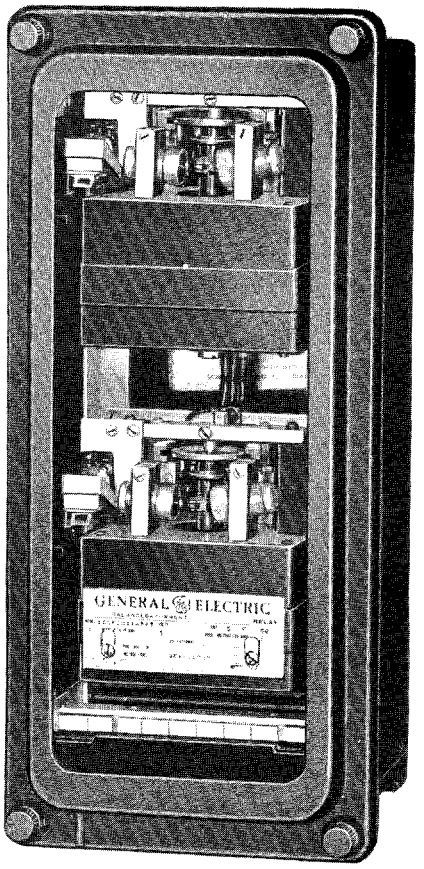
INSTRUCTIONS

GEI-22727B
SUPERSEDES GEI-22727A

BALANCED CURRENT RELAY



Type CFCB11A

POWER SYSTEMS MANAGEMENT DEPARTMENT

GENERAL ELECTRIC

A PHILADELPHIA, PA.

CONTENTS

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

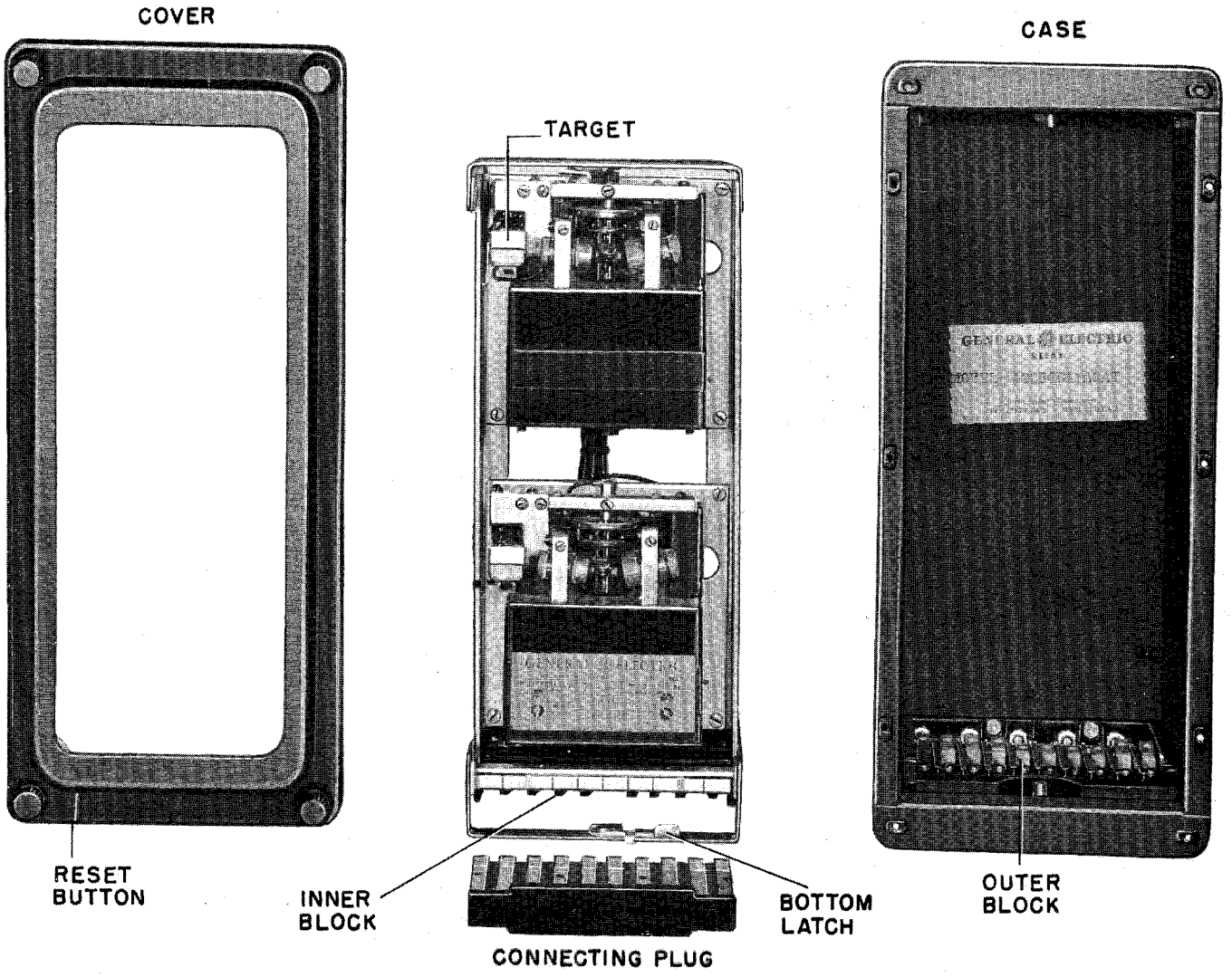


Fig. 1 The Type CFCB11A Relay Disassembled

BALANCED CURRENT RELAY
TYPE CFCB11A

INTRODUCTION

The Type CFCB11A relays provide high-speed balanced current protection for two parallel lines. Certain forms of the Type CFCB11A relays are designed for balancing the phase current in one line against the corresponding phase current in the other parallel line, while other forms are for balancing ground currents in the two parallel lines. When used for phase protection, one relay is needed for each pair of parallel phase conductors; this means a total of three relays for the two terminals of the parallel lines. When used for ground protection one relay is sufficient for two parallel lines.

These relays consist of two induction cylinder elements of similar design. The phase or ground current of one line is used to energize the operating coils of the top element and the restraining coils of the bottom element. The phase or ground current of the other parallel line is used to energize the restraining coils of the top element and the operating coils of the bottom element. In this manner the phase or ground currents in the two parallel lines are balanced against each other, and one or the other element will operate depending on which of the two parallel lines is subject to an internal fault.

The relay elements will operate if the operating current becomes higher in magnitude than 125 per cent of the restraining current. This ratio of operating current to restraining current is called the "slope" of the element; therefore, the CFCB elements have a 125 per cent slope.

After the CFCB realy operates to clear one of the parallel lines which is faulted, increased load or fault current in the unfaulted line balanced against zero current in the cleared, faulted line causes the CFCB element to operate to interrupt the sound line carrying load current. To prevent this needless interruption of service the trip circuits from the CFCB relays to the circuit breakers of the parallel lines must be interlocked so that the tripping of the breaker on the faulted line causes the trip circuit from the CFCB relay to the breaker on the unfaulted line to be opened before the CFCB element can operate to trip the circuit breaker on the unfaulted line due to the unbalance between increased load or fault current and zero current. This interlocking can be done by either (a) auxiliary switches on the circuit breakers which open before the main breaker contacts open, or (b) series auxiliary relays energized by the tripping current. Refer to Fig. 11 for connections of these auxiliary devices.

The Type CFCB11A relays are designed to eliminate the necessity for potential transformers, such as were used on preceding types. These relays, both for phase and ground protection, are available only in single-end, two-unit cases for semi-flush or surface mounting.

On each element of the Type CFCB relays are two contacts, one for tripping the circuit breaker and the other for operating an annunciator or another alarm device. It is recommended that the front contacts (those connected to studs 2 and 9) be used for tripping, and the back contacts (those connected to studs 3 and 4) be used to operate the annunciator or alarm.

CHARACTERISTICS

The pickup characteristics of the Type CFCB-11A phase relay are shown on the curves of Fig. 2. Note that the minimum pickup is 7 amperes with zero restraint current. The term "forward" used on the pickup curves indicates a condition in which currents flowing from stud 5 to stud 6 and from stud 7 to stud 8 are in phase. If the current flowing through one of these circuits is reversed (180° out of phase) then the curves marked "reverse" apply.

The corresponding pickup characteristics of the Type CFCB11A ground relay are shown on the curves of Fig. 3. Note that the minimum pickup for the standard ground relay is 3 amperes with zero restraint current.

The time characteristics for the Type CFCB-11A relays are shown in Fig. 9.

RATINGS

The Type CFCB11A current balance relays for the balancing of phase currents have a pickup of 7 amperes with a slope of 125%. These relays are continuously rated at 7 amperes. The Type CFCB-11A relays for balancing ground currents have a pickup of 3 amperes with a slope of 125%. These relays are continuously rated at 3 amperes. Figs. 2 and 3 show the relay characteristics for the phase and ground relays, respectively.

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

Function	Amperes A-C or D-C	
	1 Amp (0.5 Ohm) Target & Holding Coils	0.2 Amp (14 Ohms) Target & Holding Coils
Tripping Duty	30	5
Carry Continuously	4	0.8

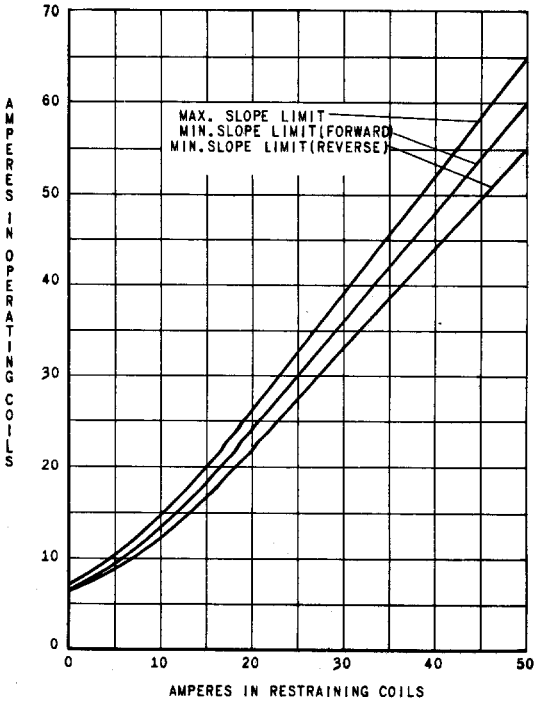


Fig. 2 Pickup Characteristics of Type CFCB11A Phase Relays

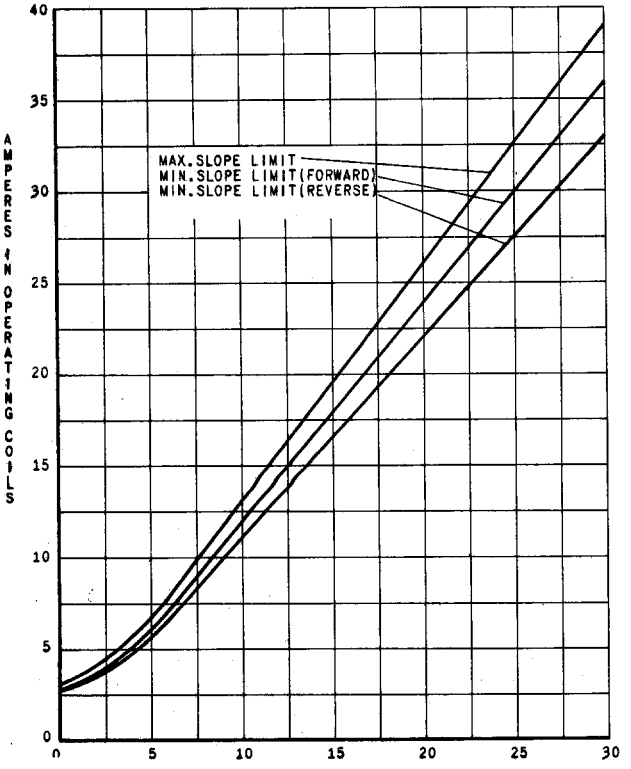


Fig. 3 Pickup Characteristics of Type CFCB11A Ground Relay

The target and holding coil ratings are determined by the current drawn by the trip coil. The 0.2 ampere rating 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 rating is used with trip coils requiring more than 1 ampere there is a possibility that the 14 ohms resistance will reduce the current to so low a value that the breaker will not be tripped.

The 1 ampere rating should be used with trip coils that take 1 ampere or more at the minimum control voltage, provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes, an auxiliary relay should be used, the connections being such that the tripping current does not pass through the contacts or the target and holding coils of the protective relay.

BURDENS

Burdens for the standard relays are given in the following table:

Pickup Amps	Freq.	Volt-Amps Burden at 5 Amps		
		Operating	Restraining	Total
7	60	1.5	2.5	4.0
3	60	8.2	13.6	21.8

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 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

There are three principal sizes of cases, each of which has studs for external connections at both ends or only at the bottom. These are respectively referred to as "double-end" and "single-end" cases. In either construction, the electrical connections between the relay units and the case are made through stationary molded inner and outer blocks; between the blocks nests a removable connecting plug which completes the circuits. The outer block, attached to the case, has the studs for external connections, and the inner block has terminals for the internal connections. The Type CFCB11A relays are furnished in single-end cases.

Fig. 1 shows a typical relay and its component parts such as the cradle, case connecting plug and cover.

The relay mechanism is mounted in the 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 by 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 cradle by thumbscrews, holds the connecting plug in place.

To draw out the cradle, the cover must first be removed. Then the plug can be drawn out. In so doing, the trip circuit is first opened, then the current-transformer circuits are short circuited. After the plug has been removed, the latch can be released and the cradle easily drawn out. To replace the cradle, the reverse order is followed.

The relay may be tested while mounted on the panel, either from its own or another source of power, by replacing the connecting plug with a separate testing plug. Or, the cradle can be drawn out and replaced by another, which has been laboratory tested.

INSTALLATION

LOCATION

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

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.

Do not lubricate any part of the mechanism except the lower jewel bearing. (See Below, "ADJUSTMENTS AND TESTS").

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel drilling diagrams are shown in Fig. 12.

CONNECTIONS

The internal connections diagram for the Type CFCB11A relay is shown in Fig. 10.

A typical wiring diagram, using relays with D-C control power, is given in Fig. 11.

GROUND CONNECTIONS

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.

ADJUSTMENTS AND TESTS

TARGETS AND HOLDING COILS

Certain forms of the Type CFCB11A relays are provided with 1.0 ampere target and holding coils, while other forms are provided with 0.2 ampere target and holding coils. The targets should operate at 90% of their ratings, while the holding coils should pull the holding armature in against its pole pieces at rated current.

PICKUP ADJUSTMENTS

The pickup values of the Type CFCB11A relays are set at the factory at 7 amperes for phase relays and 3 amperes for ground relays with zero restraining current in the element under test. Generally these settings will not have to be disturbed.

If, however, a readjustment is necessary the pickup values can be reset by adjusting the control spring. (See Figs. 4 and 6). Loosening the hex head spring-locking screw allows the spring collar to be rotated. Rotating the collar in a counter-clockwise direction (viewed from the top) increases the pickup value; rotating the collar in a clockwise direction (viewed from the top) reduces the pickup value. When the desired pickup value is obtained the spring-locking screw should be tightened.

The test circuit of Fig. 7 can be used for the pickup current test, with ammeter A_2 reading zero for a test of the top unit, and ammeter A_1 reading zero for a test of the bottom unit.

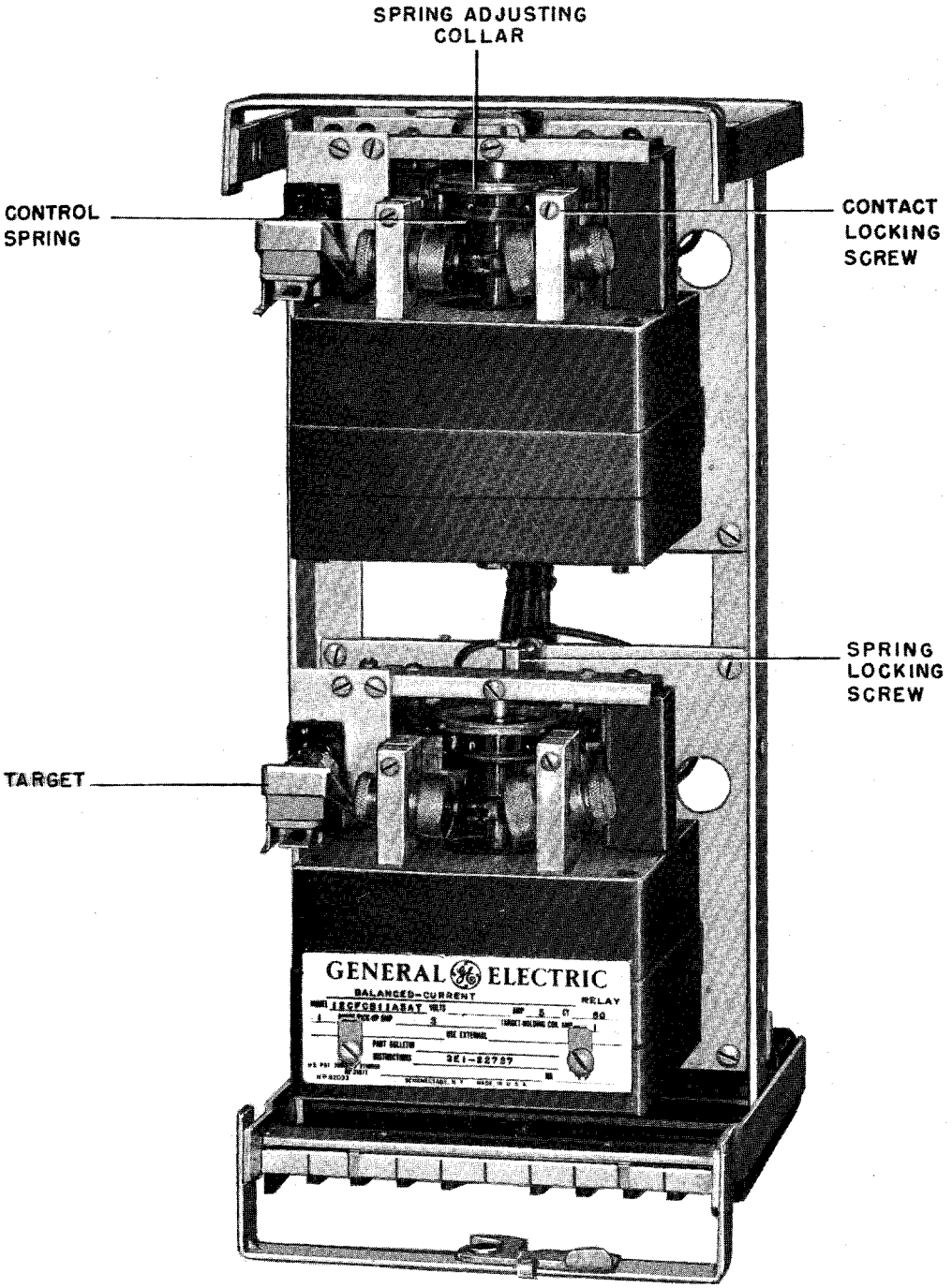


Fig. 4 Type CFCB11A Relay Withdrawn from Case, Front View

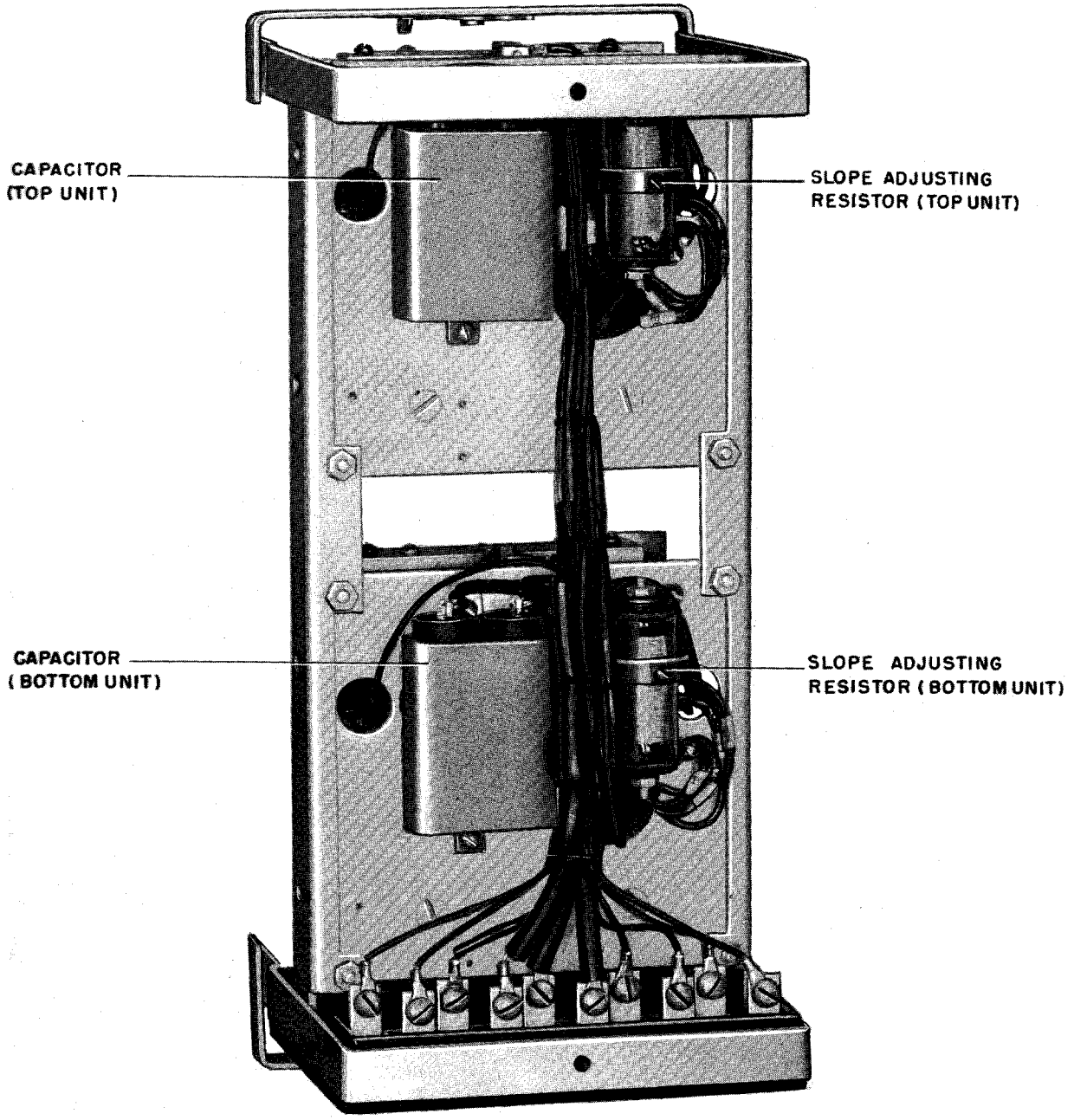


Fig. 5 Type CFCB11A Relay Withdrawn from Case, Back View

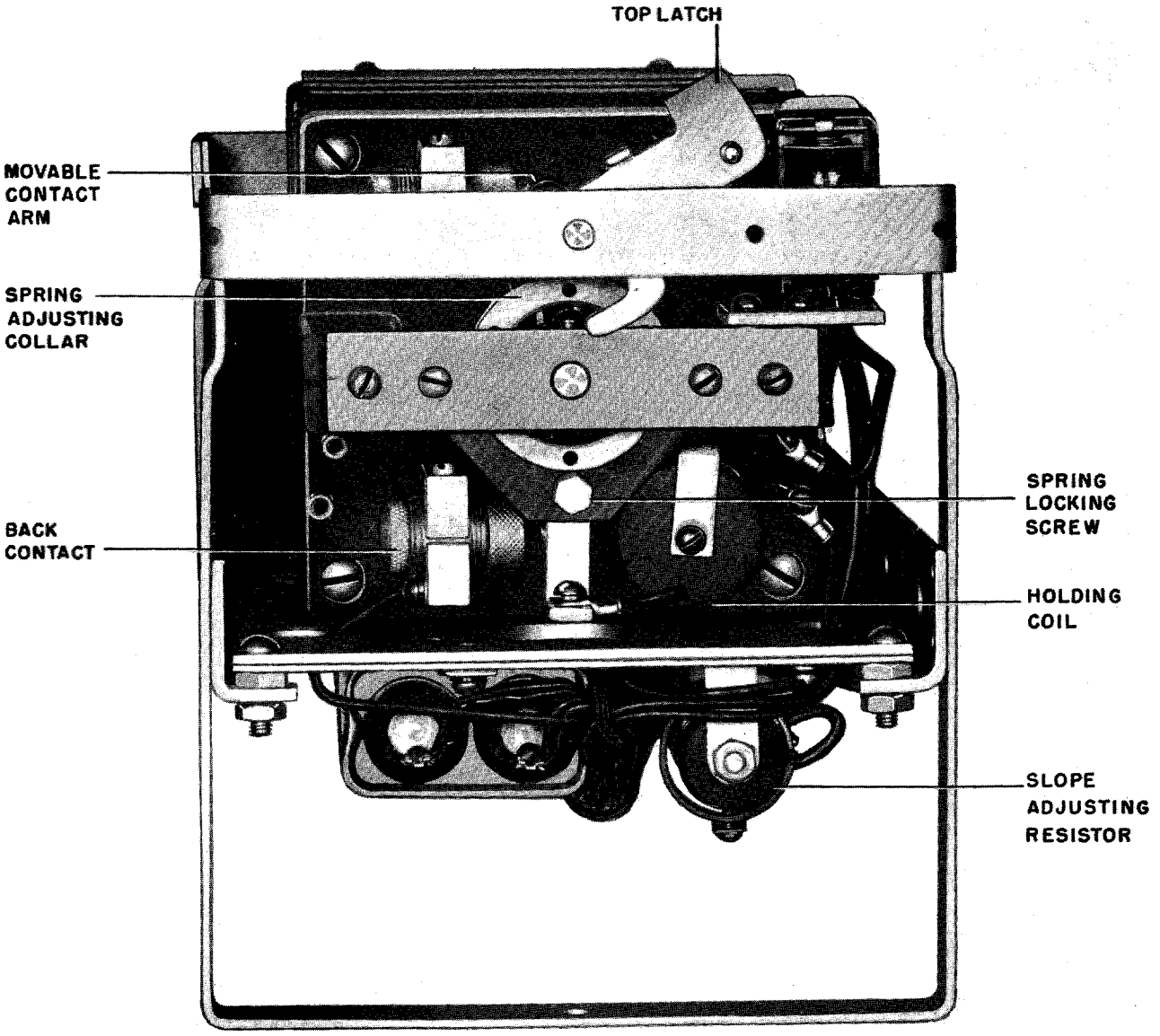


Fig. 6 Type CFCB11A Relay Withdrawn from Case, Top View

CLUTCH ADJUSTMENT

The clutch between the induction cup shaft and the moving contact assembly should slip at from 2 to 2.5 times pickup current. This slipping can be adjusted by the small headless screw which protrudes from the right side (viewed from the front) of the molded part carrying the moving contacts. This screw is located midway between the front and back contacts and points toward the induction cup shaft.

SLOPE ADJUSTMENT

The term "slope" is applied to that ratio of operating current to restraining current at which pickup occurs. At low values of operating current the restraining effect of the control spring causes the operating characteristic to depart from a straight line and to flatten out to the pickup value at zero restraining current. The slope, therefore, is practically attained only when the electrical torques are high enough to cause the spring restraining torque to become negligible. Figs. 2 and 3 show the slope characteristics of the Type CFCB11A relay and the effect of the control spring at low values of current.

The slope is adjusted at the factory to be 125 per cent, and this adjustment should not be disturbed, except if tests show that this adjustment has been changed, perhaps due to shock during shipment. For checking the slope follow the procedure outlined below.

(1) Set up a test circuit according to Fig. 7.

(2) Before closing the test switch pull out the connecting plug. This removes the relay coils from the test circuit and completes the test circuit through the shorting bars on the drawout case.

(3) Close the test switch and adjust the currents in ammeters A_1 and A_2 so that the test point falls inside of the limits shown on Fig. 2 for phase relays or on Fig. 3 for ground relays. Note that ammeter A_1 reads the operating current for the top unit and the restraining current for the bottom unit, while ammeter A_2 reads the operating current for the bottom unit and the restraining current for the top unit.

(4) Open the test switch and replace the connecting plug. After the plug is in place close the test switch and the element under test should pickup.

(5) Repeat steps (2), (3), and (4) using a decreased value of operating current so that the operating point falls just below the limits shown on the curves of Fig. 2 or 3. The curve marked "Min. Slope Limit (Forward)" applies when the current flowing from studs 5 & 6 is in phase with the current flowing from studs 7 & 8. The curve marked "Min. Slope Limit (Reverse)" applies when these same currents are 180 degrees out of phase.

(6) Repeat steps (2), (3), (4), and (5) for as many operating points as are necessary to establish the proper slope over the calibration range indicated on Fig. 2 or 3. The maximum calibrating restraining current for phase relays is 50 amperes, for ground relays, 30 amperes.

(7) If a readjustment of the slope is indicated by the above tests the slope adjusting resistor (See Fig. 3.) may be changed to provide the proper correction. This resistor has a maximum slope position on either side of which the slope decreases. The only requirement for setting this resistor is that the operating characteristic shall fall within the limits indicated on Fig. 2 or 3, within the calibrating currents indicated on these figures.

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.

ASSEMBLY OF ELEMENTS

After disconnecting the leads and removing unit intact with its mounting plate, the rotors may be removed as follows (be sure to tag the leads so that they may be reconnected to the proper terminals).

Remove the top (flat head) screw holding the unit to the mounting plate. Then, avoiding any disturbance to the top bearing plate, remove the entire top structure from the stator assembly by

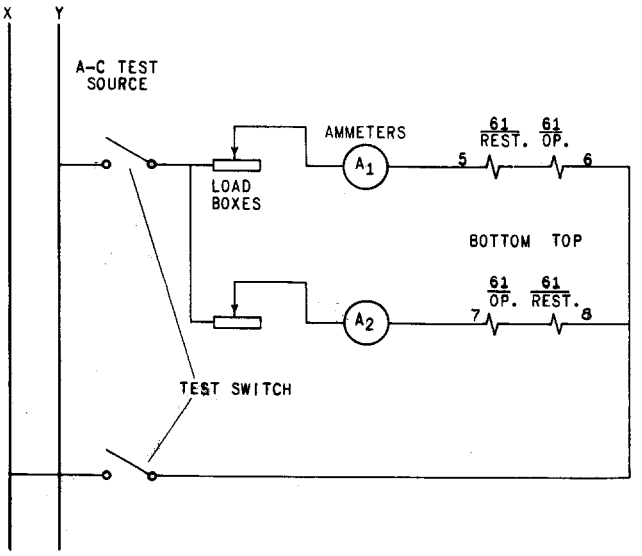


Fig. 7 Field Testing Connections for Type CFCB11A Relays

removal of the four corner screws. This will give access to the cup and stator assembly. In this way all parts will again be aligned by the pins when replaced.

Use care in handling the rotor while it is out of the relay and see that the air gap and rotor are kept clean.

In reassembly, the rotor will go into the air gap easily without forcing if the parts are held in proper alignment.

OPERATION

INITIAL OPERATION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under "ADJUSTMENTS AND TESTS".

Before the relay is put into service it should be given a partial check to determine that factory adjustments have not been disturbed.

Recommended test connections for the above tests are shown in Fig. 7.

MAINTENANCE

PERIODIC TESTING

An operation test and inspection of the relay at least once every six months are recommended. Test connections are shown in Fig. 7.

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 following points should be observed in 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" 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".

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

The contacts of the relay (Figure 8) 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. 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

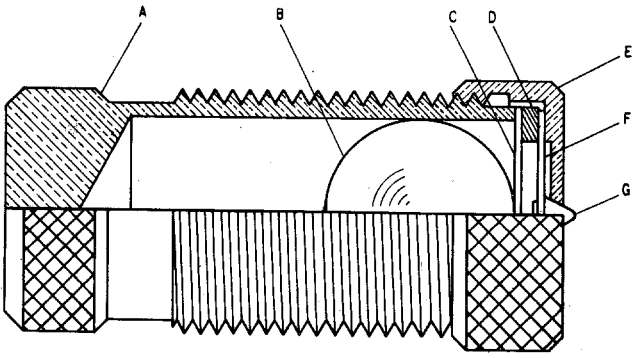


Fig. 8 Contact Assembly for Induction Cup Relays

the cap (E). 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 (G), the ring spacer, the diaphragm (C) and the steel ball in the cap (E) 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 1-2/3 turn to obtain approximately 0.050" 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.

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 contacts.

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.

HOLDING COILS

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 0.055" between the pole pieces and the armature. Forty mils (0.040") is equivalent to 1-1/4 turns of the contact barrel. Holding coil gap must not be adjusted appreciably below 0.040".

RENEWAL PARTS

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

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

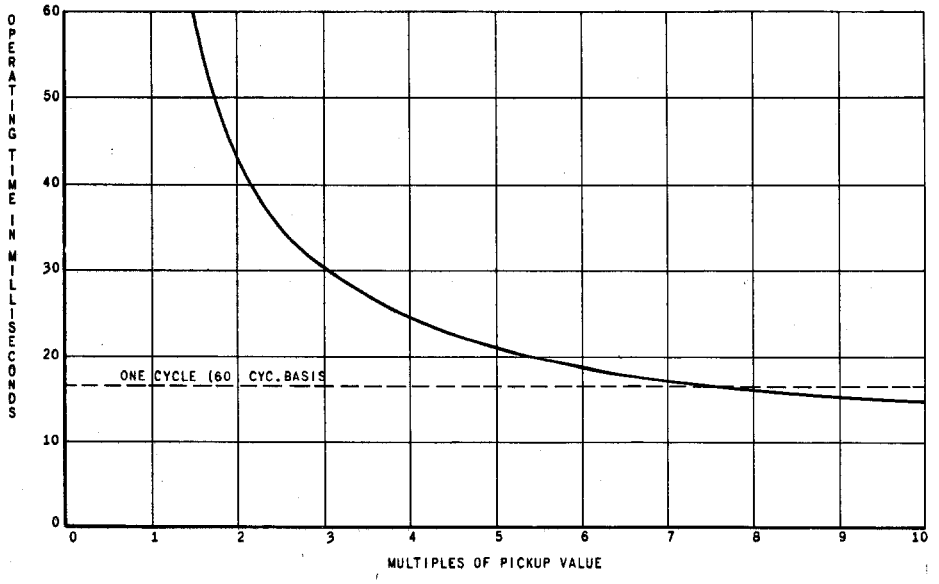


Fig. 9 Time Characteristics of Type CFCB11A Relays

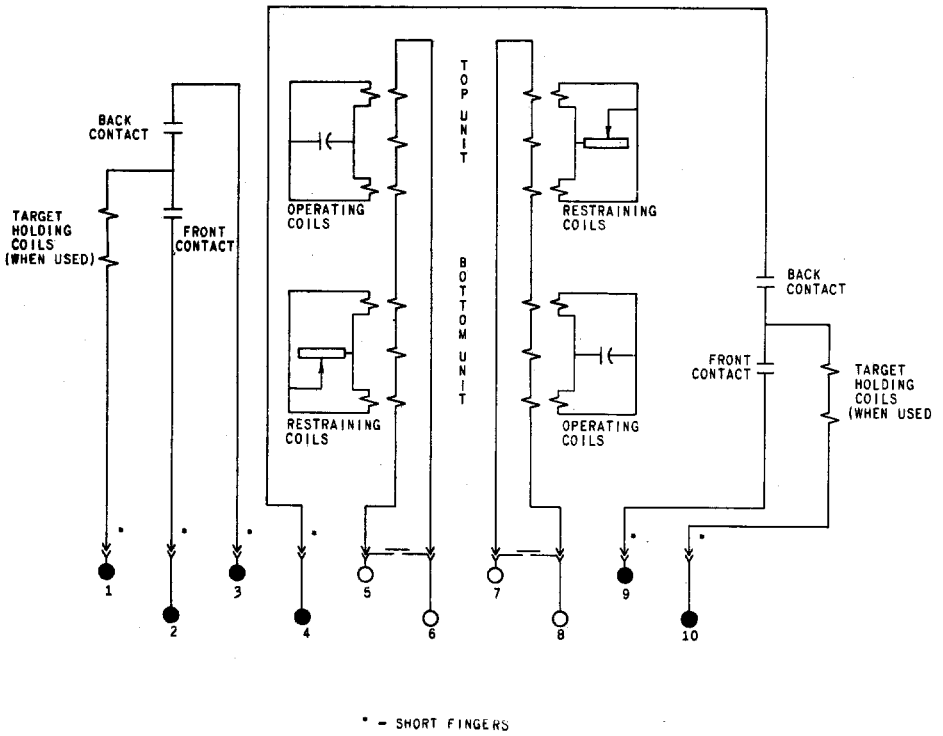
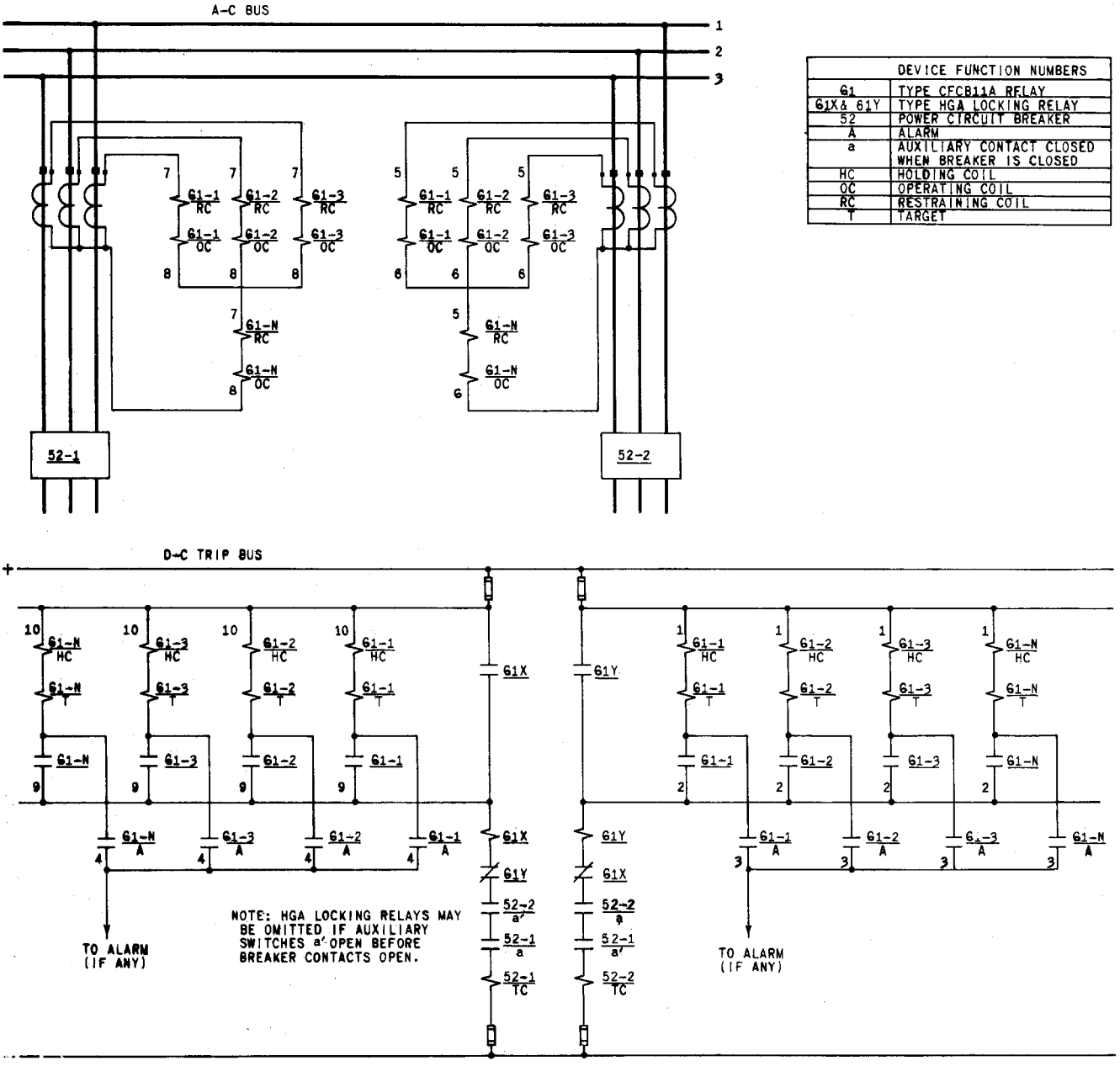
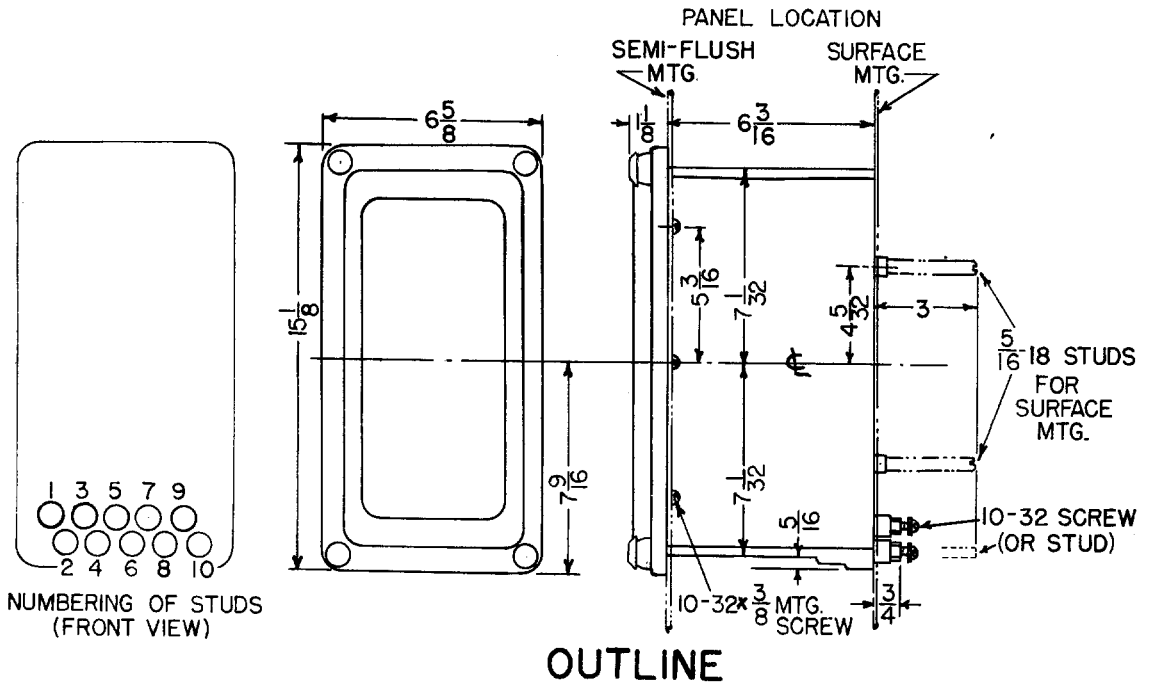


Fig. 10 Internal Connections of Type CFCB11A Relays

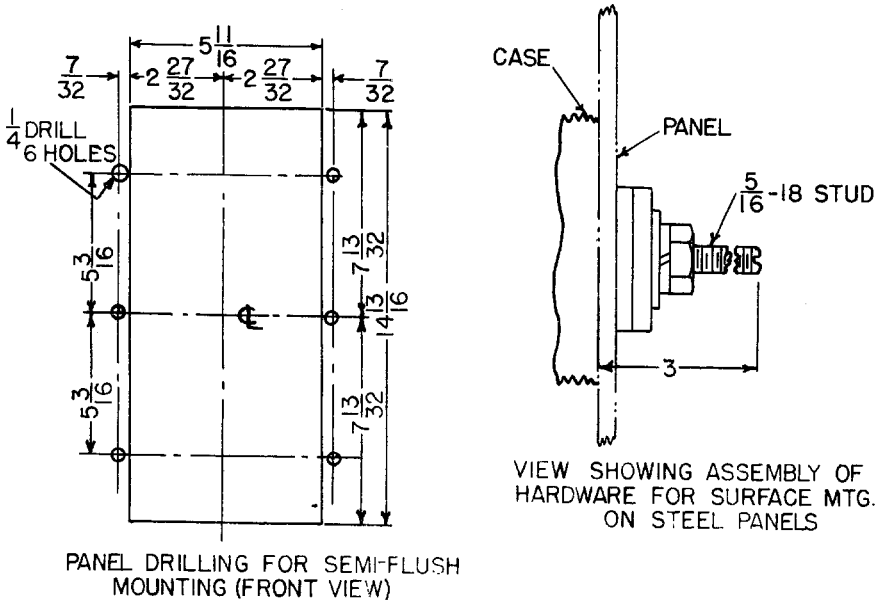


DEVICE FUNCTION NUMBERS	
G1	TYPE CFCB11A RELAY
G1X & G1Y	TYPE HGA LOCKING RELAY
52	POWER CIRCUIT BREAKER
A	ALARM
a	AUXILIARY CONTACT CLOSED WHEN BREAKER IS CLOSED
HC	HOLDING COIL
OC	OPERATING COIL
RC	RESTRAINING COIL
T	TARGET

Fig. 11 Typical External Connections for Type CFCB11A Relays

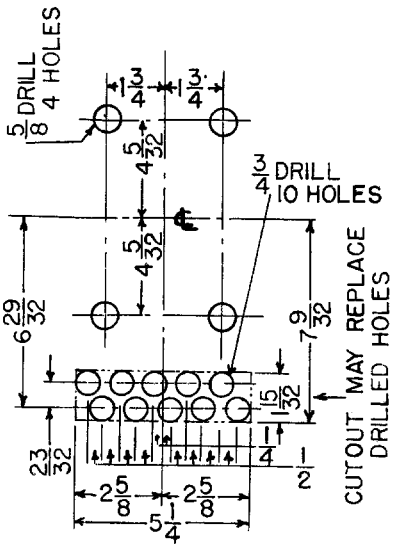


OUTLINE



PANEL DRILLING FOR SEMI-FLUSH MOUNTING (FRONT VIEW)

VIEW SHOWING ASSEMBLY OF HARDWARE FOR SURFACE MTG. ON STEEL PANELS



PANEL DRILLING FOR SURFACE MOUNTING (FRONT VIEW)

Fig. 12 Outline and Panel Drilling for Type CFCB11A Relays