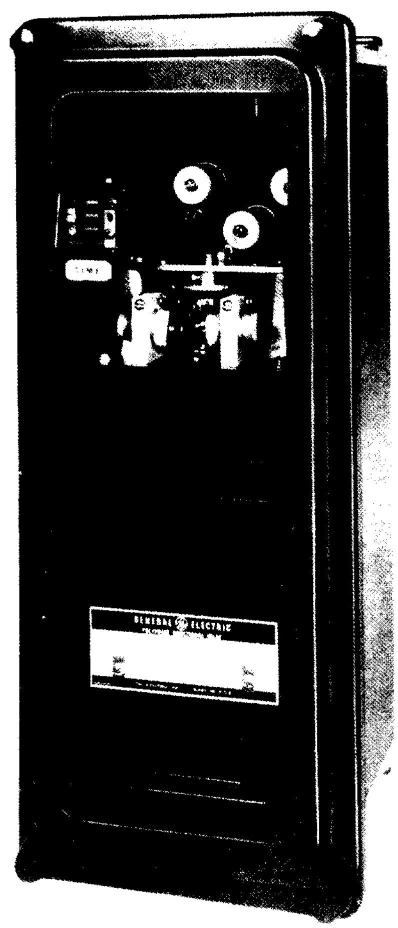
GEK-65525C

INSTRUCTIONS

THREE-PHASE POWER-DIRECTIONAL RELAY

TYPE CCP13E



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Cover photo (8043505)

THREE-PHASE POWER-DIRECTIONAL RELAY

TYPE CCP13E

DESCRIPTION

The type CCP13E relay is a very sensitive induction-cylinder power-directional relay for three-phase alternating-current circuits.

The relay consists of three single-phase directional units with the three rotors mounted on a single shaft. The contact assembly consists of two electrically-separate contacts, one normally open and one normally closed. The normally-closed contacts are held closed by two spiral springs that also complete the control circuits to the moving contacts. There is a target and seal-in coil in series with the normally-open contact.

The CCP13E relay is functionally equivalent to the CCP13D relay, but the two relays are not electrically interchangeable. There are differences in the output circuit arrangements.

APPLICATION

Because of its sensitivity and its real power-directional characteristics, the CCP13E relay finds application where it is important to detect extremely small reverse power flow. This application is restricted to cases where the normal direction of power flow is always in the same direction. The classical example of such an application is illustrated in Figure 1.

Consider the section of a system shown in Figure 1 with normal load flow from the system to the load. If a single-phase-to-ground fault were to occur at F, it would be cleared at source #2, but not necessarily at breaker #2 because of delta-wye transformer #2. However, it is desirable to open circuit breaker #2 to clear the ground fault completely. This can be accomplished by the CCP13E relay associated with circuit breaker #2. The CCP13E is generally sensitive enough to operate on the real component of the exciting current (this is the core-loss component) taken by the transformer through circuit breaker #2 when source #2 is removed.

Since the CCP13E is very fast and very sensitive, it might operate for system disturbances that result in momentary reversals of power through one or the other of the two banks. For this reason, the CCP13E should be used in conjunction with some time delay when applied as discussed above. Figure 2 shows how this can be done.

Before the CCP13E is applied, certain calculations should be made to check the sensitivity of the relay, against the available core-loss component of the associated transformer, to ensure proper operation. A sample calculation is illustrated in the section titled **SAMPLE CALCULATIONS**. In general, the current transformers (CT's) that supply the CCP13E relay should be selected with the lowest possible ratio without exceeding the 5.0 ampere continuous rating of the relay.

SAMPLE CALCULATIONS

Consider the system illustrated in Figure 1 having the following transformer ratings:

10,000 KVA
13,800 Volts wye/138,000 Volts delta
Core losses = 15.0 KW at Rated Voltage

The full load current at 13,800 volts is

$$\frac{10,000}{13.8\sqrt{3}} = 418 \text{ Primary Amperes.}$$

At rated voltage, the core-loss component produces an in-phase current of

$$\frac{15}{13.8\sqrt{3}} = 0.628 \text{ Primary Amperes.}$$

Since the relay may be called on to operate at lower-than-normal voltages, the core losses at these lower voltages should be obtained. If this information is not readily available, consider that 95% of rated voltage is a good figure and, since the transformer core losses are roughly proportional to the square of the applied voltage, the minimum core-loss current will be

$$(0.95)\ (0.95)\ (0.628) = 0.567 \text{ Primary Amperes.}$$

At reduced voltage, the CCP minimum operating current goes up. Actually, it is inversely proportional to the applied voltage. Thus, the minimum pickup in this case will be the nameplate value divided by 0.95, and the 0.004 ampere relay will have a minimum pickup, at 95% voltage, of

$$\frac{0.004}{0.95} = 0.0042 \text{ Secondary Amperes.}$$

Based on the maximum full-load current, the smallest CT ratio that could be used is 500/5. With this ratio, the core-loss component of current would be

$$\frac{0.567}{100} = 0.00567 \text{ Secondary Amperes.}$$

Since the CCP will pick up at 0.0042 secondary amperes, this application is satisfactory.

If the main CT's had been selected as 800/5, then the core-loss component would have been 0.00354 amperes and the relay would not operate. If this were the case, it might be possible to use suitable auxiliary CT's to step up the current to the CCP. However, caution should be used in the selection of these auxiliary CT's to ensure that no more than 5.0 amperes is supplied to the relay under full-load conditions.

Note that the above calculations are based on a balanced three-phase condition, with equal magnitudes of core-loss current flowing in all three phases.

CONSTRUCTION

The type CCP13E relay is mounted in an M2-size case. The case has studs at both ends in the rear for external connections. The outline and panel drilling for this case is shown in Figure 3.

The electrical connections between the relay units and the case studs 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 the studs for the external connections and the inner blocks have the terminals for the internal connections.

Every circuit in the drawout case has the auxiliary brush, as shown in Figure 4, to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars (see internal connections in Figure 5), and on those circuits it is especially important that the auxiliary brush make contact, as indicated in Figure 4, with adequate pressure to prevent the opening of important interlocking circuits.

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

The relay case is suitable for either semiflush or surface mounting on all panels up to two inches thick, and appropriate hardware is available. However, panel thickness must be indicated on the relay order to insure that proper hardware will be included.

These relays are induction-cylinder devices for alternating-current (AC) circuits. The principle by which torque is developed is the same as that employed in an induction-disk relay with a watthour meter element, though in arrangement of parts they are more like split-phase induction motors.

The stator of each unit has eight laminated magnetic poles projecting inward and arranged symmetrially around a central magnetic core. The poles are fitted with current and potential coils; four potential coils that are internally connected, forming a single circuit, as well as four current coils similarly connected. In the annular air gap between the poles and central core is the cylindrical part of the cup-like aluminum rotor, which turns freely in the air gap. The central core is fixed to the stator frame; the rotor alone turns. The three units are mounted one on top of the other. The three rotors are mounted on a single shaft.

This construction provides higher torque and lower rotor inertia than the induction-disk construction, thus making these relays faster and more sensitive.

The directional contacts (see Figure 6) are especially 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 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.

There is a High-Seismic target and seal-in unit whose coil is in series with the normally-open left contact. The High-Seismic target and seal-in unit's contact is brought out to a separate terminal. See Figure 1 and the **APPLICATION** section for external wiring.

When the normally-open CCP contact closes, the target and seal-in unit will pick up if the current is above its pickup rating. When the target and seal-in unit picks up, it raises a target that latches up and remains exposed until reset by the reset mechanism located at the lower left-hand corner of the cover assembly.

RATINGS

Relays are available with potential coils rated 115 or 208 volts, 60 hertz. The 50 hertz relay is available with potential coils rated for 115 or 208 volts.

The current coils of all models are rated 5 amperes continuously, or 200 amperes for 1 second.

The relay has maximum torque when the three-phase system is a unit power factor if the relay is connected as shown in Figure 2. The balanced three-phase current to operate the relay at maximum torque angle and with rated voltage on the potential circuits will be between 0.004 and 0.016 amperes, depending on the relay control spring setting.

The High-Seismic target and seal-in unit ratings are shown in Table I.

* TABLE I

	TAP	
	0.2	2.0
DC RESISTANCE +10% (ohms)	8.0	0.24
Minimum Operating (Amp.) +0 - 25%	0.2	2.0
Carry Continuous (Amperes)	0.3	3.0
Carry 30 Amps for (Sec.	0.03	4.0
Carry 10 Amps for (Sec.)	0.25	30.0
60 Hertz Impedance (Ohms)	68.6	0.73

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.

BURDENS

The current-circuit burdens with 5 amperes flowing and pickup set for minimum are listed in Table II.

* Revised since last issue

TABLE II

Pickup	Frequency	R	X	Z	Watts	Vars	VoltAmperes
0.004 Amp	60	0.27	0.62	0.68	6.8	15.6	17.0
0.004 Amp	50	0.23	0.52	0.57	5.9	13.0	14.3

The potential burdens at rated voltage and rated frequency are given in Table III.

TABLE III

Frequency	Volts	R	X	Z	Watts	Vars	VoltAmperes
60	115	408	710	815	8.1	14.1	16.2
60	208	1350	2300	2640	8.4	14.3	16.4
50	115	413	720	830	8.0	13.9	16.0
50	208	1370	2370	2730	7.9	13.7	15.8

CHARACTERISTICS

This relay consists of three single-phase directional units with the three rotors on a common shaft. Each unit develops maximum torque when the current, through the current coils, leads the voltage, applied to the potential coils, by 30°. When the delta voltages are applied to the potential coils, as shown in Figure 2, the currents in the current coils will lead these voltages by 30° when the three-phase system is at unity power factor. For example, the top unit is connected so that it will have Phase 1 current in its current coils (studs 3-4) and Phase 1-3 on its potential coils (studs 13-14). The relay will therefore respond to the watt component of the power (Figure 7).

The High-Seismic target and seal-in unit has two tap selections located on the front of the unit. See Figure 8.

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 Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured nor 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 make sure 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.**

VISUAL INSPECTION

Check the nameplate stamping to make sure 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 screws are tight.

MECHANICAL INSPECTION

1. There should be no noticeable friction in the rotating structure of the relay unit.
2. Make sure the control springs are not deformed.
3. With the relay leveled in its upright position, the left-hand contact should be open and the right-hand contact should be closed.
4. Check the location of the contact brushes and shorting bars in the case and cradle blocks against the internal connection diagram for the relay (Figure 5).
5. Check the vertical end play of the moving contact and shaft assembly. It should be between 1/64 inch and 1/32 inch.
6. The contact gap should be approximately 3/64 inch.
7. The contact wipe should be 0.004 inch to 0.009 inch.

If there is reason to believe that the jewel is cracked or dirty, the screw assembly can be removed from the bottom of the unit and examined under a microscope, or the surface of the jewel explored with the point of a fine needle. When replacing a jewel, have the top pivot engaged in the shaft while screwing the jewel screw.

All nuts and screws should be tight.

The felt gasket on the cover should be securely cemented in place in order to keep out dust.

All contact surfaces should be clean.

CAUTION

Every circuit in the drawout case has an auxiliary brush; this is the short one in the case (not in the cradle) that the connecting plug or test plug should engage first. On every current circuit or other circuit with a shorting bar, make sure these auxiliary brushes are bent high enough to engage the connection plug or test plug before the main brushes in the case do; otherwise the CT secondary circuit may be opened (where one brush touches the shorting bar) before the circuit is completed from the plug to the main brush.

A cutaway view of the case, cradle blocks, and connection plug is shown in Figure 4.

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

DIRECTIONAL UNITS

Polarity

Complete polarity tests are made at the factory, but these may be checked by using the connections shown in Figure 10. Each unt should be checked separately. The cup should rotate in the direction to close the left-hand contact (front view).

Pickup

The pickup of the CCP13E relay may be checked by applying rated voltage and frequency to the relay as in Figure 11. The relay should close its left contact at the current specified on the nameplate (relays are shipped with current pickup set to the minimum setting) multiplied by 1.15. The 1.15 multiplier is used to compensate for the test being made 30° off the angle of maximum torque ($1/\cos 30^{\circ} = 1/0.866 = 1.15$). A phase shifter and phase angle meter could be used to give a test circuit that would test the units at the angle of maximum torque. However, most phase-angle meters will not operate correctly with only 0.004 amperes in their current coils. For this reason, the three-phase test circuit with phase shifter and phase-angle meter is **not** recommended.

Clutch

The clutch should not slip at rated voltage and 10 amperes when the relay is connected as in Figure 2. See the **SERVICING** section for clutch adjustment.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

The target and seal-in unit has an operating coil tapped at 0.2 and 2.0 amperes. The relay is shipped from the factory with the tap screw in the higher ampere position. The tap screw is the screw holding the right-hand stationary contact. To change the tap setting, first remove one screw from the left-hand stationary contact and place it in the desired tap. Next remove the screw from the undesired tap and place it on the left-hand stationary contact where the first screw was removed. See Figure 8. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Screws should **never** be left in **both** taps at the same time.

Pickup and Dropout Test

1. Connect relay terminals 1 and 11 to a DC source using a load box to control the current over a range of 0.1 to 2 amperes.

2. Close the left contact manually.

3. Increase the current slowly until the seal-in unit picks up. See Table IV. The target must latch in.

4. Decrease the current slowly until the seal-in unit drops out. See Table IV. The target must remain latched in. Reset the target before checking pickup again.

TABLE IV

TAP	Pickup Current	Dropout Current
0.2	0.12 - 0.20	0.05 or more
2.0	1.2 - 2.0	0.50 or more

INSTALLATION

The location of the relay should be clean and dry, free from dust, excessive heat and vibration, and should be 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 Figure 3.

The internal connections of the CCP13E are shown in Figure 5. An elementary diagram of typical external connections is shown in Figure 2.

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

The following tests are to be performed at the time of installation.

PICKUP

Perform Directional Units pickup test as outlined in the **ACCEPTANCE TESTS** section. Adjust pickup as desired per **SERVICING** section.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

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

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

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.

These tests are intended to make sure that the relays have not deviated from their original settings. If deviations are encountered, the relay must be retested and serviced as described in this manual.

PICKUP

Perform Directional Units pickup test as outlined in the **ACCEPTANCE TESTS** section.

The pickup test, checked using the connections of Figure 11, will show whether the relay is operating correctly. If any of the coils should become open-circuited, then the pickup will be higher, since all three units will no longer be producing torque.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

1. Make sure that the unit picks up at the values shown in Table IV.

2. Check that the unit drops out at 25% or more of tap value.

SERVICING

If it is found during installation or periodic testing that the relay is out of calibration, recalibrate as follows:

RELAY CONTACTS

Checks and Adjustments

The clearance between (a) the back of the silver stationary contact mounted on the flat spiral, and (b) the diaphragm behind it, should be 0.004 inch to 0.009 inch. This wipe should be measured by moving the contact arm over until it just touches the appropriate stationary contact. Then, holding the contact arm in this position, rotate the barrel until the back of the contact touches the diaphragm. Rotating the barrel 45° corresponds to 0.004 inch wipe, while 105° is the equivalent of 0.009 inch.

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

The contact gap should be 3/64 inch. This should be adjusted in the following manner: with the contact arm parallel to the sides of the relay, turn the contact barrels until both contacts are just made (use neon lamps to verify). Tighten the clamping screw, locking the right-hand barrel. Back off the left-hand contact barrel 1½ revolutions (540°) and tighten its clamping screw.

To change the stationary contact mounting spring, loosen the screw at the front of the contact block, then remove the contact barrel and sleeve as a complete unit. Unscrew the cap (E). The contact and its flat spiral mounting spring may then be removed. See Figure 6.

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

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 ensures 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 that 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.

BEARINGS

The lower jewel screw can be removed from the unit by means of an offset screwdriver or an end wrench. The jewel may be tested for cracks by exploring its surface with the point of a fine needle. If it is necessary to replace the jewel, a new pivot should be screwed into the bottom of the shaft at the same time.

The lower jewel bearing should be screwed all the way in until its head engages the end of the threaded core. The upper bearing should be adjusted to allow about 1/32 inch end play of the shaft.

Press down on the contact arm near the shaft to check the clearance between the iron core and the inside of the rotor cup; this will depress the spring-mounted jewel until the cup strikes the iron; the shaft should move about 1/16 inch.

VOLTAGE BIAS

1. Unwind the upper control spring until the moving contact assembly is floating approximately half way between the right contact and the left contact. This should be done with the relay mounted in a level position and with no voltage or current applied to the relay.

2. Apply rated three-phase voltage to the potential circuit, using the same connections as shown on the external connection diagram (Figure 2). With no current in the current coils, the moving contact should stay in the float position set in Step 1. Should the moving contact arm move enough to close the right or left contact, it will be necessary to readjust the core. The core is adjusted by loosening the core locknut and rotating the core slightly to the right or left to return the moving contact arm to its floating position. The core locknut is located in the center of the lower iron casting. The core is turned by putting an offset screwdriver into the jewel screw slot. The locknut should only be loosened enough to allow the core to be turned. When the contact assembly is set for the float position by turning the core, the locknut should be tightened. Recheck that the moving contact assembly is still floating when the locknut is tight.

POLARITY

The polarity of the coils can be checked using the connections of Figure 10. Each unit is checked separately, and each should produce a torque in the direction to close the left contact.

If in any of the three tests the torque is in the direction to close the **right** contact, the polarity is reversed. To correct the polarity, the connections of that potential circuit should be reversed at the cradle terminals. For example, if the polarity was reversed when the top unit was tested, then the potential coil lead to terminal 13 should be moved to terminal 14, and the lead going to terminal 14 should be connected to terminal 13.

ANGLE OF MAXIMUM TORQUE

If the maximum angle of torque (30° lead) of the relay has been disturbed, it may be restored by referring to Figure 12. With rated voltage and frequency applied to the potential circuit, and 5 amperes flowing in the current circuit, the potential circuit resistor is adjusted so that the contact will not move at a phase angle meter reading of 120° or 300° (angles of zero torque). The relay should close its left contact at all angles between 120° and 300°. This test is performed by energizing **one unit at a time.**

PICKUP ADJUSTMENT

* The control spring adjustment is made by using the connections of Figure 11. This single-phase test connects the three potential coils in parallel and the three current coils in series. With these connections, each unit is 30° off the angle of maximum torque. It is therefore necessary to apply 1.15 times the current that would have to be used if the three units were at the angle of maximum torque. For example, if the minimum pickup setting required at maximum torque angle is 0.004 ampere, then 1.15 x 0.004 ampere, or 0.0046 ampere, should be applied to the current circuit and the control spring should be moved in the counterclockwise direction until the left contact is just closed.

CLUTCH ADJUSTMENT

Using the connections of Figure 11, increase the current to 10 amperes and see that the clutch does not slip. This test should be made with rated voltage on the potential circuits. It can be determined if the clutch is slipping by watching the "hairpin" clip at the top of the moving contact shaft. If the hairpin clip is not turning, then the clutch is not slipping. If the clutch slips at 10 amperes, then the clutch should be tightened. This is done by loosening the locknut on the right side of the moving contact assembly, and then turning the adjusting screw in until the clutch stops slipping. The locknut should then be retightened.

HIGH-SEISMIC TARGET AND SEAL-IN UNIT

Both contacts should close at the same time, and the backing should be so formed that the forked end (front) bears against the molded strip under the armature.

CAUTION

Since mechanical adjustments may affect the Seismic Fragility Level, it is advised that no mechanical adjustments be made if seismic capability is of concern.

To check the wipe of the seal-in unit, insert a 0.010 inch feeler gauge between the plastic residual of the armature and the pole piece with the armature held closed. Contacts should close with the feeler gauge in place.

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.

* Revised since last issue

LIST OF ILLUSTRATIONS

* Revised since last issue

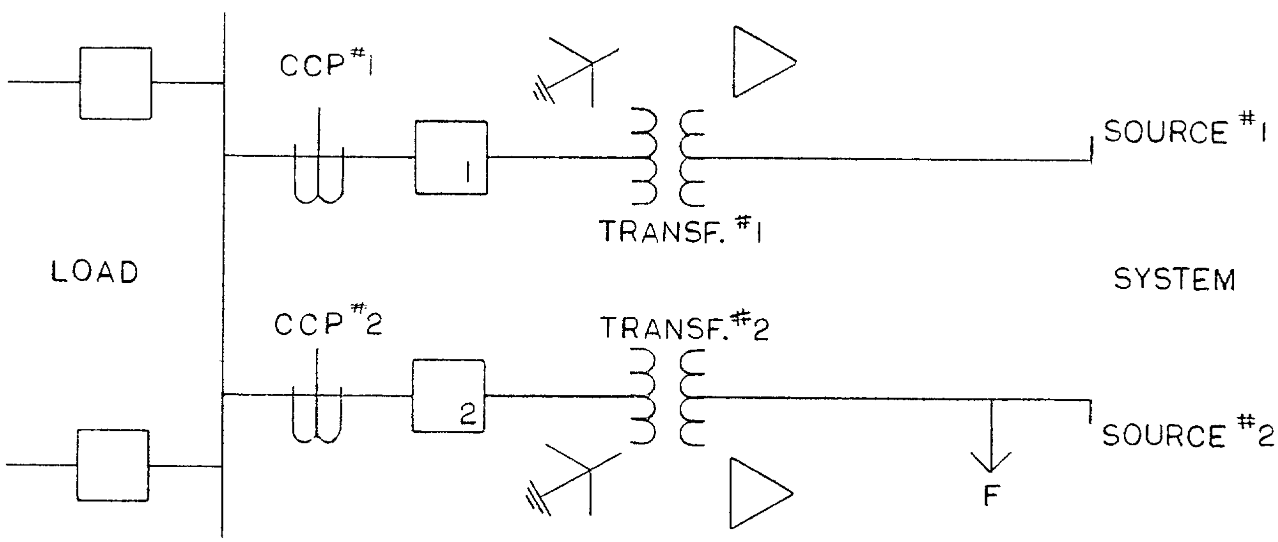


Figure 1 (0285A9917) Classical Application of Type CCP13E Relay

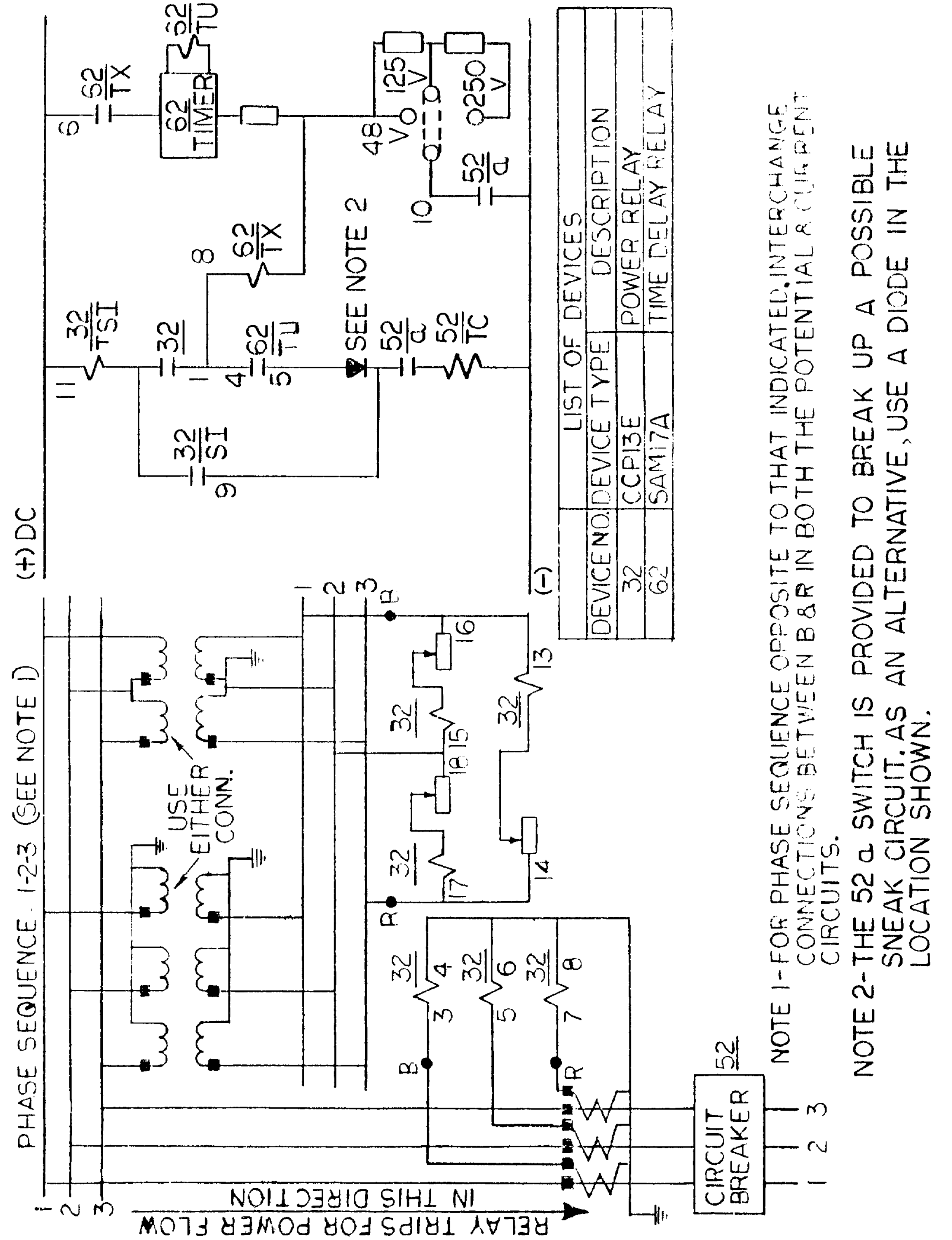
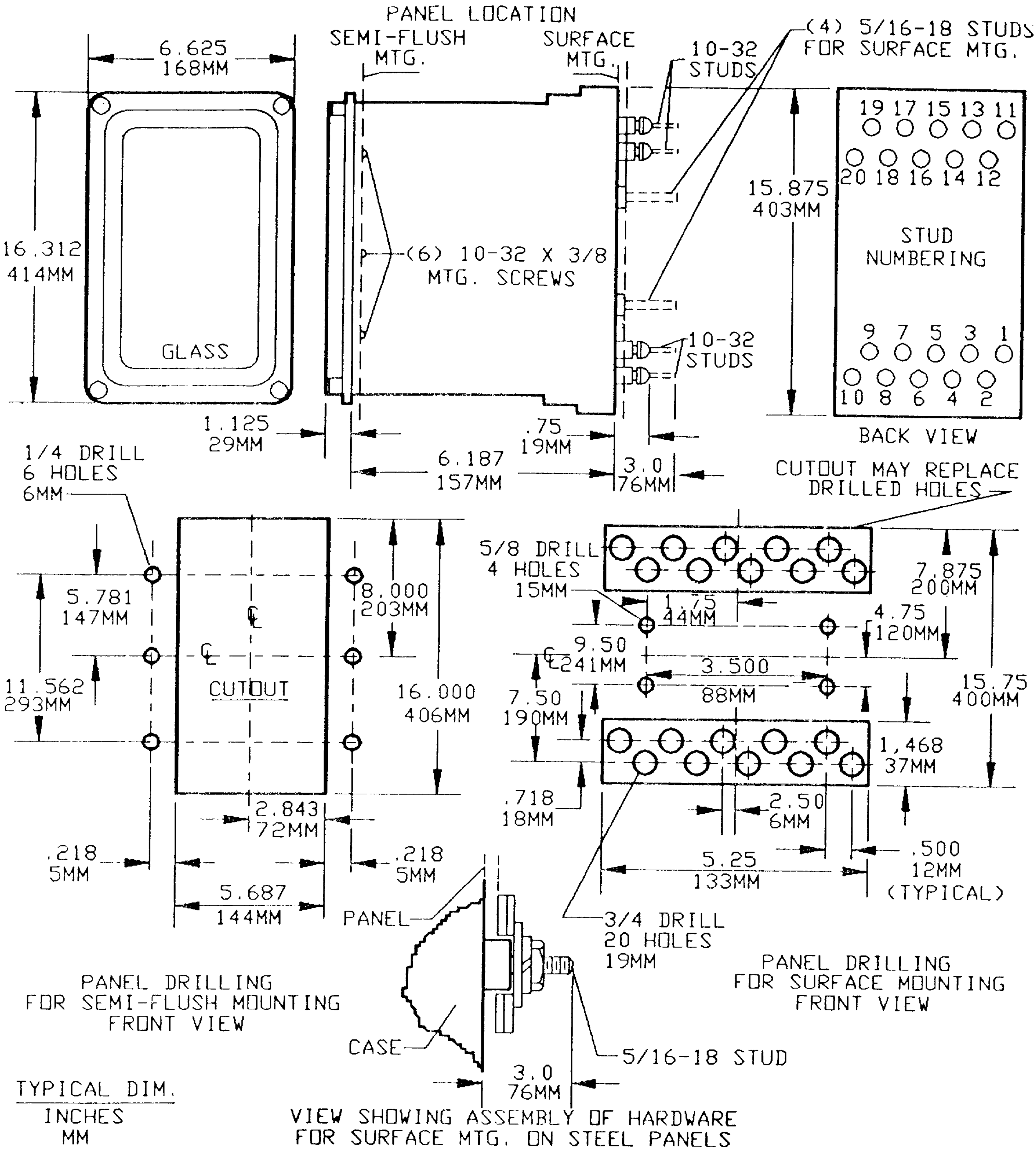


Figure 2 (0275A4413-6) Typical External Connections for Type CCP13E Relay



* Figure 3 (K6209274-6) Outline and Panel Drilling Dimensions Diagramfor Type CCP13E Relay

* Revised since last issue

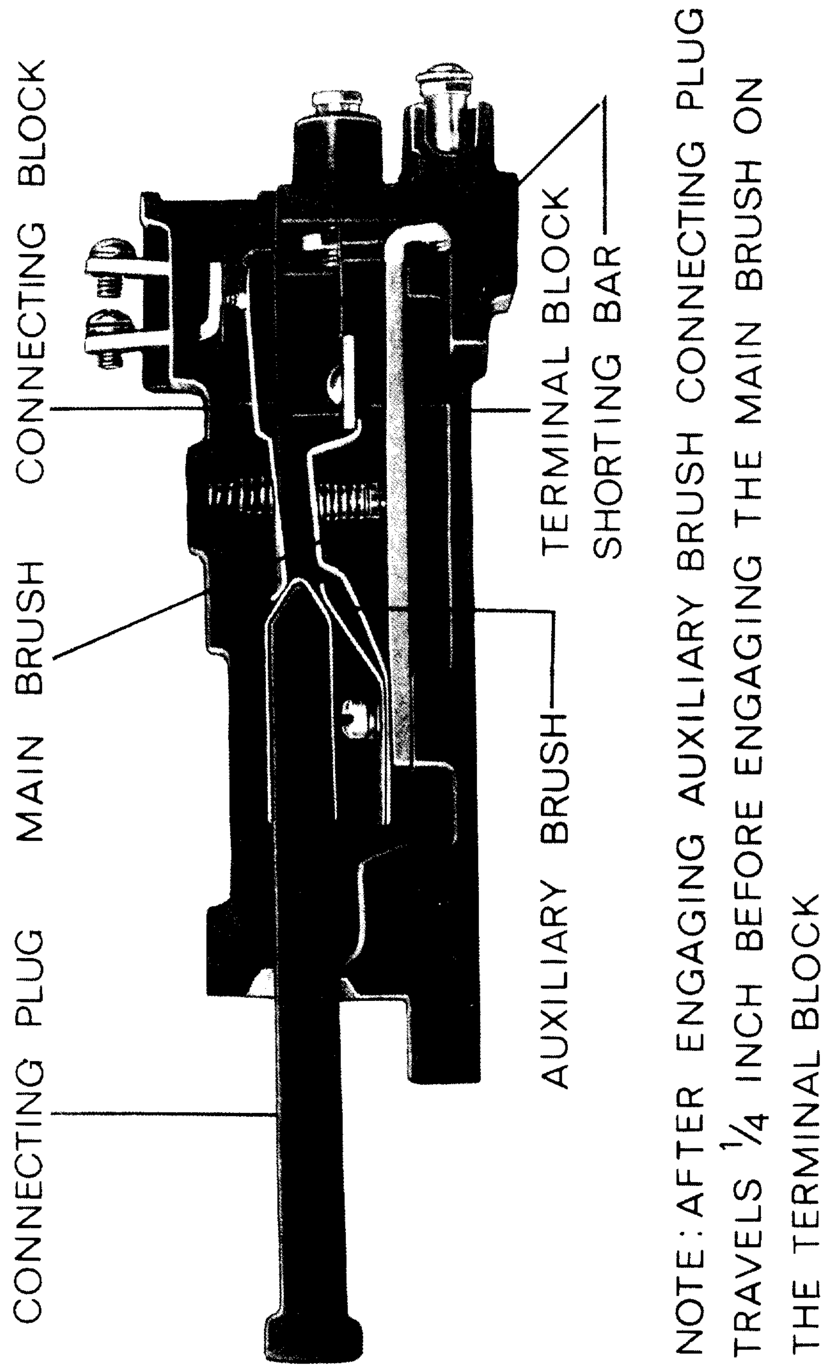


Figure 4 (8025039) Cross-Section of Case and Cradle Blocks

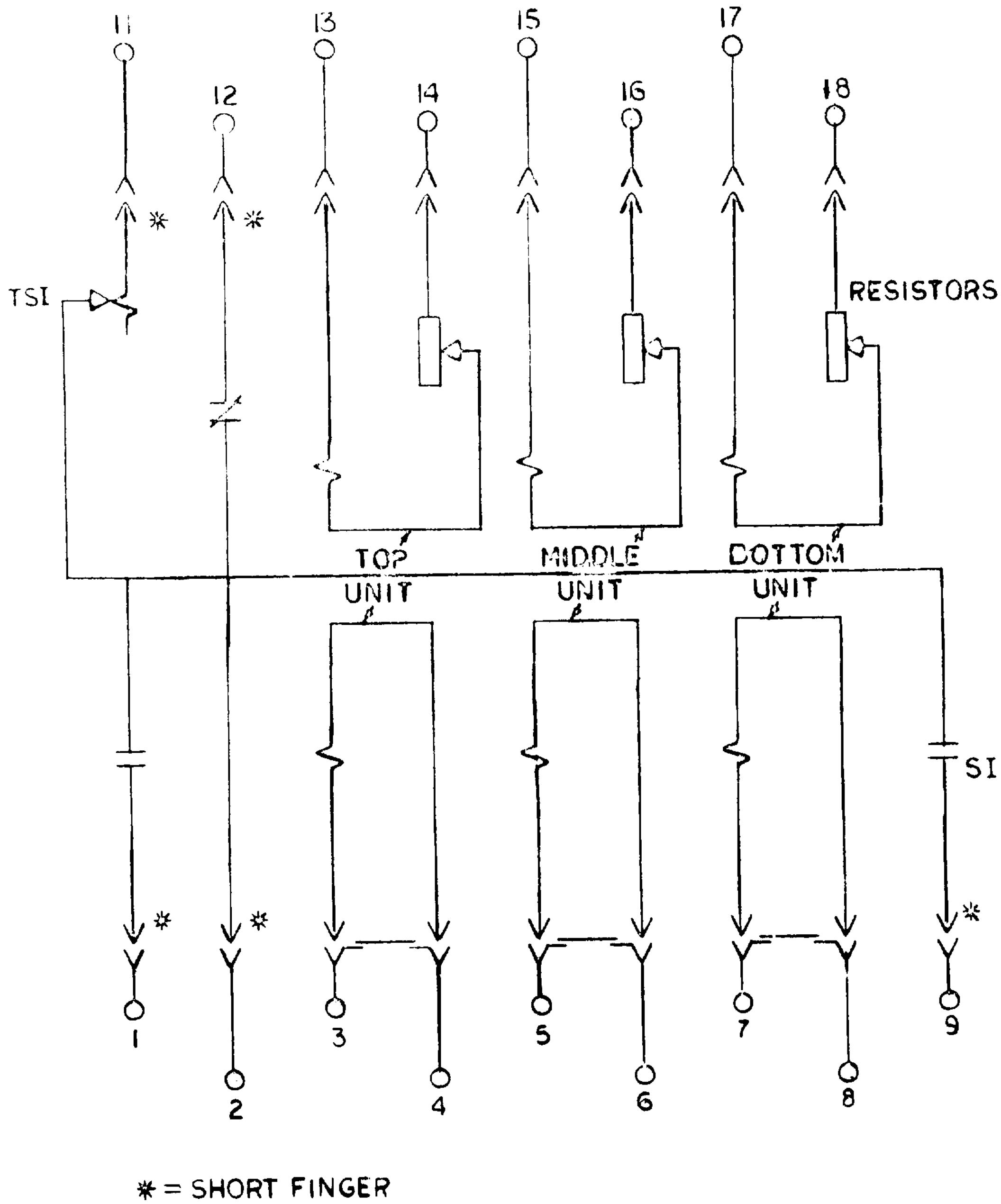
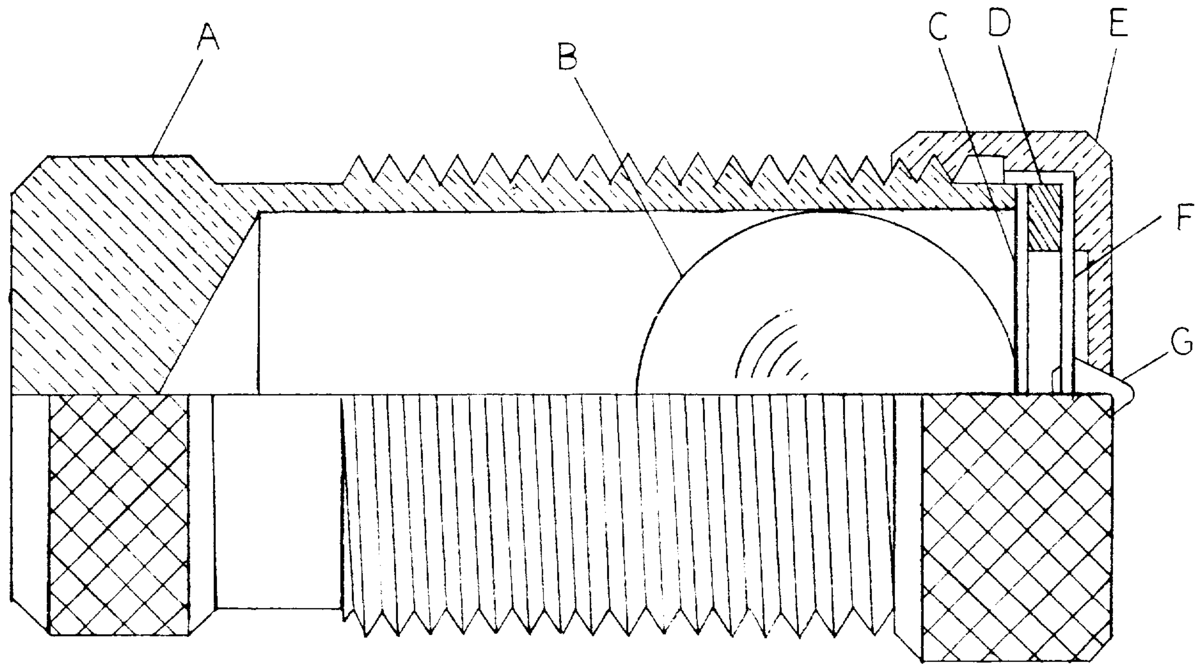


Figure 5 (0275A4384) Type CCP13E Relay Internal Connections



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

Figure 6 (6077069-4) Barrel-Type Contact Assembly

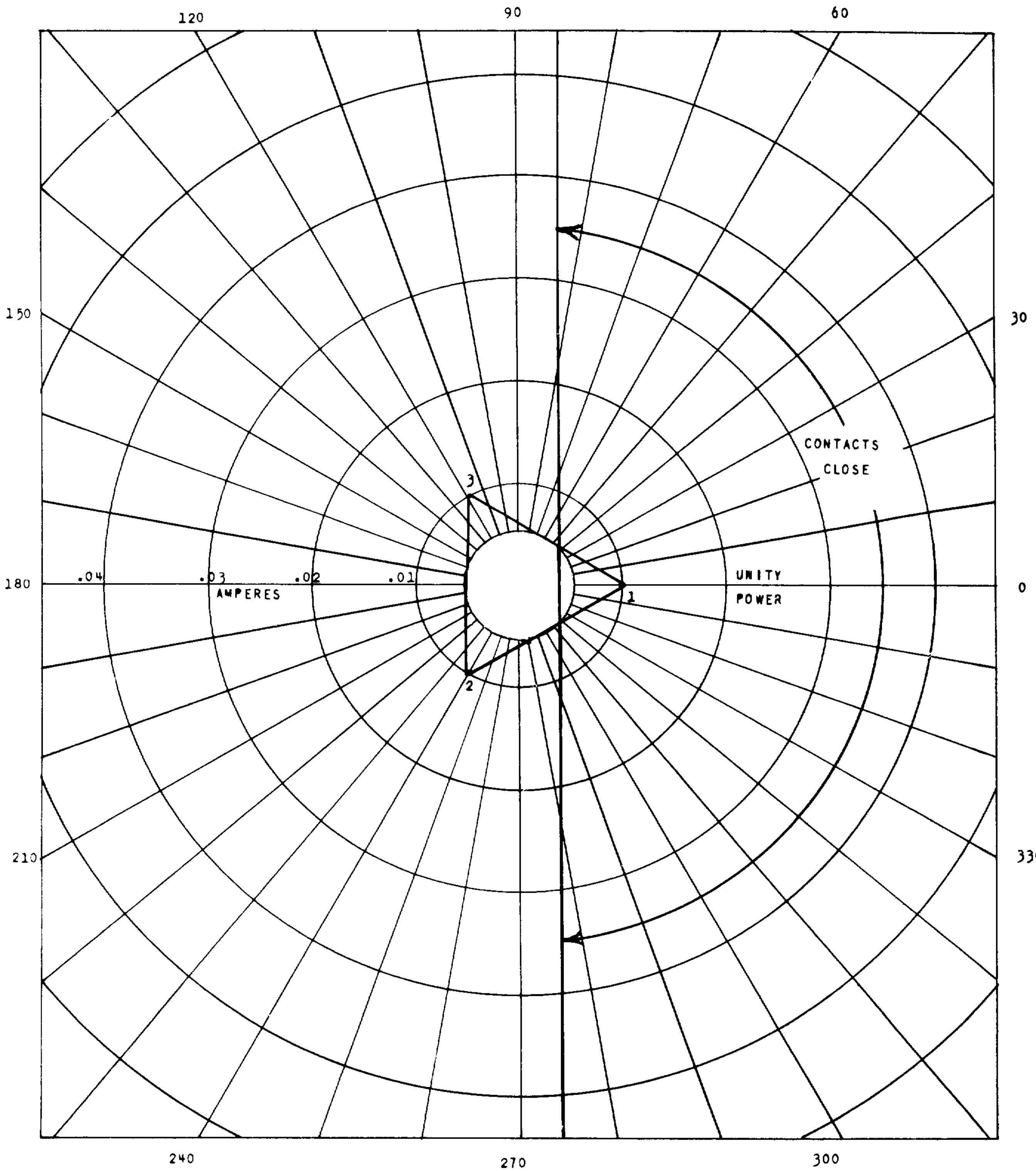


Figure 7 (K6556481-1) Phase Angle Characteristics of Type CCP13E Relay when Set for 0.004 Amp pickup at Rated Voltage and Maximum Torque Angle

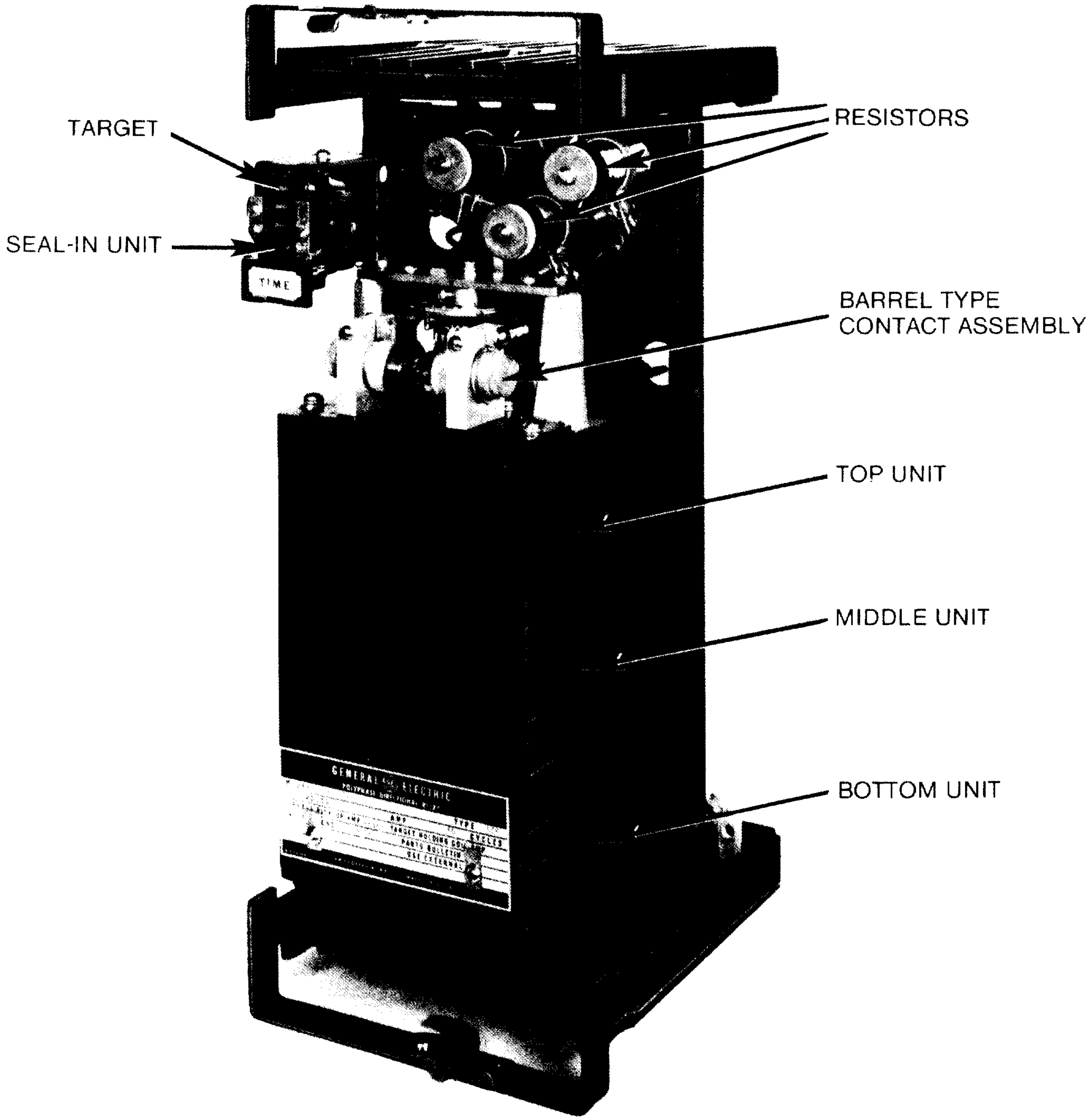


Figure 8 (8043506) Type CCP13E Relay, Removed from Case, Front View

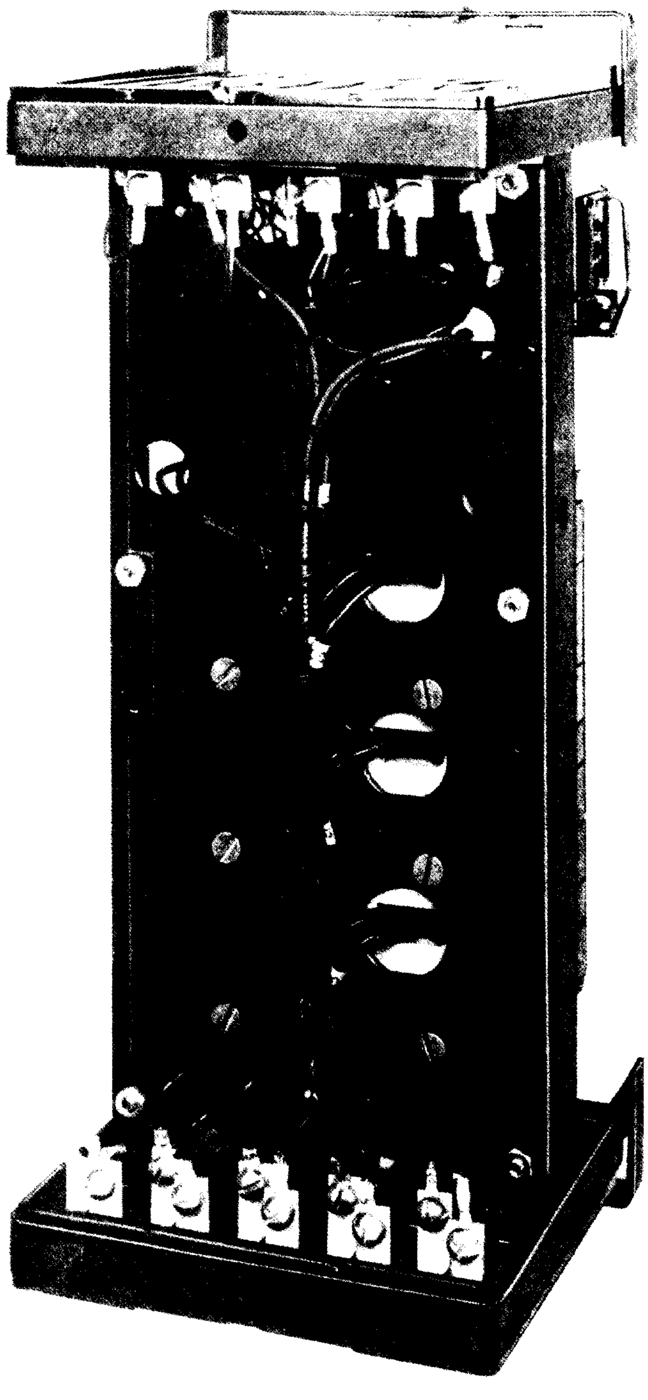
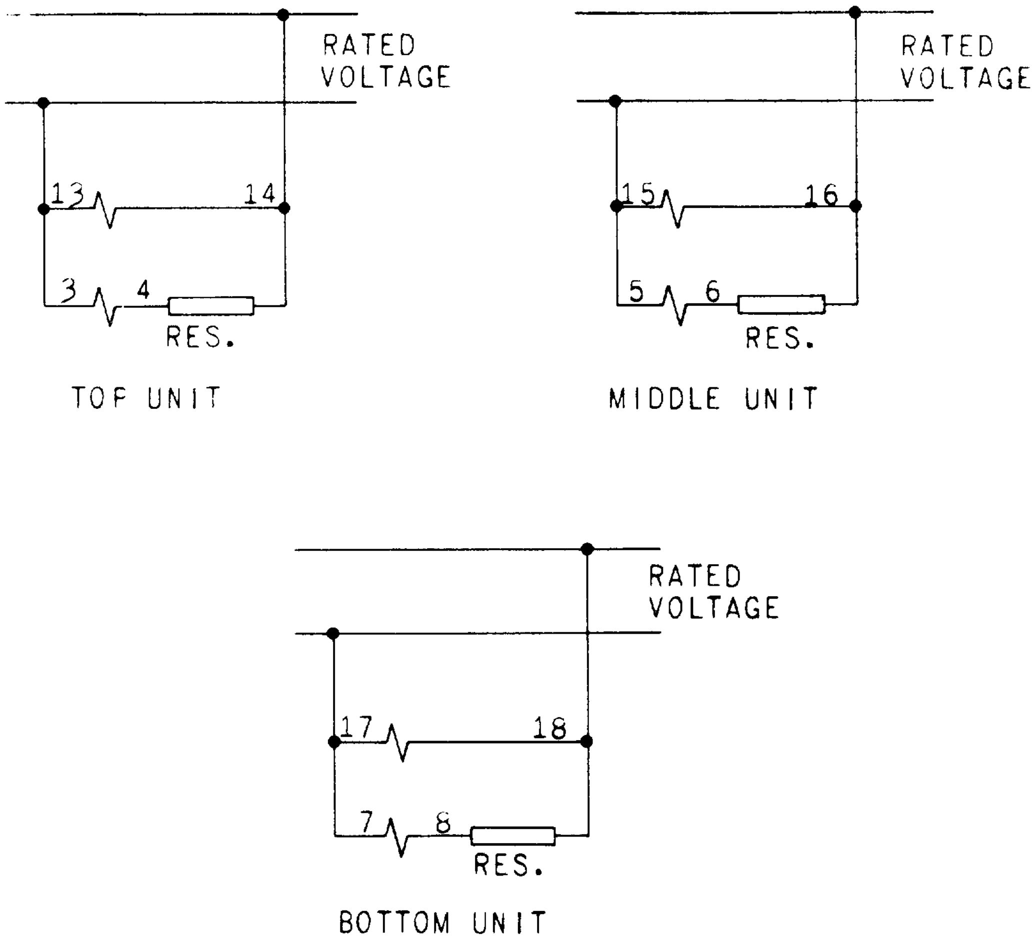


Figure 9 (8043507) Type CCP13E Relay, Removed from Case, Back View



RES = 50-100 OHMS.

NOTE = LEFT-HAND CONTACT, (FRONT VIEW) SHOULD CLOSE

Figure 10 (6507918) Connections for checking the polarity of Type CCP13E Relay

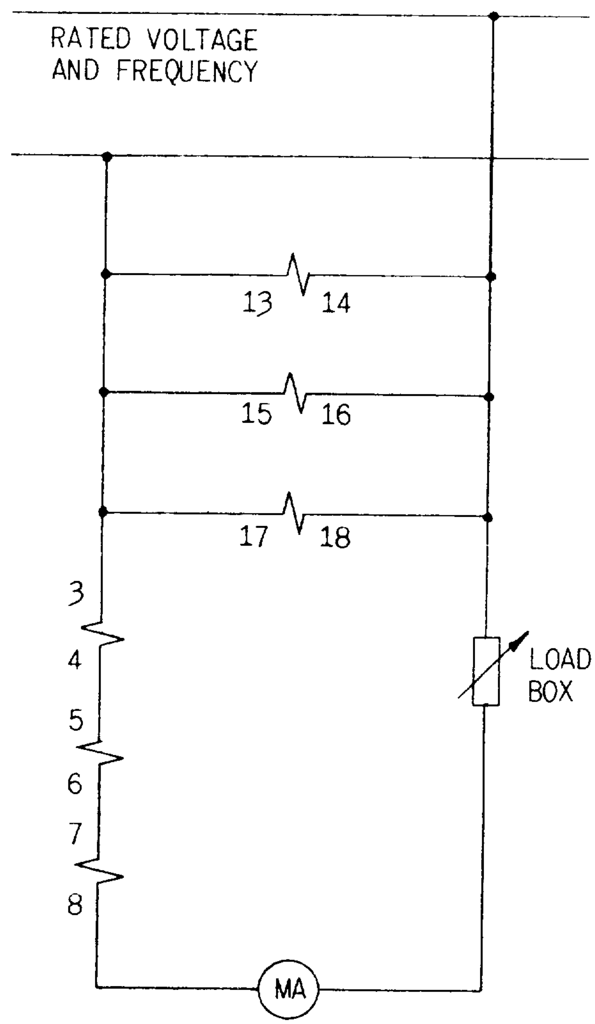
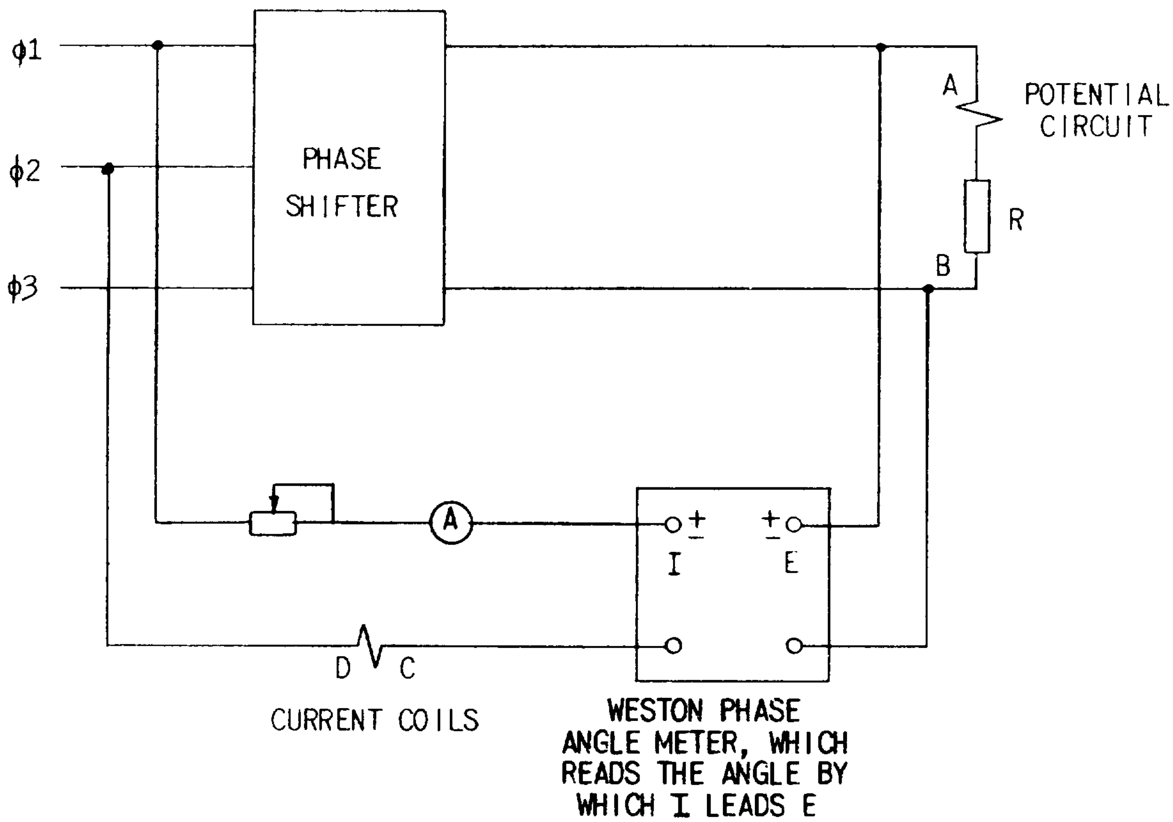
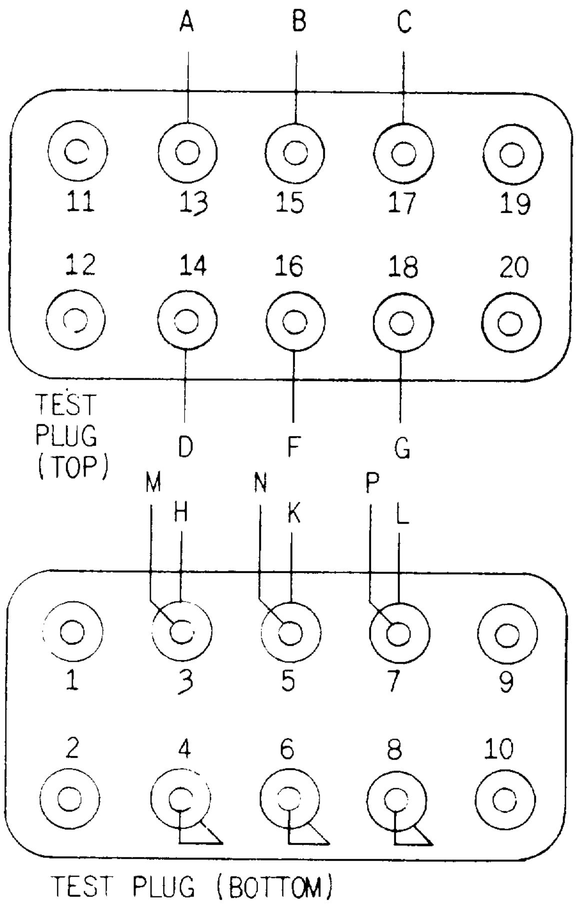


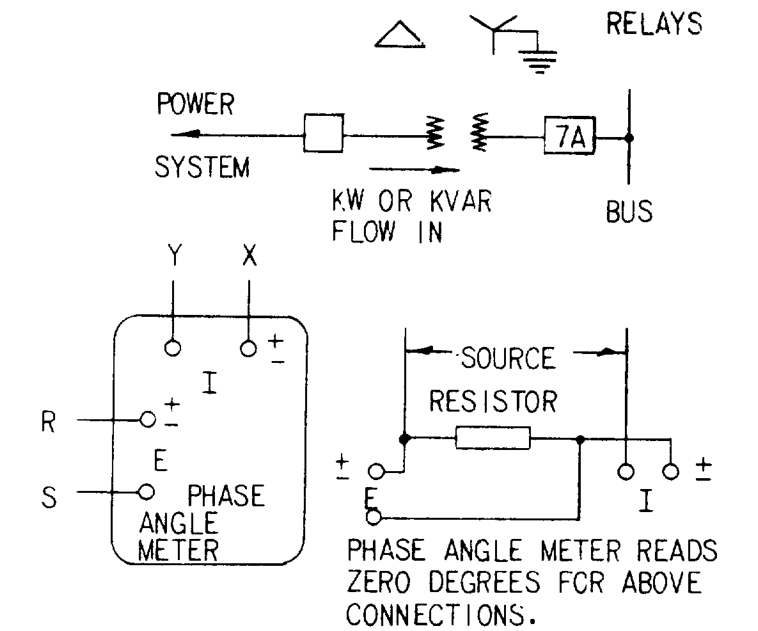
Figure 11 (0104A8511) Test Connections for Checking Pickup and Clutch Adjustments of Type CCP13E Relay



RELAY UNIT	ADJUST. RESISTOR	POWER CONNECTIONS	
		POTENTIAL STUDS A-B	CURRENT STUDS C-D
TOP	R_T	13-14	3-4
MIDDLE	R_M	15-16	5-6
BOTTOM	R_B	17-18	7-8

Figure 12 (0104A8512) Test Connections for Making the Torque Adjustments of the Type CCP13E Relay





NOTE: ADD JUMPER FROM K TO N & FROM L TO P WHEN PHASE ANGLE METER IS CONNECTED TO H & M TO AVOID OPEN CT SECONDARY CIRCUITS. USE SIMILAR JUMPERS FOR OTHER CONNECTIONS.

		PHASE ANGLE METER READING WITH PROPER EXT. CONNS.			
	POWER FACTOR ANGLE* DEGREES LEAD OR LAG AS NOTED	90° TO 45°	45° TO 0°	0° TO -45°	-45° TO -90°
RELAY CONNECTIONS	R TO F , S TO B X TO K , Y TO N M TO H , P TO L	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°
	R TO G , S TO C X TO L , Y TO P M TO H , N TO K	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°
	R TO D , S TO A X TO H , Y TO M N TO K , P TO L	120° † TO 75°	75° † TO 30°	30° † TO 345°	345° † TO 300°

† THESE RANGES OF PHASE ANGLE METER READINGS ARE THE ANGLES BY WHICH THE CURRENT LEADS THE VOLTAGE WITH THE DESCRIBED CONDITIONS OF LOAD POWER FACTOR ANGLE.

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

*AS DETERMINED FROM INSTRUMENTS READING POWER INTO BUS FROM THE POWER SYSTEM. NEGATIVE SIGN FOR LAG. POSITIVE SIGN FOR LEAD.

Figure 13 (0104A8513) Test Connections for Checking Polarity of Windings to the Type CCP13E Relay

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