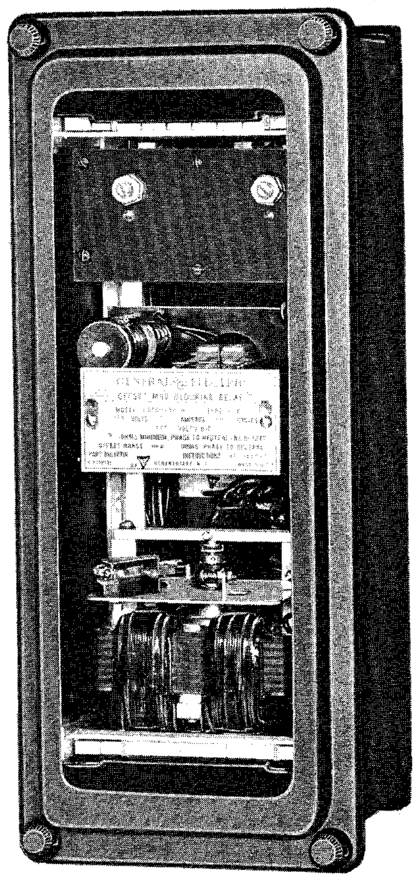
INSTRUCTIONS

GEI-25370D

SUPERSEDES GEI-25370C

OFFSET MHO BLOCKING RELAY



Types

CEB12A and CEB12B

POWER SYSTEMS MANAGEMENT DEPARTMENT

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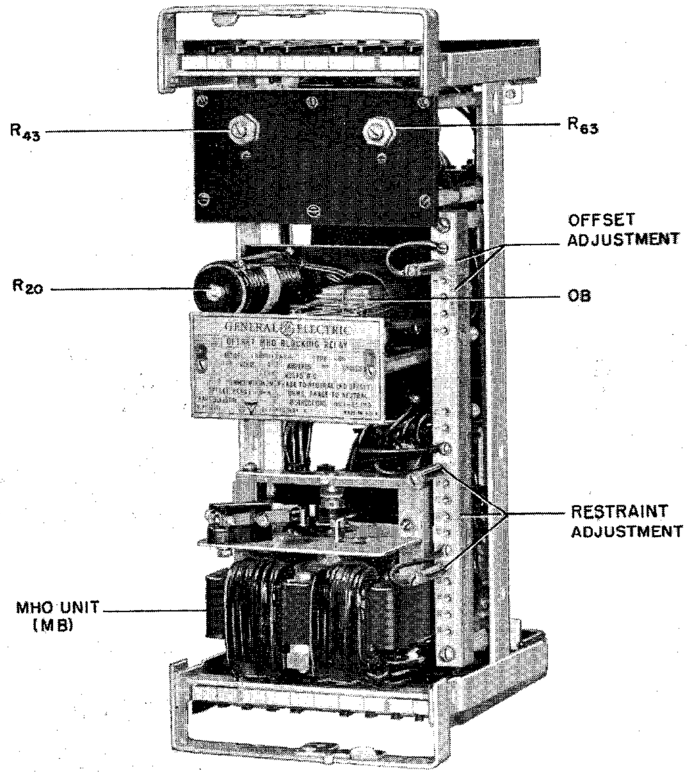

Fig. 1 The Type CEB12A Relay Withdrawn From Case (Front View)

Cover (8009028)

Fig. 1 (8009031)

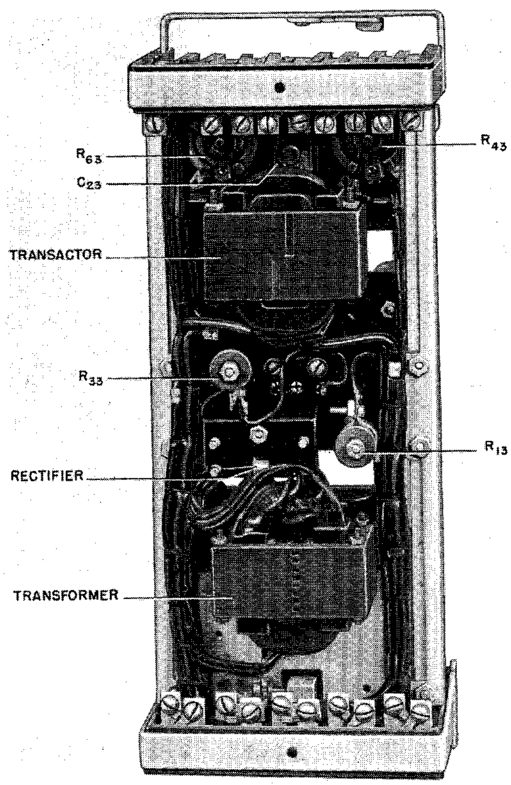

Fig. 2 The Type CEB12A Relay Withdrawn From Case (Rear View)

Fig. 2 (8017470)

OFFSET MHO BLOCKING RELAY TYPE CEB12A AND CEB12B

INTRODUCTION

The Type CEB12A and CEB12B relays are single phase offset mho blocking relays which operate on the induction cylinder principle, providing a high steady torque acting on low inertia parts.

The Type CEB12B relay has an additional normally closed contact on the out-of-step block auxiliary relay (OB) which is not contained in the Type CEB12A relay.

The relays are designed to provide out-of-step blocking in conjunction with the M2 unit of a Type GCY relay, when the OM3 unit of the relay is connected with reversed connections. An auxiliary telephone type relay is included with contacts suitably arranged for out-of-step blocking of either tripping or reclosing. This element has a time delay pickup so that it will not operate on fault conditions when the M2 unit of the GCY and the mho blocking unit operate simultaneously.

The mho unit is supplied with line-to-line voltage and the vector difference of the currents in these same two lines (delta current). Consequently, the ohmic reach of a unit is the same for three phase, phase to phase, or two phase to ground faults. The ohmic reach is adjusted by means of a tapped transformer in the restraint circuit.

APPLICATION

The application of this relay is covered in separate instructions. These instructions are furnished with the GCY carrier relaying equipment.

When the application requires a relay to be set for less than the minimum ohmic reach of the Type CEB12A and CEB12B relays, two secondary current transformers are required to step down the current by a suitable factor. For instance, a three ohm setting of the relay can be made the equivalent of a 1.5 ohm relay by the use of two 5/2.5 ampere CT's one for each of the two currents. It should be remembered in this case, that the relay is energized by one-half the secondary current of the line CT's, and this fact used when referring to operating time or accuracy data recorded as a function of current. Data recorded as a function of relay terminal voltage is not affected.

The use of the secondary step down CT's reduces the minimum ohmic reach and the offset of the three units by the same factor.

The remainder of these instructions cover the operation of the relay with no reference to the use of auxiliary current transformers.

The offset mho unit is similar to the basic mho unit with the addition of a transactor. The transactor is an air gap reactor with a secondary winding for obtaining the desired voltage at a given primary current without the attendant high burden, also for obtaining electrical insulation. By adding the transactor secondary voltage in series with the terminal voltage and applying the vector sum to the operating unit the effect is to offset the ohmic characteristic without changing its diameter.

The internal connections are such that the offset is in the direction to include the origin instead of pass through it. This enables the offset characteristic to be adjusted to be approximately concentric with the GCY M2 unit characteristic for use in recognizing out-of-step conditions when used in distance relaying, or in a carrier current scheme in which the OM3 unit of the GCY is connected with reversed connections. Taps are provided on the transactor secondary winding in order to obtain 0, 1, 2, 3, or 4 ohms offset.

Referring to Fig. 7, the characteristic at 75 deg. with zero offset is the same as the M2 unit of the Type GCY relay. By using the one ohm offset tap, the circle is moved one ohm along its 75 deg. characteristic line as shown by the circle No. 3.

The characteristic circles may be expanded by reducing the effect of the restraint circuit. This is accomplished by decreasing the setting of the tapped transformer in that circuit. The curves shown are for a 75 per cent setting of this transformer.

When zero offset is used, the characteristic circles all pass through the origin. When one ohm offset is used, these circles continue to pass through a common point which has moved to point A in Fig. 7.

The direction of the zero offset characteristic can be adjusted from the 75 deg. setting shown by the upper heavy circle of Fig. 7 to any angle down to the 60 deg. setting shown by the light circle. This adjustment is made by decreasing the resistance in R_{33} plus R_{43}. Making this change in the angle will reduce the minimum reach of the unit so that it will be about 2.4 ohms instead of 3 when a 60 deg. setting is used. If no change is made in the

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.

setting of R_{63}, and if offset is used, the new circle initially at 60 deg. for example, will be shifted along a 75 deg. line. In order to have the offset along a 60 deg. line, the resistance of R_{63} must be reduced.

No attempt has been made to limit the transient overreach of this relay. The directional action with low voltages is correct from 5 to 60 amperes, when no offset is used.

The auxiliary telephone relay for power swing blocking is designated as OB. This element has a time delay pickup of 4 cycles (60 cps) so that it cannot operate inadvertently on fault conditions. The drop out time is not usually of importance in the control circuits, but it is set at the factory for a minimum of 9 cycles (0.15 sec.). The blocking germanium rectifier shown connected between terminal No. 2 and the OB contact is to prevent any formation of sneak circuits that will change the pick-up time of OB. The external connections in Fig. 6 do not show these circuits since other GCY connections are purposely omitted for simplicity.

RATINGS

The relays are available with ratings 115 volts, 5 amps at 50 or 60 cycles. The basic range of ohmic adjustment is 3 to 30 ohms, phase-to-neutral when set with the factory angular adjustment.

Additional ranges of 2-20 ohms and 1.33 to 13.3 ohms can be obtained by the use of two auxiliary current transformers, mounted externally to the relay. The ohmic setting is changed over this range of adjustment by transformer taps arranged for settting any multiple of 5 per cent in the restraint circuit.

The auxiliary element, OB, can be furnished for operation at 110, 125, 220 and 250 volts d-c.

BURDENS

VOLT AMPERE

Because of the presence of the transactor in the relay, the ohmic burdens imposed upon the current and potential transformers are not constant, but vary somewhat with the ohmic reach, amount of offset, and current. This variation is of little importance to the current transformer, so that a formula for calculating only the potential burden will be given.

CURRENT CIRCUITS

The maximum current burden imposed on each CT with a practical setting at 5 amperes, 115 volts and 60 cycles is:

R	X	Z	Watts	Vars	VA
.15	.25	.30	3.9	6.3	7.4

The above burden was measured under phase-to-phase fault conditions which yields higher burden readings than balanced three-phase conditions. Also any other change caused by different conditions of offset will cause the burden to be less than indicated.

POTENTIAL COILS

The maximum potential burden in the affected phase with a practical setting at 115 volts, 5 amperes and 60 cycles with 100% restraint tap setting is:

Offset Setting Ohms	Watts	Vars	Volt-Amperes
0	13.5	5.5	14.6
4	13.5	9.0	16.2

The potential burden is altered by changing the restraint setting in order to obtain the proper reach, as well as by changing the offset adjustment. In order to present equations for calculating the burden, the following symbols will be used:

$W - jV$ = Total volt-amperes
E = Relay Terminal Voltage
Z_O = Ohmic offset (secondary)
Z_L = Ohms through the fault or load (secondary)
Z_S = Self impedance of potential circuit
T = Setting of restraint taps in per cent

The burden for any set of conditions can be computed by using the equation below.

In equation (1) the difference in the angles of Z_O and Z_L may be neglected so that the volt-ampere burden is the conjugate of $E\ /Z^2$ where Z_s is a complex value computed from the circuit impedance and the mutual coupling with the current circuits of $1 \pm Z_O/Z_L$ where the scalar value of Z_O/Z_L may be used.

The choice of the positive or negative sign in the correction factor $(1 \pm Z_O/Z_L)$ is determined by the direction of the fault relative to the direction of offset. If they are opposite, the sign in plus.

Potential Burden Equations (60 cycle rating)

$$W - j\,V = \frac{E^2}{Z_s}\left(1 \pm \frac{Z_O}{Z_L}\right) \tag{1}$$

$$Z_s = \frac{1900\ (952 + j1050)}{(T)^2\,(0.190 + j0) + 952 + j1050} + Z_O^{\,2}(4.5 + j14.5) \tag{2}$$

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 notfy 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 main unit is an offset mho unit with induction cylinder construction i.e., it has a circular impedance characteristic similar to that of the basic mho unit except that it is offset so as to encircle the origin of the impedance diagram instead of passing through it. This offset is provided by the voltage drop across a transactor in the current circuit in conjunction with an element which is otherwise simply a mho unit. Transactor is the name given to a reactor which has a secondary winding with a step up ratio so as to provide more reactance with less burden on the current circuit.

CONTACTS

The contacts are of fine silver for low contact resistance and are of the ideal design of two cylinders at right angles, which provides a point contact without using an actually pointed contact. To protect the contacts from damage caused by high operating torques under short circuit conditions, a felt clutch is provided between the shaft and the contact arm.

CASE

The case is suitable for either surface or semi-flush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case and also carries the reset mechanism when one is required. Each cover screw has provision for a sealing wire.

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

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

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

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

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. 8.

CONNECTIONS

Internal connection diagrams for the CEB12A and the CEB12B relays are shown in Figs. 3 and 4 respectively. A typical wiring diagrm is given in Fig. 5.

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

ADJUSTMENTS AND TESTS

The unit is adjusted at the factory to have maximum torque at 75 deg. lag. If this angular setting is retained, the reach and offset can be set without using a test set-up. The size of the characteristic circle is inversely proportional to the tap setting. The offset is equal to the tap selected, regardless of the setting of the tapped transformer.

If the maximum torque angle is to be changed a test set-up as shown in Fig. 6 should be used. The resistor adjustments for changing the angular settings have been previously described under APPLICATION. In making such a change in adjustments the following steps should be followed. The rheostats are provided with locking nuts to maintain their settings.

1. With zero offset adjust R_{43} plus R_{33} to obtain the desired maximum torque angle. The tapped resistor near the middle of the relay is R_{33}. The left rheostat at the top is R_{43}. See Figs. 1 and 2.

2. Set the restraint circuit selectors, lower part of the tap block, for the desired diameter of the characteristic circle. This should exceed the diameter of the GCY unit M2 by twice the desired offset ohms.

3. Select the offset ohms desired at the top of the tap block.

4. Adjust R_{63} until the angle of offset is equal to the angle of the unit without offset. This is the rheostat at the right near the top of the relay.

The rotating structure of the mho units is not balanced, so that any slight torque caused by a tilt of the shaft when the relay is installed ready for operation should be compensated using the control spring adjusting arm at the top rear of the unit. First loosen the set screw on the front of the top pivot support, and rotate the control spring adjusting arm so as to return the contact arm to the backstop, but without supplying enough torque so that the contact would move beyond this position if the backstop were removed. Tighten the set screw permitting approximately 1/64-inch end play to the shaft.

The clutch on each unit is adjusted by means of the steel collar at the upper end of the rotating shaft. The clutch should slip at a torque corresponding to approximately 50 grams applied at the contact normal to the contact arm. To adjust the clutch, loosen the set screw in the collar, rotate the collar on the shaft through the number of half turns (there is a groove for the set screw on the shaft) necessary to obtain the correct pressure. Moving the collar down increases the clutch pressure. Then lock in place by means of the set screw which should be inserted into the hole of the collar which is in front of the groove in the shaft.

The contact should have 1/32-inch gap (1/8-inch for the CEB12B) when open and .005-inch to .010-inch wipe. If the stationary contact is replaced, the following precautions should be observed. The brush should be carefully formed so that the silver contact meets its backstop simultaneously along their entire line of contact. The contact brush along with the .003-inch scraper brush in front of it should be formed so that the contact brush has the minimum initial tension which will bring the wipe within the above limits. The adjusting screw for the brushes should not be used for more than one-eighth of a turn of effective adjustment.

OPERATION

INSPECTION

Before placing a relay into service the following mechanical adjustments should be checked, and faulty conditions corrected according to instructions under ADJUSTMENTS AND TEST or under MAINTENANCE:

There should be no noticeable mechanical friction in the rotating structure of the mho unit and the moving contact should barely return to the right when the relay is de-energized.

There should be approximately 1/64-inch end play in the shaft of the rotating structure. The lower jewel screw should be screwed firmly in place, and the top pivot locked in place by its set screw.

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, with particular attention paid to tap plugs.

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

The contact surfaces should be clean.

The clutch should slip at a torque corresponding to approximately 50 grams applied at the contact normal to the contact arm.

The normally open contacts of the telephone relay should have at least .005-inch wipe and the normally closed contacts should have at least 15 grams contact pressure.

MAINTENANCE

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

PERIODIC INSPECTION AND TESTING

The relay should receive an inspection such as described under ADJUSTMENTS at least once every six months, with enough of an electrical test to determine that the units will operate.

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.

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

INSTALLATION OF RENEWAL PARTS

All stationary contact parts can be installed directly in place by removing the appropriate screws.

The jewel screw can be removed from the unit by means of an offset screw driver or an end wrench. When turning a jewel screw into place, special precautions should be taken to prevent damage to the phosphor bronze bearing surface at the top of the shaft as the shaft is raised by the jewel screw.

If it is necessary to remove the shaft structure, the outer turn of the spiral spring should first be unsoldered from its slot in the support post mounted on the adjusting arm. Then after removing the two screws holding the top bearing support to the supporting posts on either side of the unit, the top bearing support should be pried straight up off its dowel pins, taking the upper pivot and spring adjusting arm with it. Exercise caution that the pivot does not mar the bearing surface inside the shaft and that the dowel pins are not bent. With the top bearing support placed aside, the entire cup and shaft with its clutch and contact assembly can be withdrawn from the magnetic structure of the unit. In order to disengage the moving contact from the stationary contact structure, the stationary contact structure can be dismounted from the two posts at the sides of the unit and worked free of the moving contact.

CAUTION: Ease the cup out very gently to avoid scratches in the soft aluminum surface. Protect the parts from dust and chips while disassembled.

Loosen the set screw in the steel collar at the top of the shaft and remove the collar. The various parts of the clutch and contact structure will then slide off the shaft.

To reassemble, reverse the procedure. Considerable care is necessary in soldering the spiral springs so that neighboring turns do not touch. Do all forming of the spirals near the mounting post and do not make any bend sharper than 1/32-inch radius. A stamp on the back of the upper bearing plate and one of its supporting posts indicates the proper position of the supoort on the dowels.

ORDERING RENEWAL PARTS

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted as described in the Renewal Parts Bulletin for this relay, and complete nameplate data. If possible give the General Electric Company's requisition number on which the relay was furnished. If no renewal parts bulletin is available describe the part in detail, giving approximate dimensions.

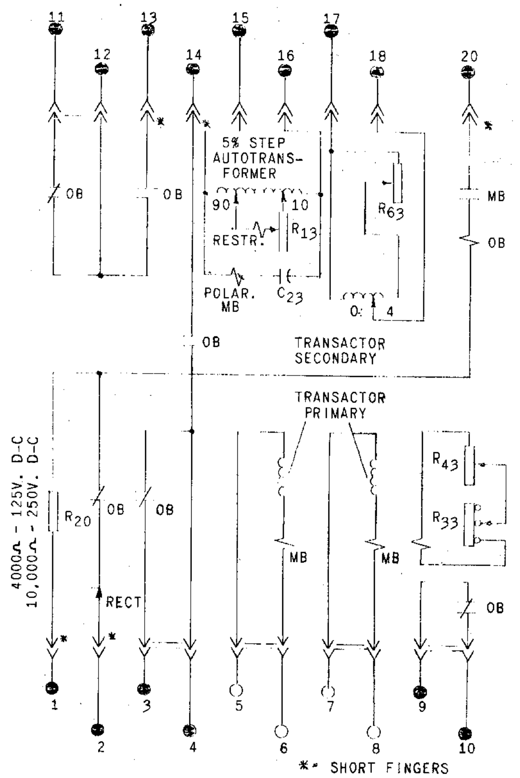

Fig. 3 Internal Connections For Type CEB12A Relay

Fig. 3 (377A102)

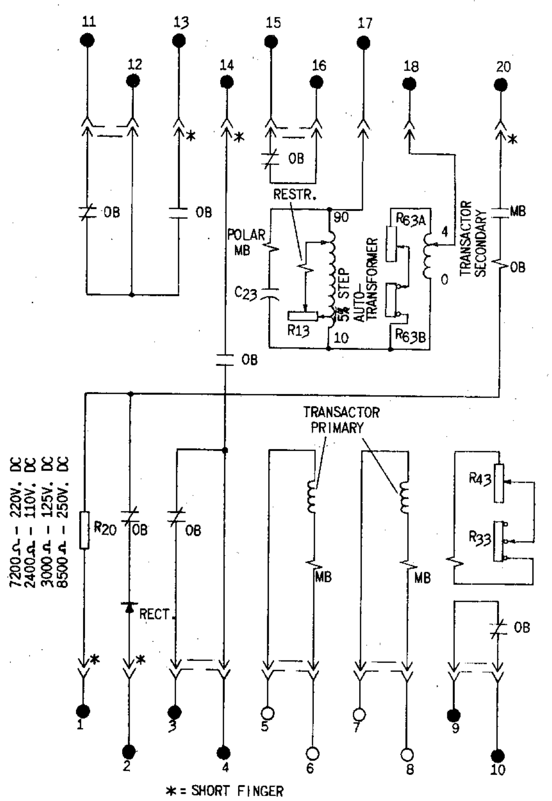

Fig. 4 Internal Connections For Type CEB12B Relay

Fig. 4 (377A103)

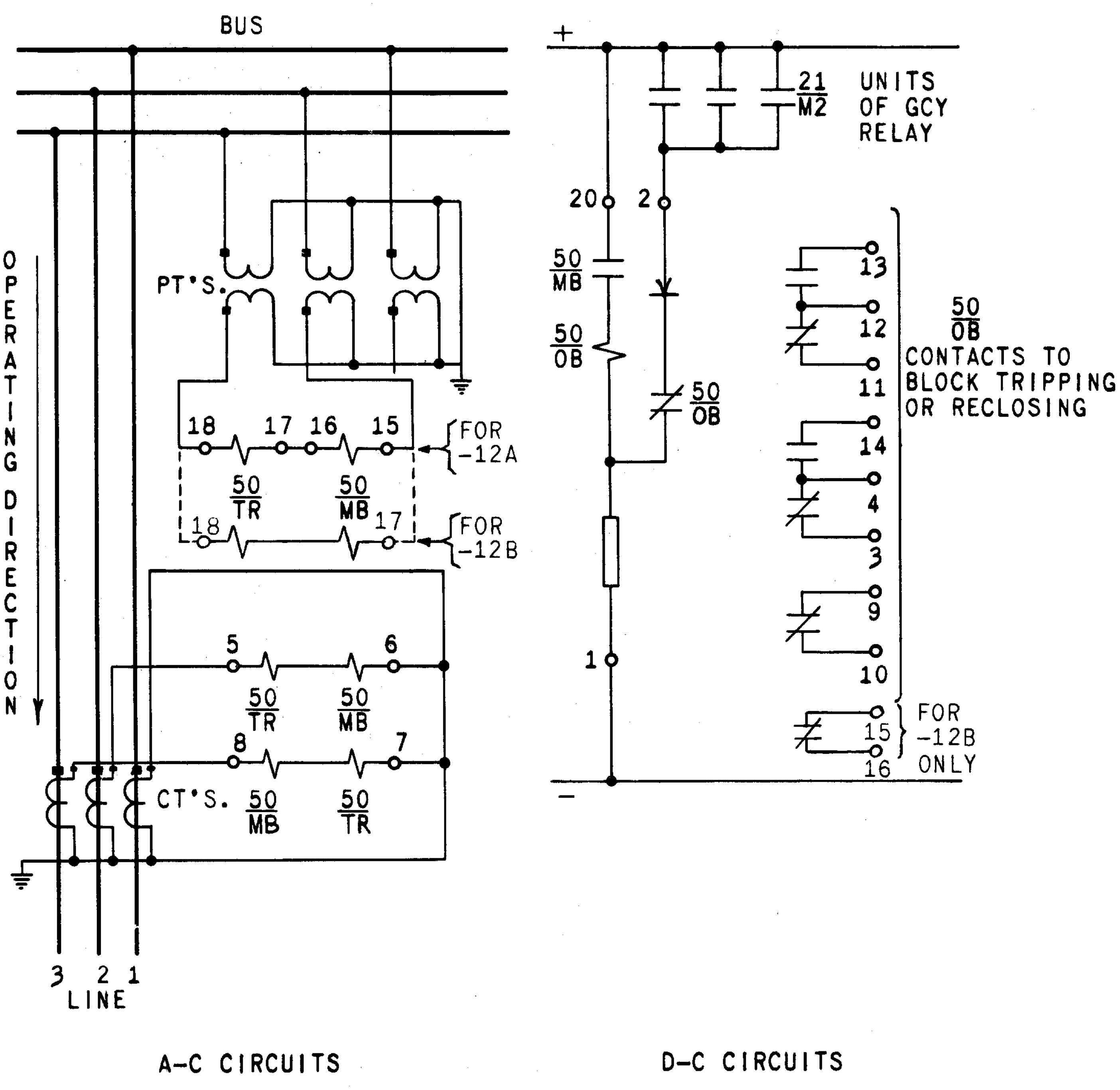

Fig. 5 (K-6400770)

Fig. 5 Typical External Connections For Type CEB12A And CEB12B Relays

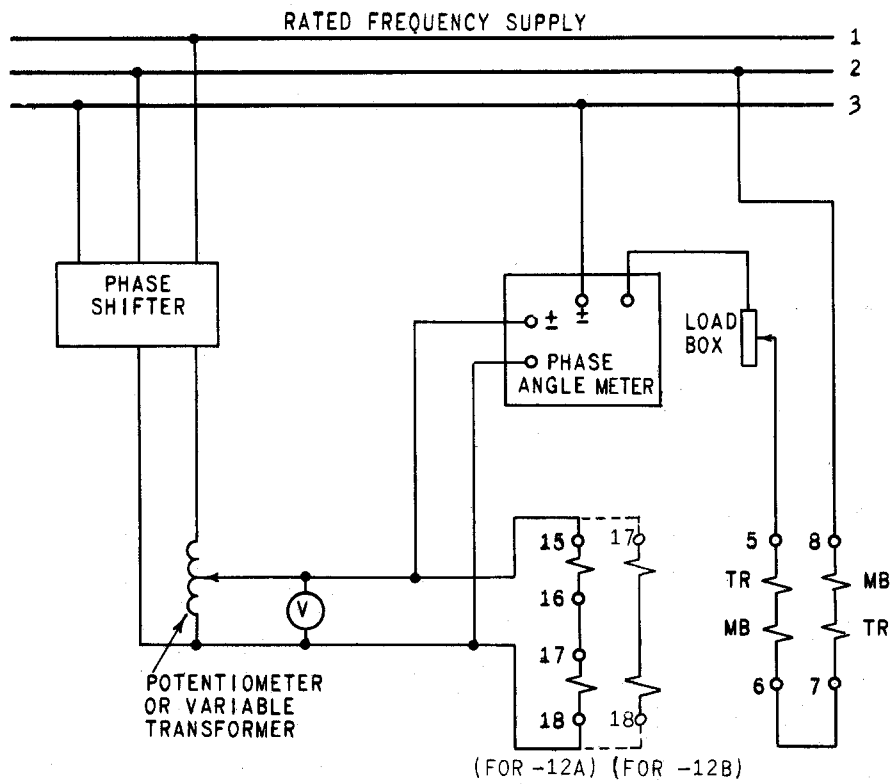

Fig. 6 (K-6400771)

Fig. 6 Test Connections For Setting Maximum Torque Of Type CEB12A And CEB12B Relays

CURVE	MAX. TORQUE	OFFSET
1	75 DEG.	0
2	60 DEG.	0
3	75 DEG.	1 OHM

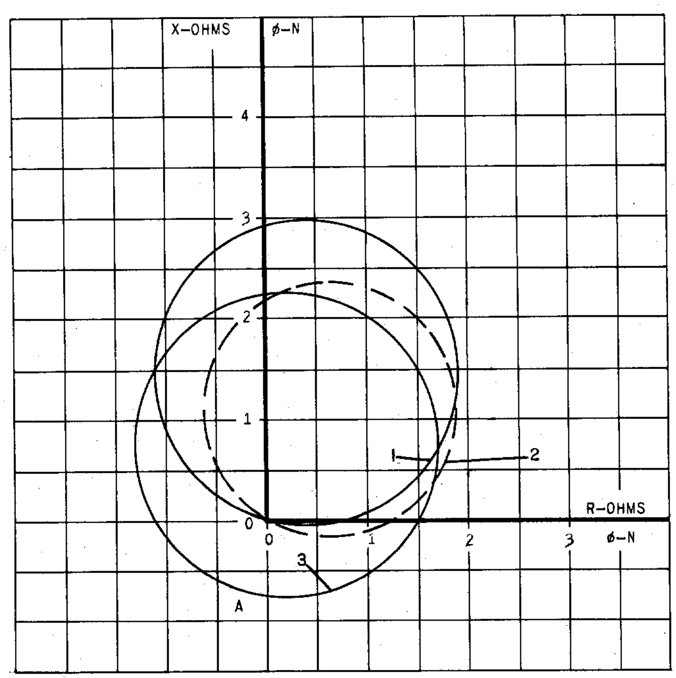

Fig. 7 (K-6375827)

Fig. 7 Impedance Characteristics Of Type CEB12A And CEB12B Relays

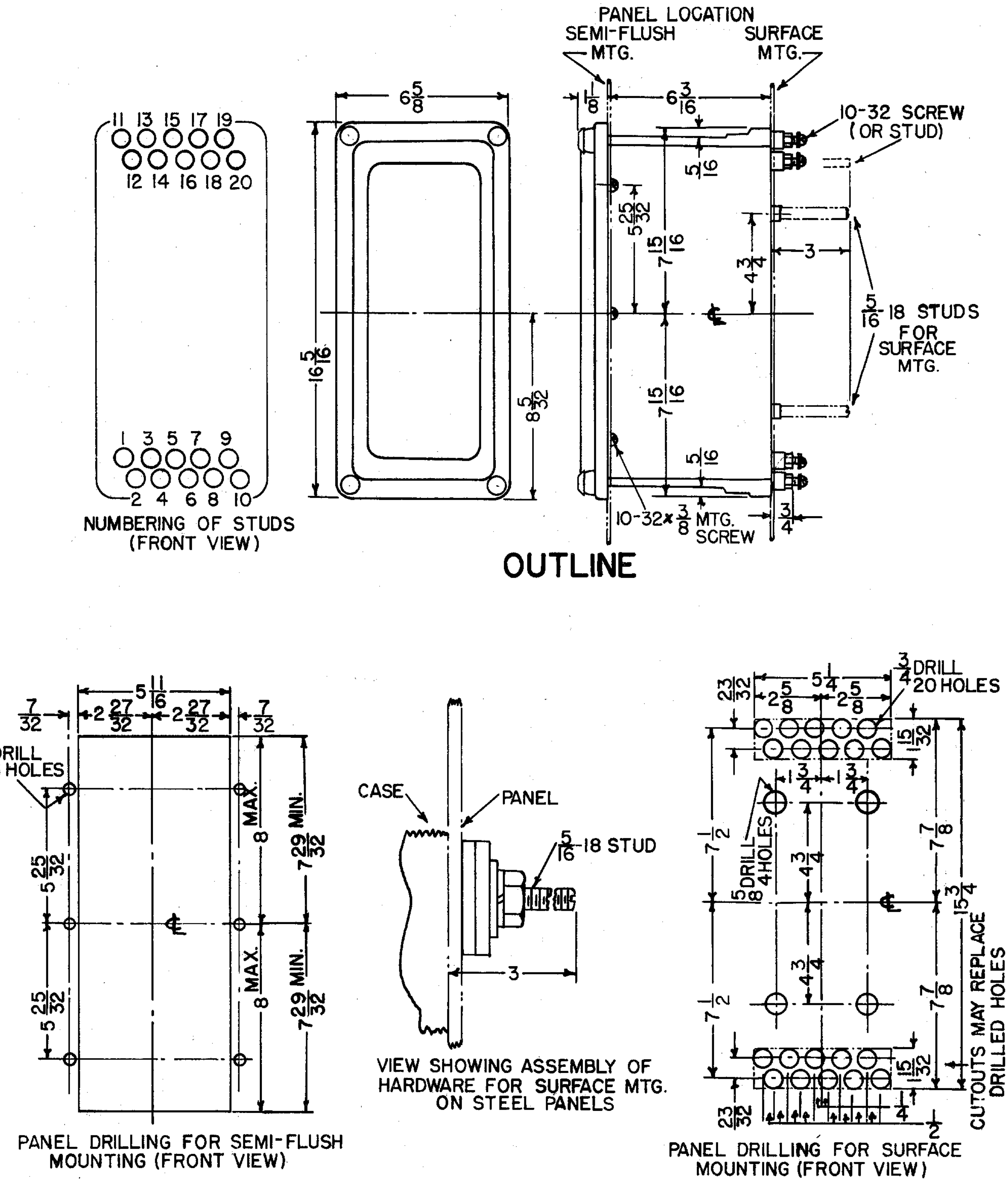

Fig. 8 (K-6209274)

Fig. 8 Outline And Panel Drilling Dimensions Of Type CEB12A And CEB12B Relays

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