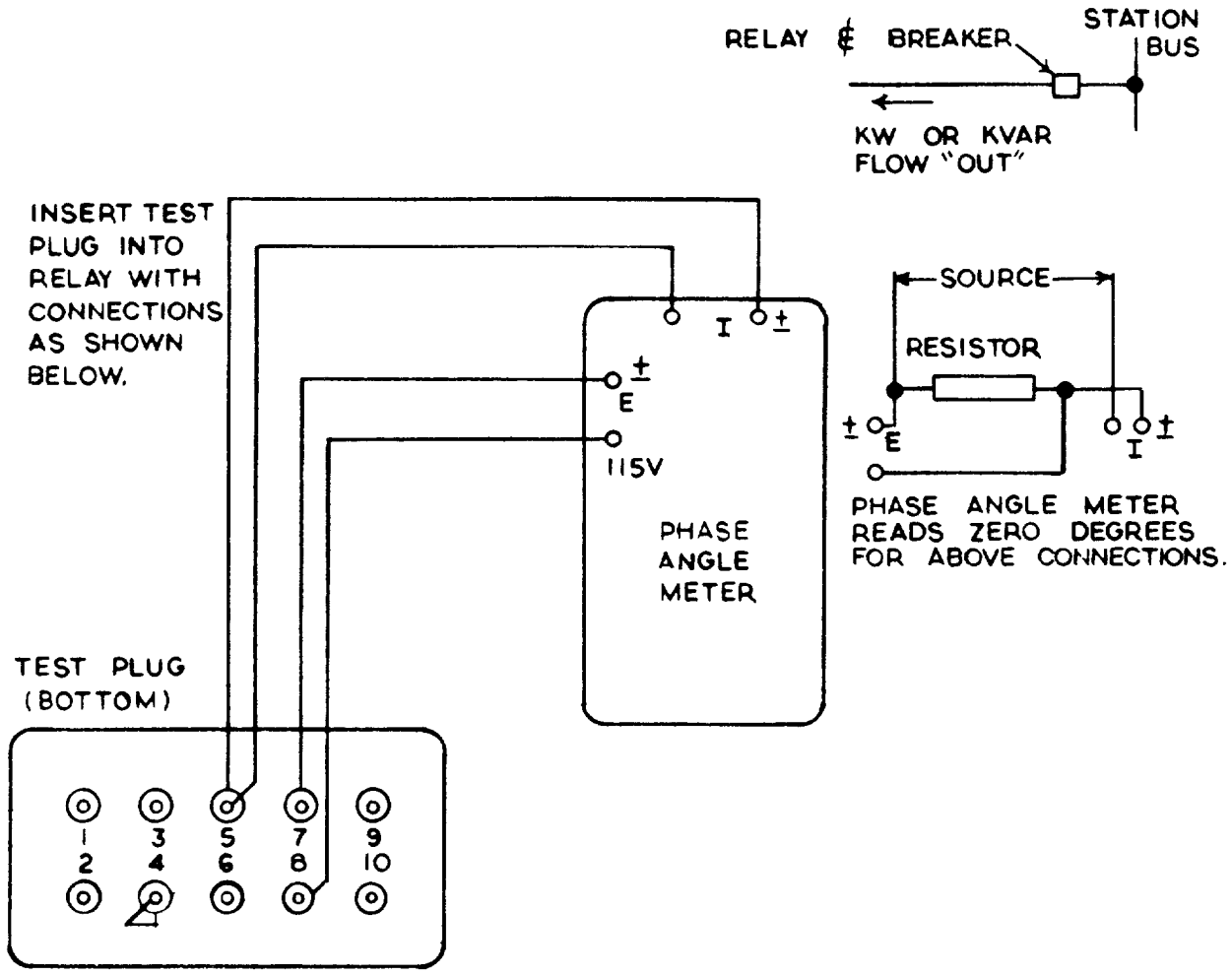


Figure 10 (K-6556439 [2]) Instantaneous Overcurrent Unit Time Curve Characteristic



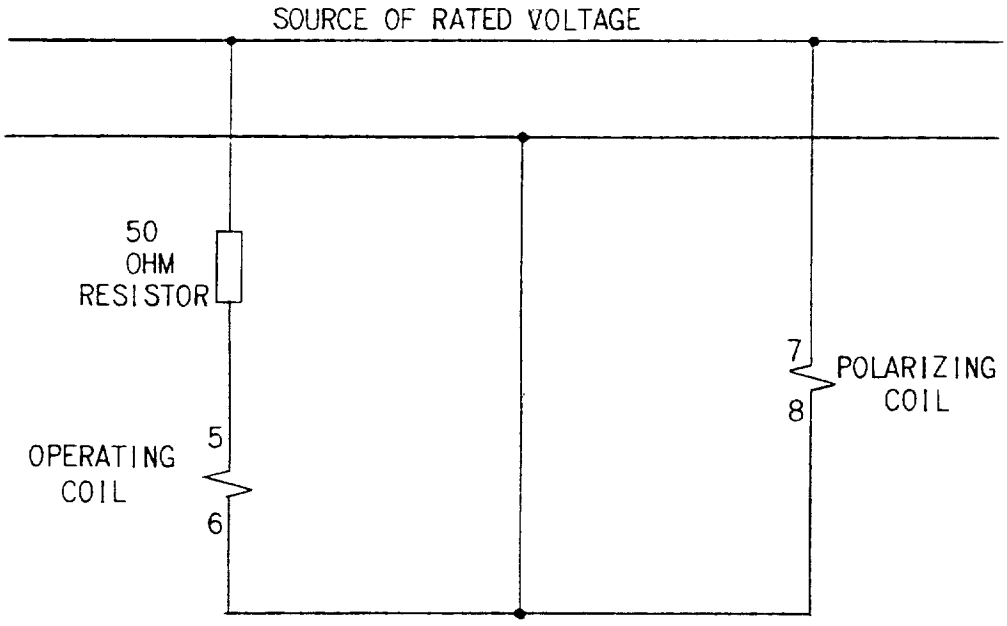
POWER FACTOR ANGLE (DEG. LEAD)	0-45	45-90	90-135	135-180	180-225	225-270	270-315	315-360
KW ¢ KVAR DIRECTIONS WITH RESPECT TO THE BUS	KW OUT > KVAR IN	KVAR IN > KW OUT	KVAR IN > KW IN	KW IN > KVAR IN	KW IN > KVAR OUT	KVAR OUT > KW IN	KVAR OUT > KW OUT	KW OUT > KVAR OUT
METER READING WITH PROPER EXT. CONNS.	90-135	135-180	180-225	225-270	270-315	315-360	0-45	45-90

THE ABOVE RANGES OF PHASE ANGLE METER READINGS ARE THE ANGLES BY WHICH THE CURRENT LEADS THE VOLTAGE WITH THE DESCRIBED CONDITIONS OF POWER (KW) AND REACTIVE POWER KVAR FLOW WITH THE STATION BUS CONSIDERED AS THE REFERENCE IN ALL CASES.

> MEANS GREATER THAN.

CAUTION: MAKE CORRECTIONS FOR METER ERRORS ON LOW CURRENTS, INHERENT IN SOME PHASE-ANGLE METERS.

Figure 11 (0275A4340 [1]) Test Connections for Checking the Polarity of the External Wiring to the Directional Unit



NOTE: THE DIRECTIONAL UNIT CONTACTS SHOULD CLOSE WHEN THE RELAY IS ENERGIZED WITH THE ABOVE CONNECTIONS.

Figure 12 (0418A0970) Test Connections for Checking the Polarity of the Directional Unit's Internal Wiring

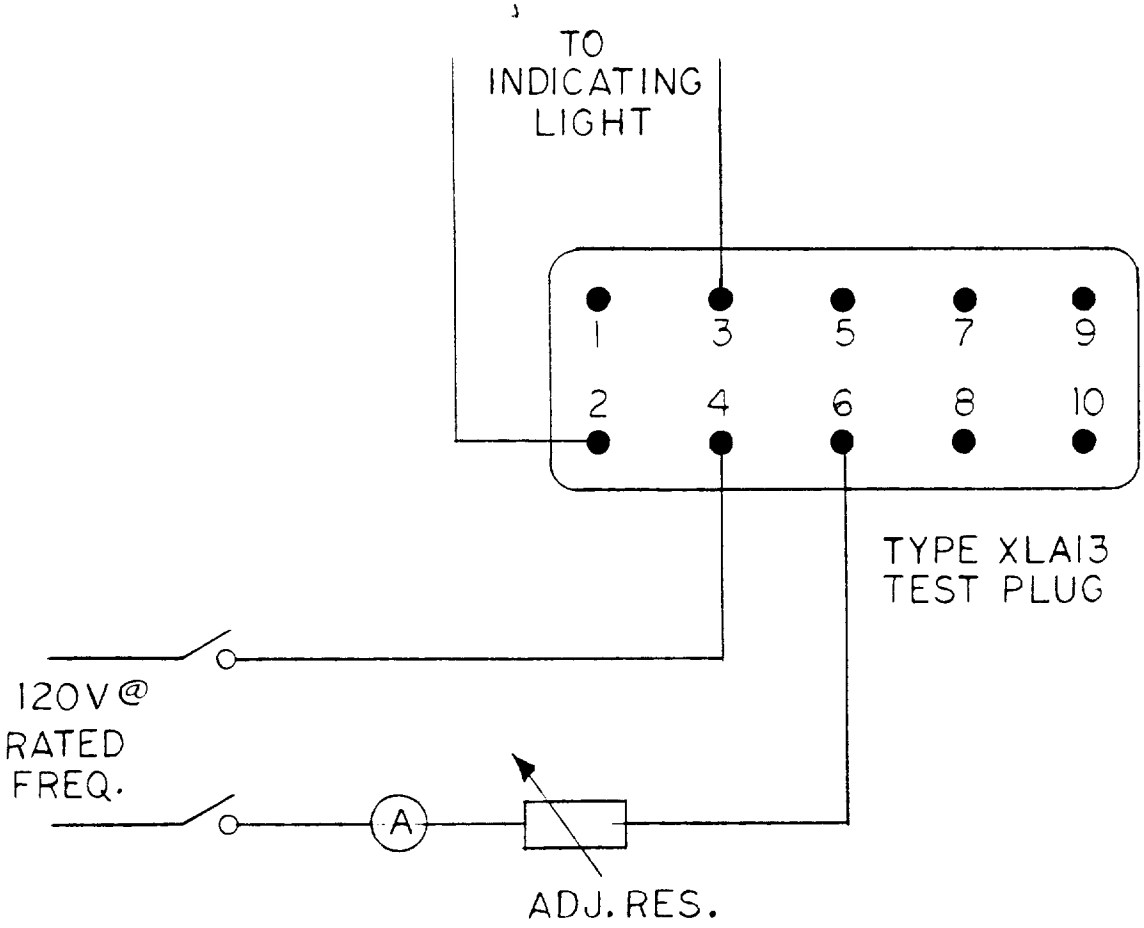
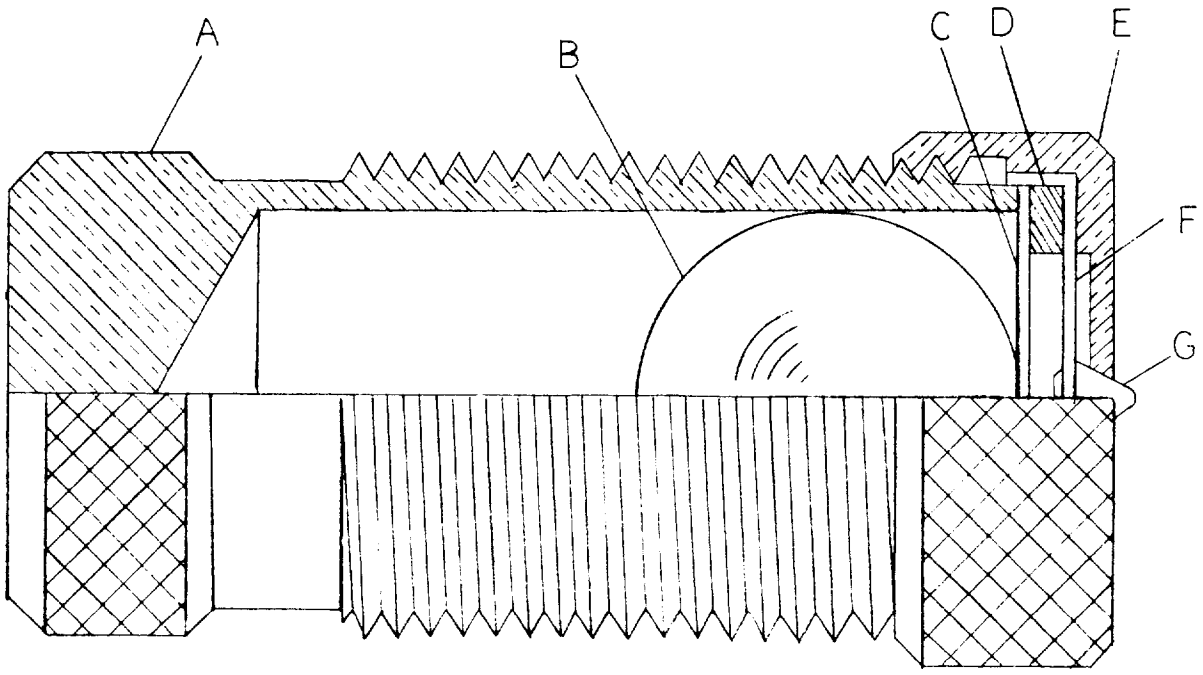


Figure 13 (0275A4338) Test Connections for Checking Pickup of the Instantaneous Overcurrent Unit on the CJC15M Relay



A - INCLINED TUBE
B - STAINLESS STEEL BALL
C - DIAPHRAM
D - SPACER
E - CAP
F - FLAT SPIRAL SPRING
G - CONTACT

Figure 14 (K-6077069 [4]) Barrel Contact Assembly for the Directional and Instantaneous Overcurrent Units

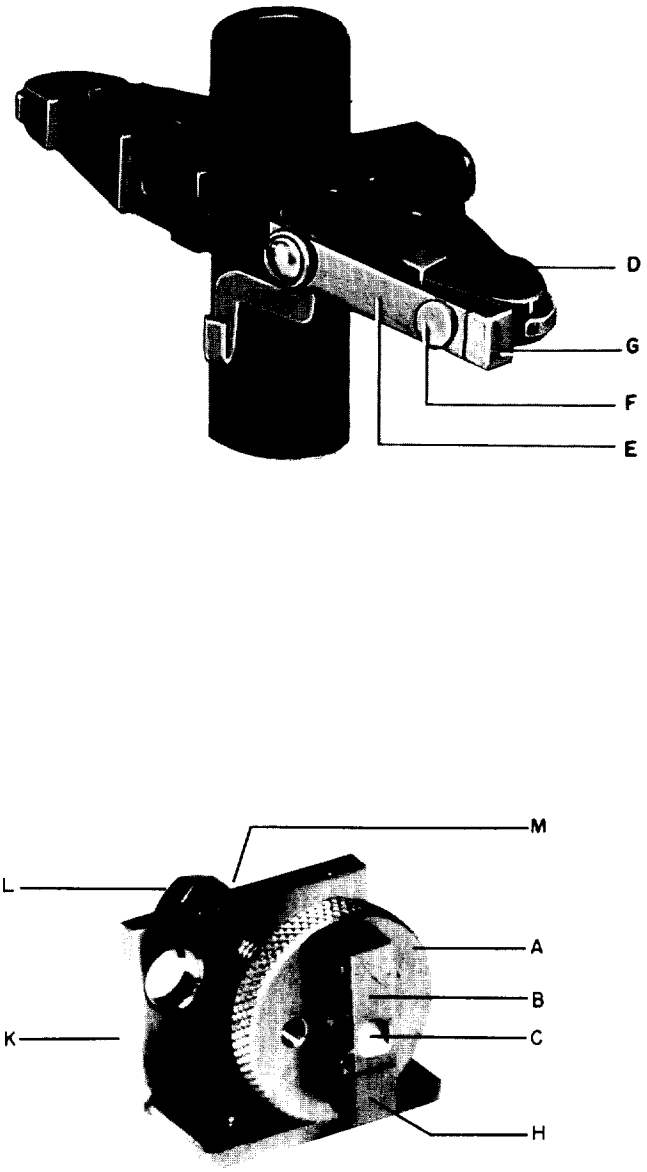
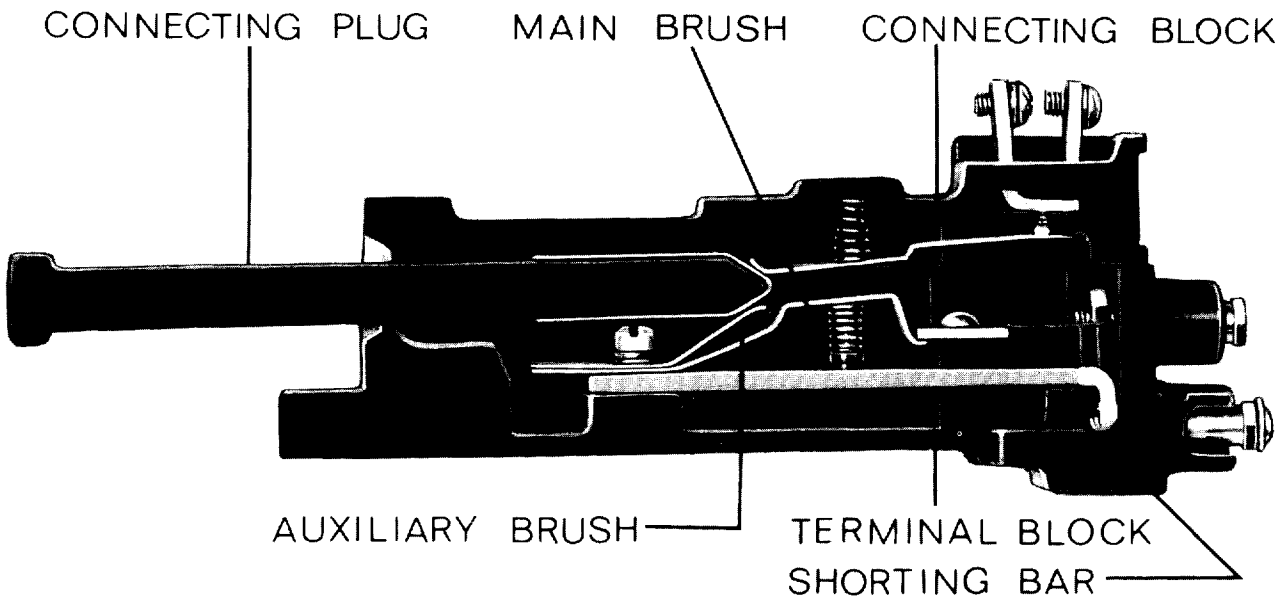


Figure 15 (8023399 and 8027689) Low Gradient Contact Assembly for the Directional Unit



NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Figure 16 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush

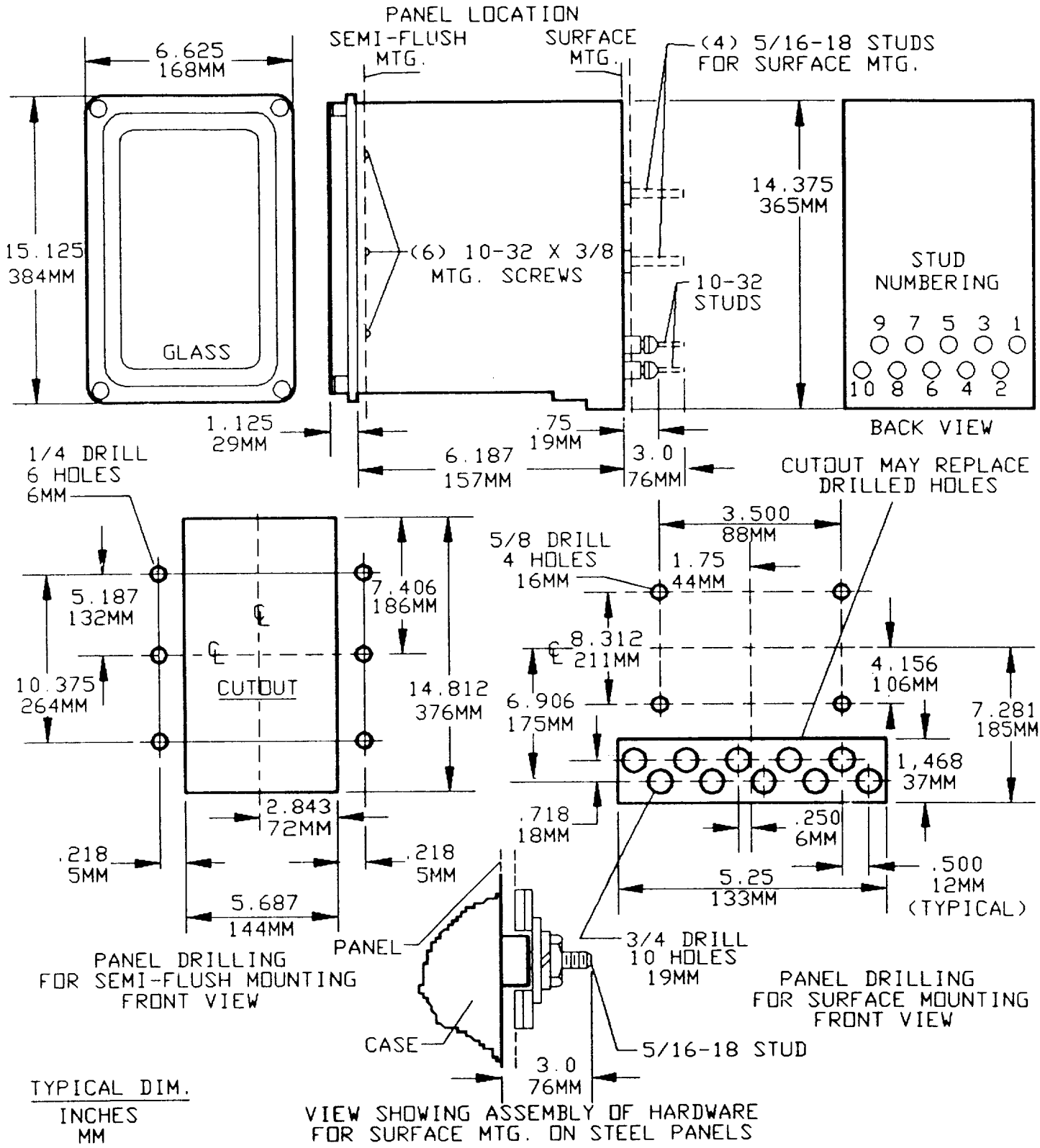


Figure 17 (K-6209273 [5]) Outline and Panel Drilling Dimensions Diagram for the Type CJC15M Relay

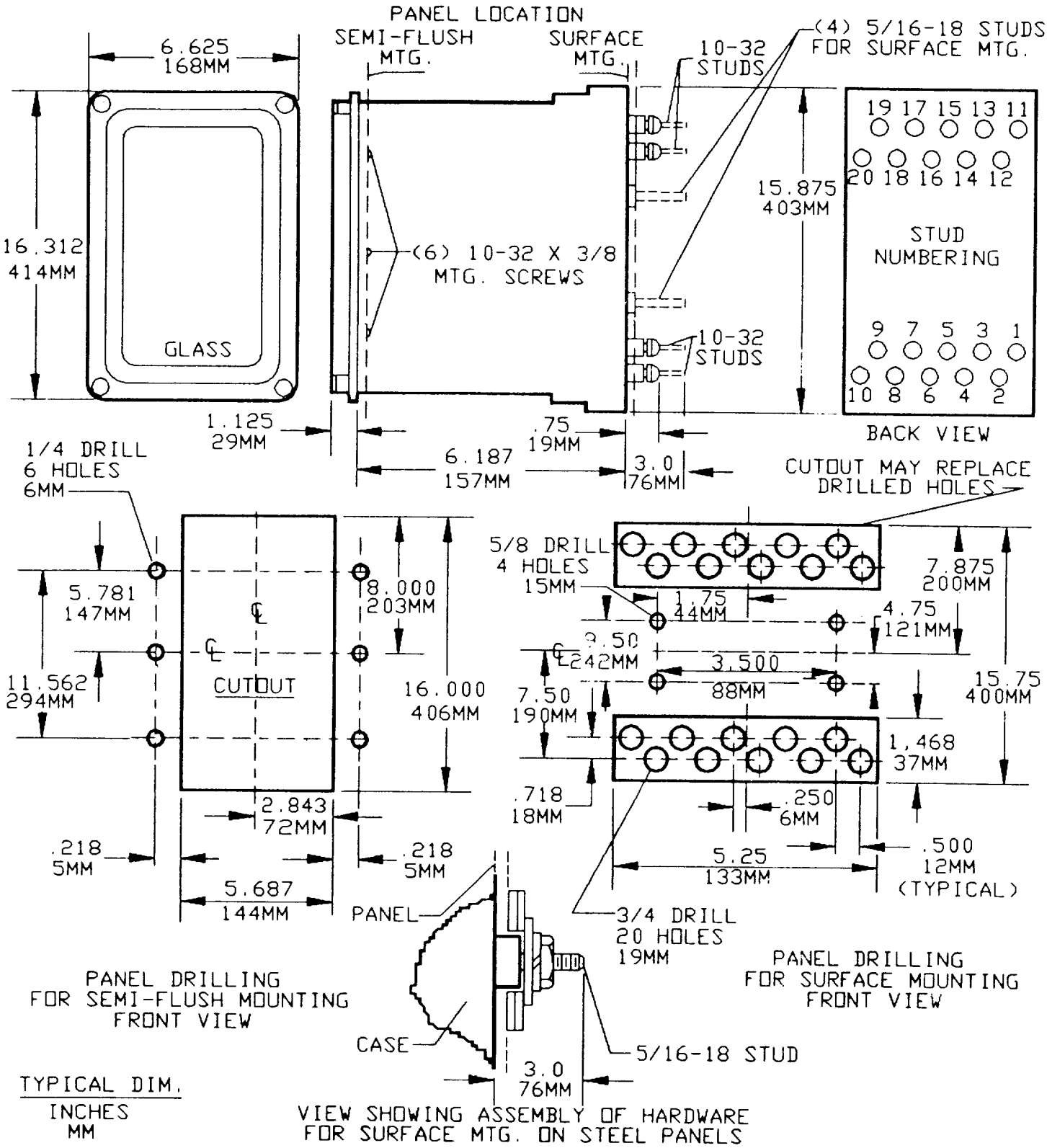
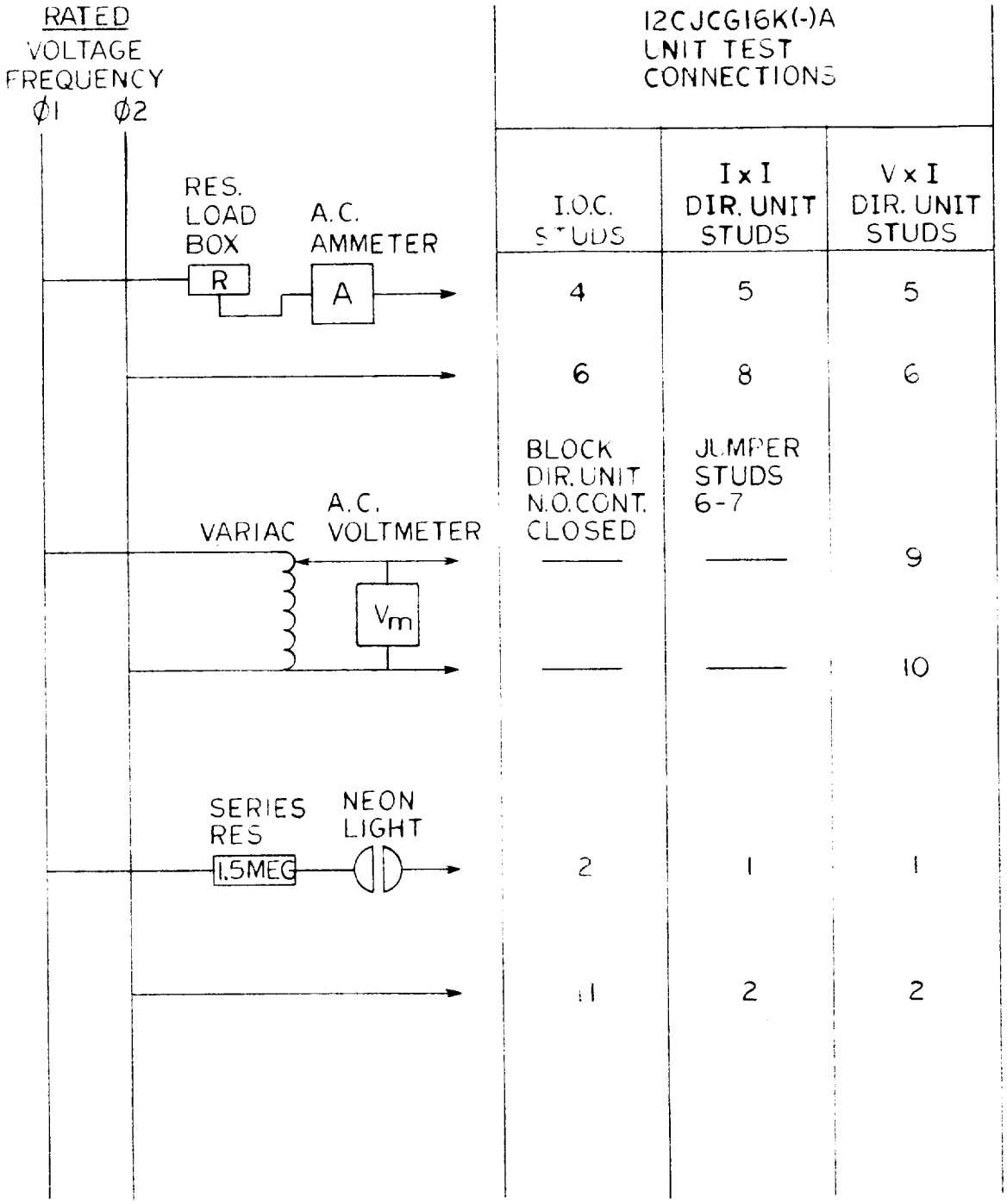


Figure 18 (K-6209274 [6]) Outline and Panel Drilling Dimensions Diagram for the Type CJCG16M Relay



	12CJCG16K(-)A UNIT TEST CONNECTIONS		
	I.O.C. STUDS	I x I DIR. UNIT STUDS	V x I DIR. UNIT STUDS
	4	5	5
	6	8	6
	BLOCK DIR. UNIT N.O.CONT. CLOSED	JUMPER STUDS 6-7	
	———	———	9
	———	———	10
	2	1	1
	11	2	2

Figure 19 (0257A8483 [1]) Test Connection Diagram for the CJCG16M(-)A Relay

GE Power Management

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