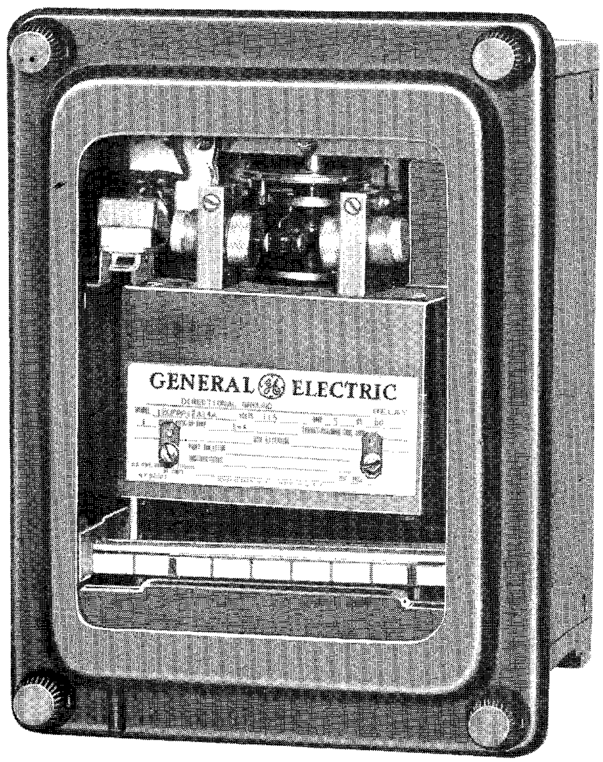
INSTRUCTIONS

GEI-38885A

SUPERSEDES GEI-38885

DIRECTIONAL GROUND RELAYS



Types

CFPP11A
CFPP12A
CFPP12E

A

LOW VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

DIRECTIONAL GROUND RELAYS
TYPES CFPP11A, CFPP12A AND CFPP12E

INTRODUCTION

The Type CFPP11A relays have single circuit-closing contacts. Maximum torque occurs when the current lags the voltage across the relay by 45 degrees.

The Type CFPP12A relays are similar to the Type CFPP11A relays except for the addition of circuit-opening contacts.

The Type CFPP12E relays are similar to the Type CFPP12A relays except that they have maximum torque at 60 degrees lag instead of 45 degrees.

APPLICATION

These relays can be used when a high-speed, potentially-polarized, ground directional relay is required. When one of these relays is used in conjunction with an overcurrent relay, directional control of the overcurrent relay should be provided if the direction of power can change while the overcurrent relay contacts are still closed.

Even if a momentary reversal of power immediately following clearing of a fault is not possible, it is advisable to use some method of directional control if both directional contacts are being used. This is evident because sufficient energy will be stored in the deflected contact to cause rebound to the other contact when a fault is removed. If only one contact is being used, the stored energy in the other (deflected) contact may be substantially eliminated by reversing the contact barrel and its sleeve in the contact holder thereby using the back end as a solid stop. To do this, loosen the screw that locks the barrel in place. Remove the barrel and the sleeve the barrel screws into. Unscrew the sleeve off the barrel. Insert the sleeve into the contact support from the inside and screw the barrel into it from the outside, with the contact pointing out. When the stop is located where desired be sure to lock in this position by tightening the screw. It has been found advisable to remove the corresponding moving contact finger as well.

OPERATING CHARACTERISTICS

The time characteristic shown in Fig. 1 applies particularly to the so-called "sensitive" relays (minimum pickup less than 0.025 ampere) rated 60 cycles and with maximum torque at 45 degrees lag. For the "nonsensitive" relays (minimum pickup ranges of 0.5-2 ampere or 1-4 ampere) the characteristic curves are shown in Figs. 3 and 4. For rated frequencies less than 60 cycles an increase in the time values may be expected (see Fig. 2 for the 25-cycle relay). For different angles of maximum torque the characteristic is substantially the same.

Phase-angle characteristics are shown in Fig. 8. If relay currents be represented on this diagram as vectors drawn from the origin at the proper phase angle, any relay currents whose vectors terminate on the zero torque line produce zero torque. Any currents whose vectors cross the line and terminate in the region beyond, produce tripping torques, which increase with the current. With the current held constant, maximum torque will be developed 90 degrees from the zero torque line.

RATINGS

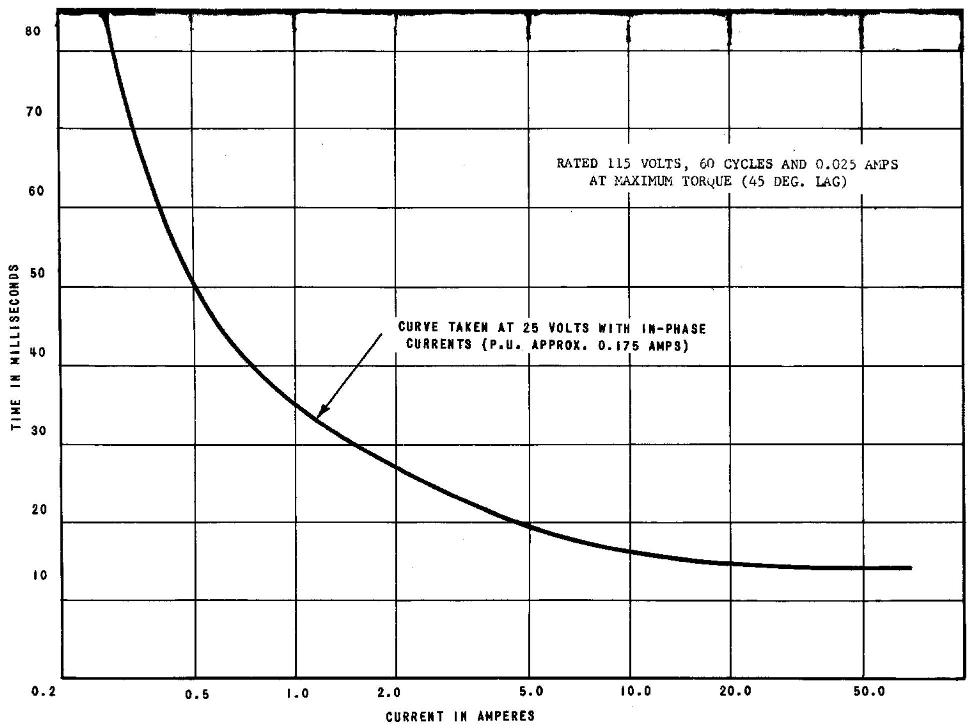
The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying ratings are limited by the two different ratings of target and holding coils as indicated in the following table:

Function	Target and Holding Coil	
	1 ampere (0.25 ohm)	0.2 ampere (7 ohms)
Tripping Duty	30	5
Carry Continuously	2.5	0.5

The 0.2-ampere coil is for use with trip coils that operate on currents ranging from 0.2 up to 1.0 ampere at the minimum control voltage. If this coil is used with trip coils that take 1.0 ampere or more, there is a possibility that the 7 ohms resistance will reduce the current to so low a value that the breaker will not be tripped. This coil can safely carry currents as high as 5 amperes.

The 1.0-ampere coil should be used with trip coils that take 1.0 ampere or more at the minimum control voltage, provided the current does not exceed 30 amperes at the maximum control voltage. If the current exceeds 30 amperes, an auxiliary relay must be used to control the trip coil circuit, the connections being such that the current does not pass through the contacts or the target and holding coil of the protective relay.

When it is desirable to adopt one type of relay as standard to be used anywhere on a system, relays with the 1.0 ampere coil should be chosen. These relays should also be used when it is impossible to obtain trip coil data, but attention is called to the fact that the target may not operate if used with trip coils taking less than 1.0 ampere.



* Fig. I Typical Time-Current Curve For Type CFPP Relays

Fig. I (K-6306942) Cover (8010090)

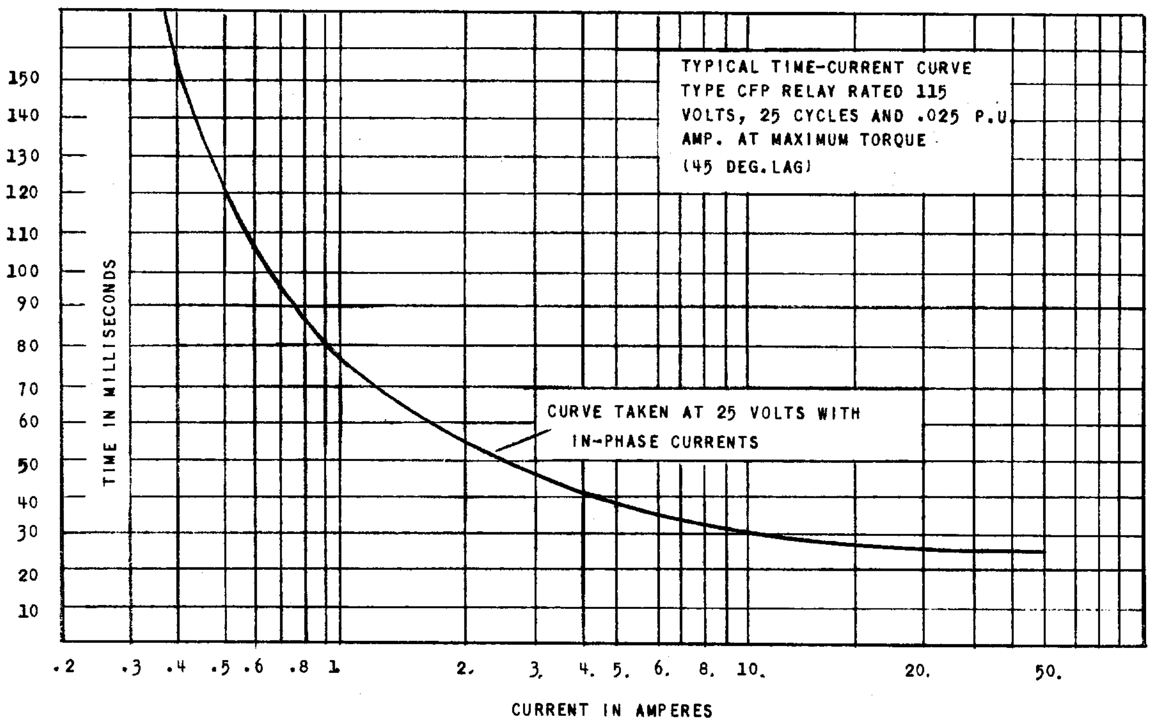
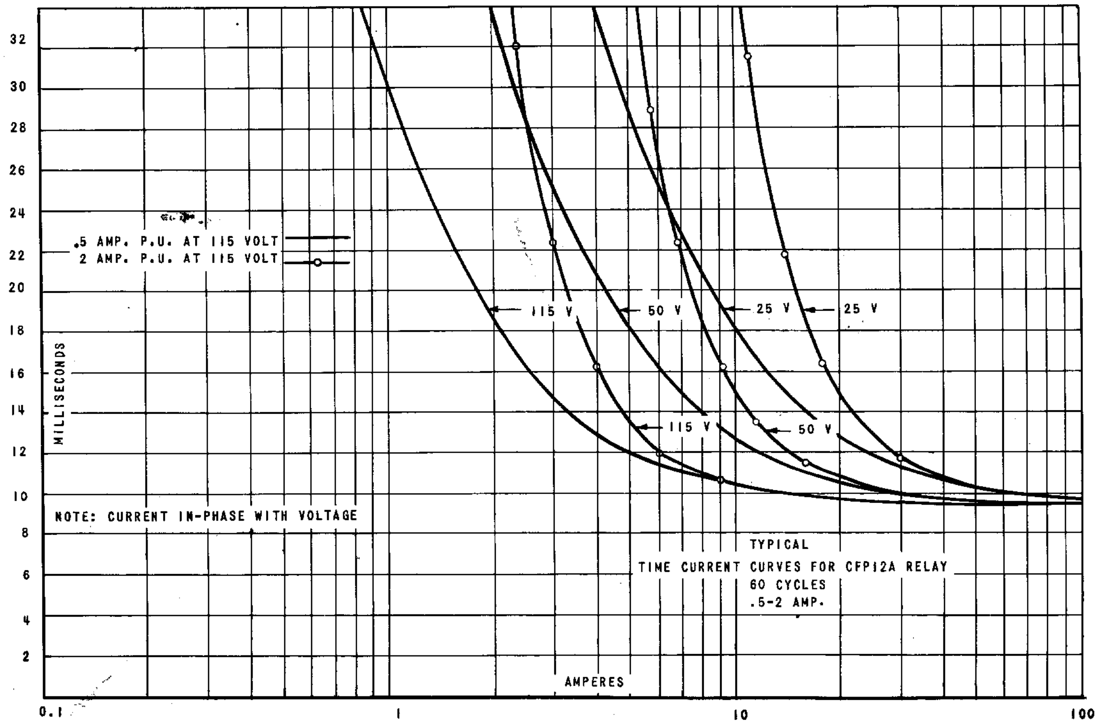


Fig. 2 Typical Time-Current Curve For Type CFPP Relays

Fig. 2 (H-6280628)

* Denotes change since superseded issue.

Fig. 3 (K-6400476) Sht. 1



* Fig. 3 Typical Time-Current Curves For Type CFPP12A Relays Rated 60 Cycles, 0.5 To 2 Amperes

Fig. 4 (K-6400476) Sht. 2

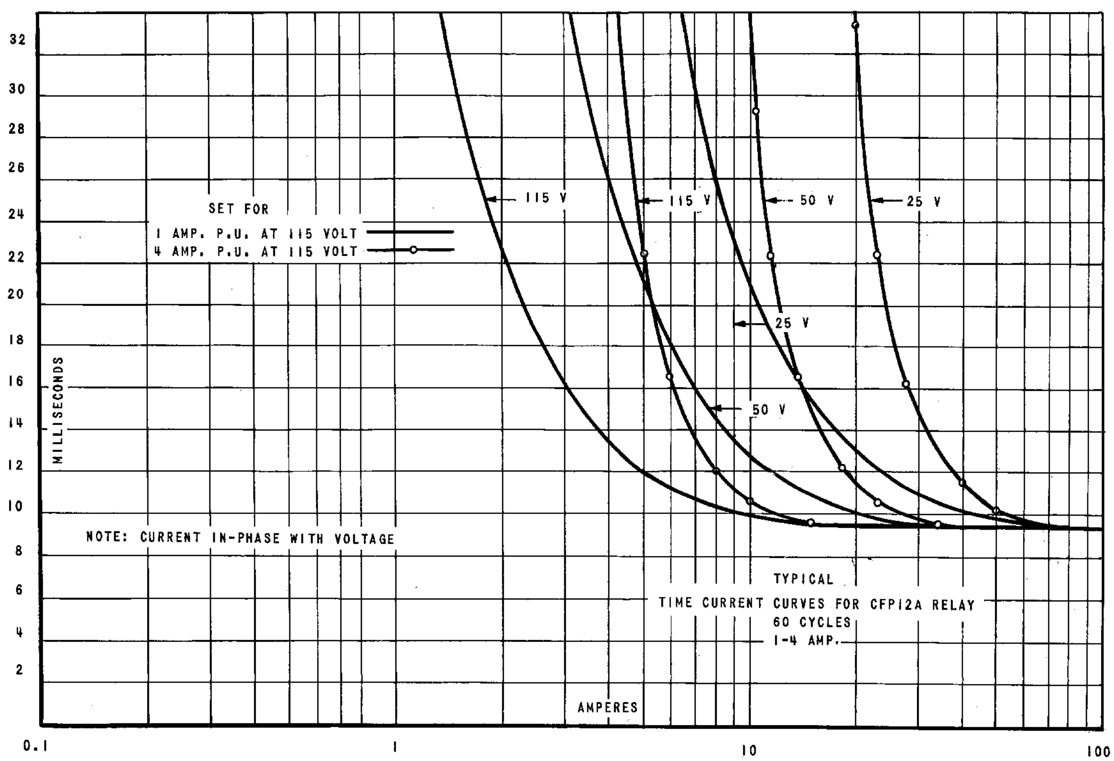


Fig. 4 Typical Time-Current Curves For Type CFPP12A Relays Rated 60 Cycles, 1 To 4 Amperes

* Denotes change since superseded issue.

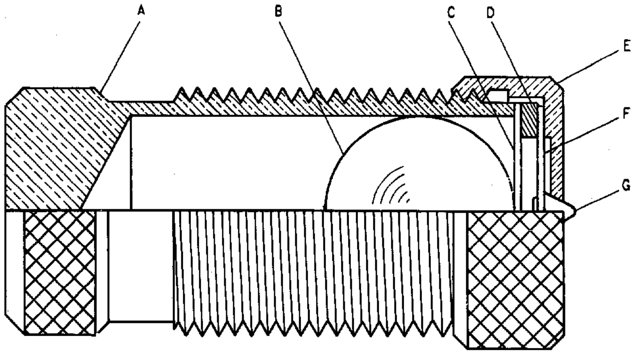


Fig. 5 Stationary Contact Assembly

Fig. 5 (K-6077069)

BURDENS

add new ... for -12E (more turns, more R less C) ATJ 11 apr 61

The burdens of the relays are given in the following table:

	Volts	Amps	Freq.	Burden VA	Burden Watts
Current Coils†		5	60	13	5
Potential Circuit	115		60	14.8**	10.3
Current Coils†		5	25	8.15	5.5
Potential Circuit	115		25	28.2	28

** A capacitive burden.

* † Does not change for relays with 0.025, 0.1-0.4, 0.5-2.0 or 1-4 ampere pick up.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

DESCRIPTION

CUP AND STATOR

These relays are induction-cylinder devices for alternating current circuits. The principle by which torque is developed in these induction-cylinder relays 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 has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. The poles are fitted with current and potential coils. 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.

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

CONTACTS

The contacts of the relay Fig. 5 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 thence 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.

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.

* Denotes change since superseded issue.

Fig. 6 (K-6209003)

Fig. 7 (K-6209385)

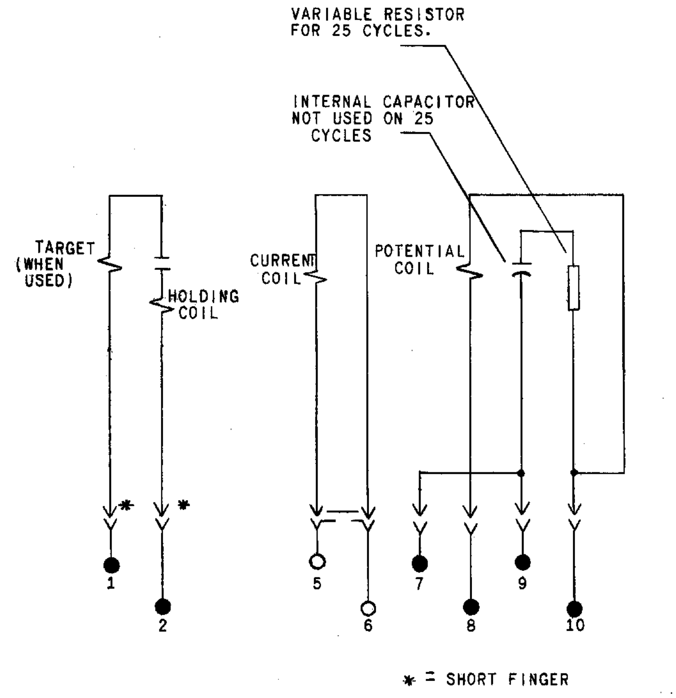


Fig. 6 Internal Connections For The Type CFPP11A Relay (Front View)

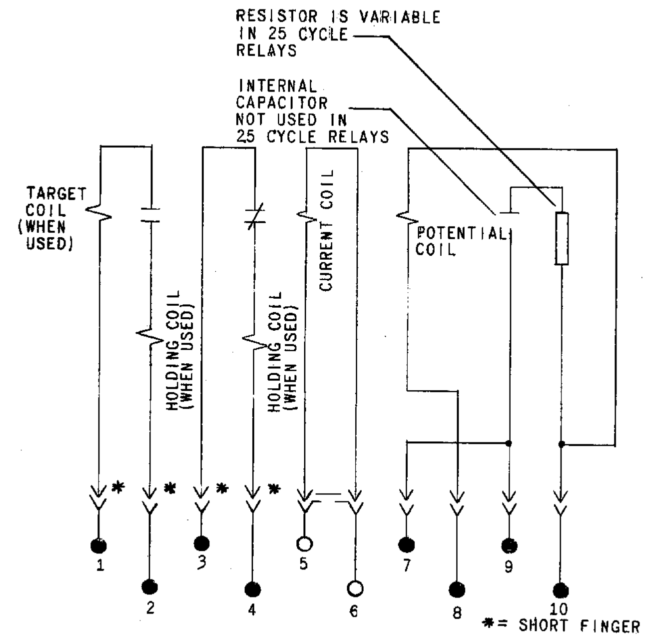


Fig. 7 Internal Connections For Relay Types CFPP12A And CFPP12E (Front View)

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 drilling dimensions are shown in Fig. 12. The outline of the external capacitor used with 25 cycle relays is shown in Fig. 11.

CONNECTIONS

The internal connection diagrams are shown in Figs. 6 and 7. The external connection diagram is shown in Fig. 10.

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

INSPECTION

Before the relay is placed in service be certain to inspect the moving parts for any evidence of damage in shipment. The movement should be very free and the spring should promptly return the contact arm when it is displaced manually from its de-energized position.

*CAUTION:
Every circuit in the drawout case has an auxiliary brush; this is the short one in the case (not on the cradle) which the connection plug or test plug should engage first. On every current circuit or other

* Denotes change since superseded issue.

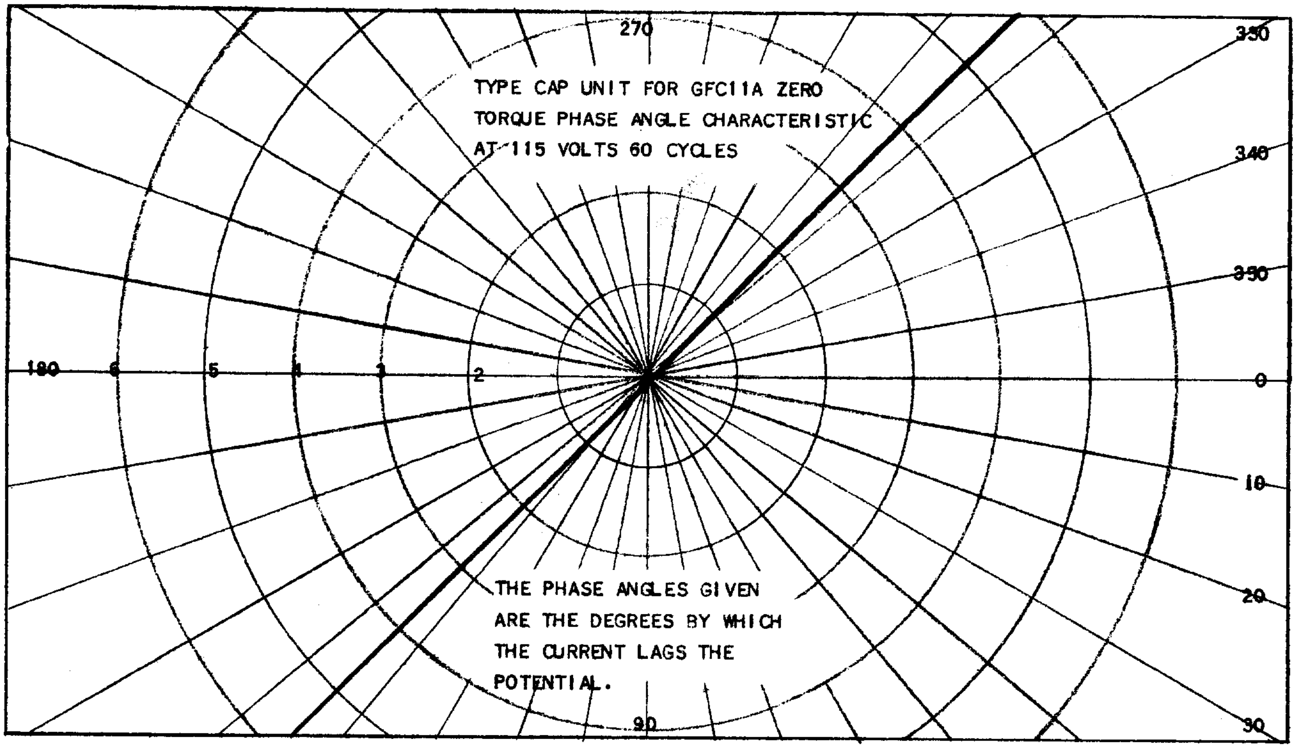


Fig. 8 Zero Torque Phase Angle Characteristic At 115 Volts, 60 Cycles

Fig. 8 (K-6174790)

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, as 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 other main brush.

The relays may or may not have holding coils, depending upon the model ordered. If supplied, they may easily be removed from the circuit. To do this, move the lead-in connection from one holding coil terminal to the opposite end of the core.

INSTALLATION TESTS

Upon installing the relay it is necessary to know (1) that the voltage and current go to the proper relay terminals, and (2) that none of the relay coils is open-circuited.

The first of these requirements may be checked by simulating a fault; use a phase-angle meter to determine the current and voltage conditions thus obtained. To do this, first remove phase one from the primary of the wye-broken, delta potential transformer and short-circuit its phase one winding to neutral. This produces a residual voltage in the secondary circuit. Then short-circuit the current transformers on phases 2 and 3, supplying the phase relays, and open up the circuit of the current coils of the phase relays corresponding to the short-circuited current transformers. Of course, the circuit of the ground unit must be left intact.

With the angle between the current and the voltage thus produced shown on the phase-angle meter, it can be determined if the relay is properly connected by referring to the phase-angle characteristics such as are given on Fig. 8, and considering the direction of power flow. If the current is close to the angle of zero torque, the interchange of reactive current should be modified so as to obtain a more favorable phase angle.

The fact that none of the relay coils is open-circuited will be made evident during the above test. This will be shown by the fact that torque is produced in one direction or the other.

ADJUSTMENTS

The relay was properly adjusted at the factory to obtain the desired characteristics, and it is advisable not to disturb these adjustments. If, for any reason, the adjustments have to be disturbed, the following points should be observed when restoring them.

BEARINGS

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 1/64 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 and thus depress the spring-mounted jewel until the cup strikes the iron, the shaft should move about 1/16 inch.

Examination under a microscope is preferable when checking the lower jewel for fractures. However, if a microscope is not available, satisfactory results generally can be obtained by exploring the jewel surface with a fine needle.

CONTACTS

To change the stationary contact brush, remove the contact barrel and sleeve as a complete unit after loosening the screw at the front of the contact block. Unscrew the cap. The contact and its flat spiral mounting spring may then be removed.

To reassemble, the contact barrel is best accomplished by placing the stationary contact, the ring spacer, the diaphragm and the steel ball in the cap in the order given. Then screw the barrel into the cap.

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

The stop screw fastened with a locknut should hold the moving contact arm in a neutral position; i.e., with it pointing directly forward. Then bring the stationary contact up until it just touches the moving contact by rotating the contact barrel. Next, back it away 2/3 turn to obtain approximately 0.020 inch contact gap. Last, tighten the screw which secures the barrel.

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

HOLDING COIL

The location of each holding coil may be adjusted by loosening the mounting screw and sliding the coil either to the left or right in a groove provided for that purpose. The holding coils are located at the factory so that there is a gap of about 0.050 inch between the pole pieces and the armature. Forty mils (0.040 inch) is equivalent to 1-1/4 turns of the contact barrel. The holding coil gap must not be adjusted appreciably below 0.40 inch.

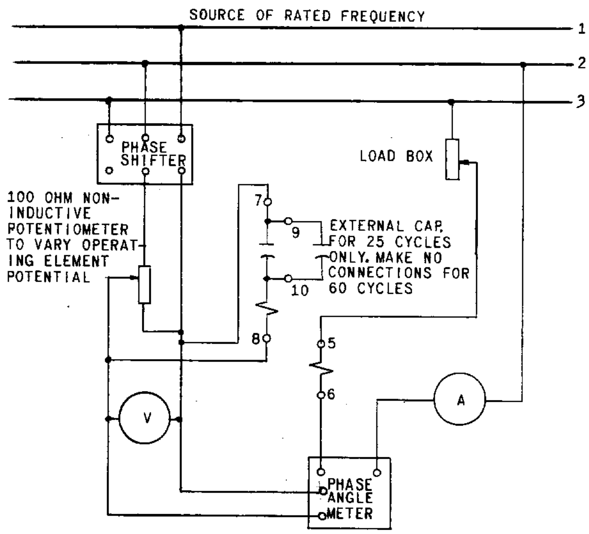


Fig. 9 Test Connections For The Type CFPP11A Relay

Fig. 9 (K-6209175)

PICKUP

The ranges of pickup of the nonsensitive relays used at present are 0.5 to 2 and 1 to 4 amperes. The pickup of the present sensitive relay is less than 0.025 ampere. These values are all taken with rated voltage at the rated angle of maximum torque using connections according to Fig. 9.

The above ranges of pickup were obtained at the factory through the proper adjustment of the upper control spring and, when the relay was shipped, its final adjustment was such that the relay closed its contacts at the low point of the range.

Readjustment of the pickup to a higher value within the range for the particular relay can be obtained readily by turning the upper spring and adjusting ring. This can be accomplished after loosening the hexagonal-head locking screw, toward the rear of the adjusting ring guide, at the top of the relay. The spring adjusting ring must be locked after the proper pickup is obtained.

MAINTENANCE

PERIODIC TESTS

An operation test and inspection of the relay at least once every six months is recommended. The following paragraphs and the information given under ADJUSTMENTS should be observed in checking the relay.

LABORATORY TESTS

POLARITY

Connect terminals 5 and 7 together. Connect a 50-ohm resistor across terminals 6 and 8 and use external capacitors where required as indicated in the external connections. The relay should close its left-hand contacts, front view.

PHASE ANGLE AND TIME CHARACTERISTICS

The phase angle and time delay characteristics of the relays may be obtained using connections according to Fig. 9. Due to the speed with which the relay operates, it is advisable to use an electronic timer, or similar device, to obtain the time delay readings.

CLUTCH ADJUSTMENT

The clutch was adjusted at the factory to slip at approximately 2.8 amperes on the sensitive relays and 11 times the low point of the range on the non-sensitive relays. This adjustment is varied by means of the threaded sleeve with screw driver slot located at the right-hand side of the moving contact arm near the shaft.

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

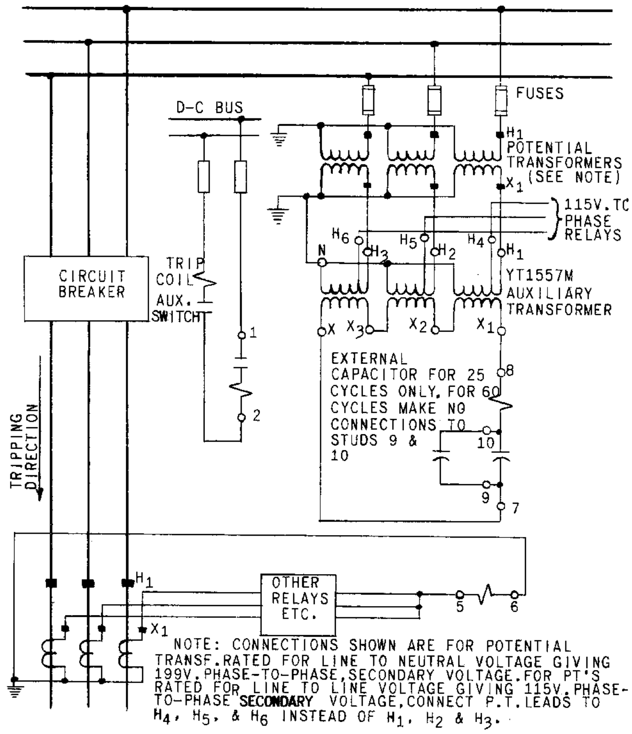


Fig. 10 (K-6209157)

Fig. 10 External Connections For Directional Ground Protection With A Type CFPP11A Relay

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted, and give complete nameplate data. Refer to parts publication GEF-3925. If possible, give the General Electric Company requisition number on which the relay was furnished.

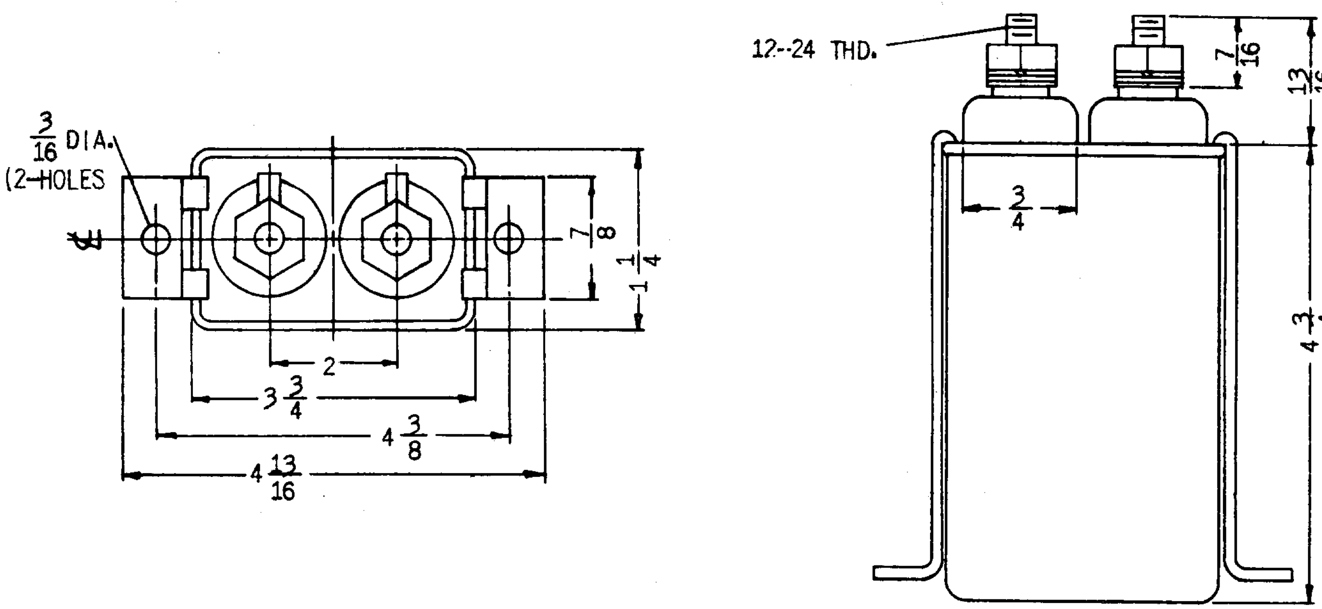


Fig. 11 (104A8913)

Fig. 11 Outline Of External Capacitor Used With 25 Cycle Type CFPP Relays

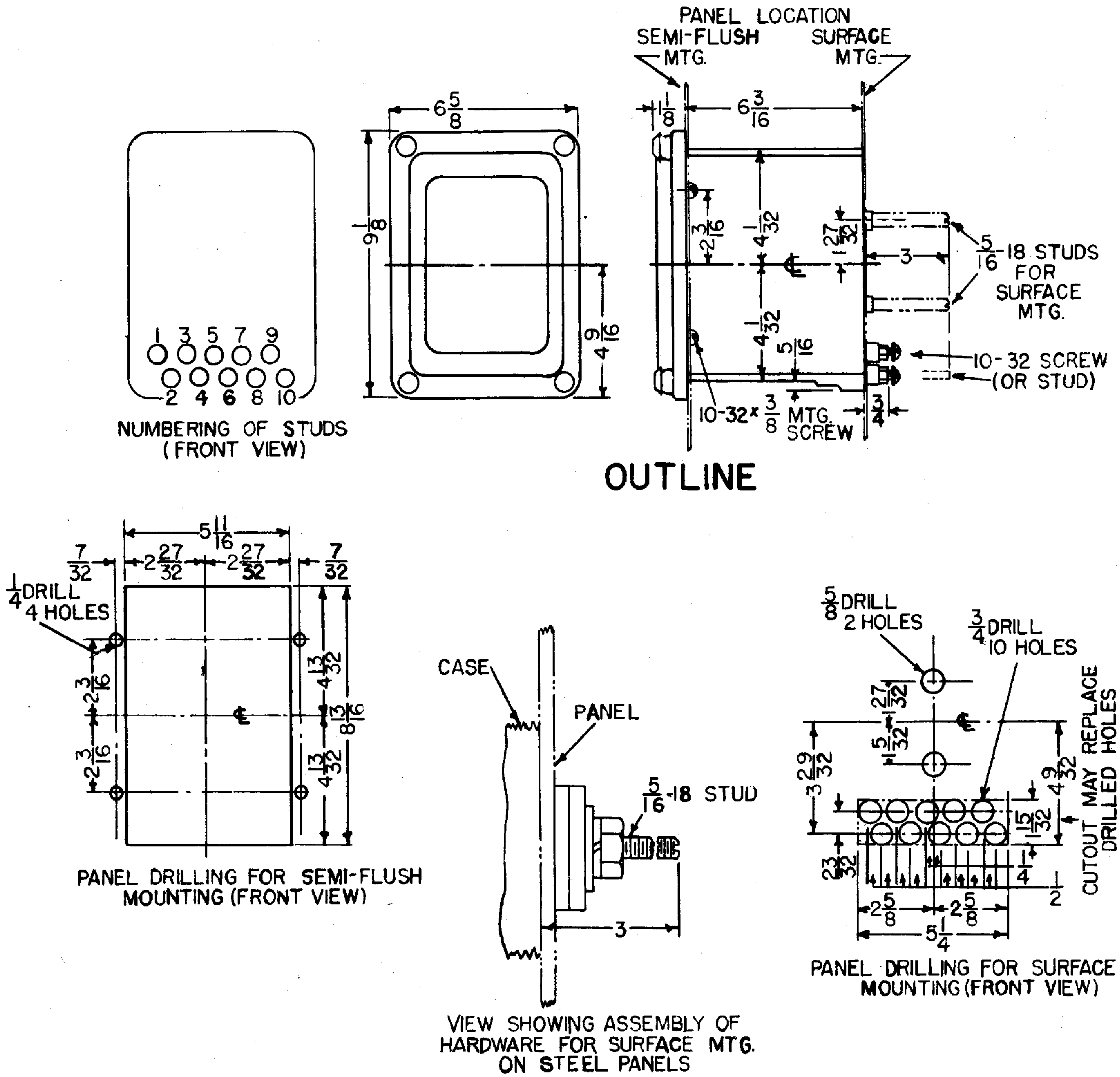


Fig. 12 (K-6209271)

Fig. 12 Outline And Panel Drilling Dimensions For Relay Types CFPP11A, CFPP12A, And CFPP12E

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5

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4-58