MicroVersaTrip® Plus and PM Conversion Kits

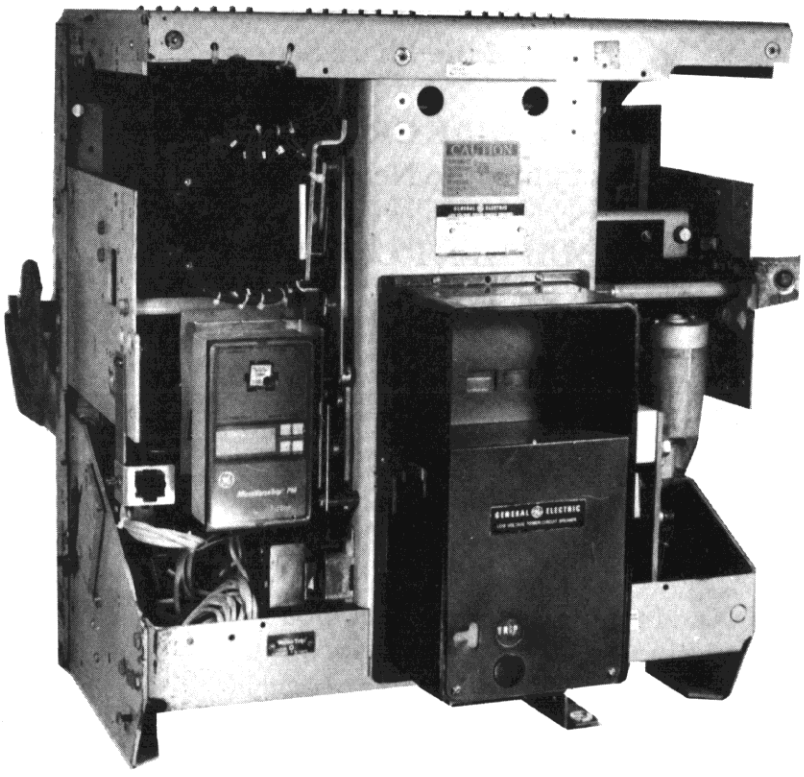
For GE Types AKR-75, AKR-100 Low Voltage Power Circuit Breakers

INTRODUCTION

GE Conversion Kits are designed to upgrade existing GE Low Voltage Power Circuit Breakers, rather than replace the entire breaker. The Conversion Kits contain enhanced solid-state MicroVersaTrip® Plus or MicroVersaTrip® PM trip units, representing the latest technological advancements in GE trip systems.

MicroVersaTrip Plus and Micro VersaTrip PM Conversion Kits are designed and breaker tested to conform with ANSI Standard C37.59, allowing the retrofitter to properly install and acceptance test the breaker.

This publication covers installation of MicroVersaTrip Plus or PM Conversion Kits on GE types AKR-75 and AKR-100 Low Voltage Power Circuit Breakers. Each Conversion Kit contains all appropriate material to convert from an existing GE Type EC, Power Sensor, ECS or SST trip system.



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SECTION 1 GENERAL INFORMATION

GE Conversion Kit installation is straightforward, but does require careful workmanship and attention to these instructions. Familiarity with the breaker itself is highly desirable. The general approach is to first strip the breaker of its existing trip devices, then install the MicroVersaTrip® Plus or PM Kit components. Following this procedure, the converted breaker is performance tested, prior to restoring the breaker to service.

The majority of breaker kit installations do not require any customized assembly work. However, some conversions may involve unusual mounting circumstances or accessory combinations which necessitate minor modification and/or relocation of a component(s). In most instances this supplementary work can be done on site.

Preparatory to the conversion, the installer should verify that the appropriate current sensors and programmable trip unit have been furnished. Whenever the ground fault trip element is furnished for breakers applied on 4-wire systems, note that an associated neutral sensor (CT) is required for separate mounting in the equipment. Make sure that retrofitted breakers are applied within their short circuit rating. For example, when the trip elements of the breaker are to be changed from long-time instantaneous to long-time, short-time, the short-time rating would govern the application. As a service- related consideration, the installation of the MicroVersaTrip Plus or PM kits provides an excellent opportunity to perform normal maintenance on the breaker, particularly when the front and back frames are separated. Such procedures are described in the installation and maintenance manuals supplied with the breakers and equipment.

SECTION 2 - PRIOR TO INSTALLATION

Before starting any work, turn off and lock out all power sources leading to the breaker (primary and secondary). Remove the breaker to a clean, well lighted work area.

> **WARNING:** Low Voltage Power Circuit Breakers utilize high speed, stored energy spring operating mechanisms. The breakers and their enclosures contain interlocks and safety features intended to provide safe, proper operating sequences. For maximum personnel protection associated with installation, operation, and maintenance of these breakers the following procedures must be followed. Failure to follow these procedures may result in personal injury or property damage.

- Only qualified persons, as defined in the National Electrical Code, who are familiar with the installation and maintenance of low voltage power circuit breakers, and switchgear assemblies, should perform any work associated with these breakers.
- Completely read and understand all instructions before attempting any breaker installation, operation, maintenance, or modification.
- Turn off and lock out the power source feeding the breaker prior to attempting any installation, maintenance, or modification. Follow all lockout and tagging rules of the National Electrical Code and all other applicable codes.
- Do not work on a closed breaker or a breaker with the closing springs charged. Trip OPEN the breaker and be sure the stored energy springs are discharged avoiding the possibility that the breakers may trip OPEN or the charging springs discharge, causing injuries.
- For both stationary and draw out breakers, trip OPEN, then remove the breaker to a well lighted work area before beginning work.
- Do not perform any maintenance including breaker charging, closing, tripping, or any other function which could cause significant movement of the breaker while it is on the draw out extension rails.
- Do not leave the breaker in an intermediate position in the switchgear compartment. Always leave it in the **CONNECTED**, **TEST**, or **DISCONNECTED** position. Failure to do so could lead to improper positioning of the breaker and flashback.

SECTION 3 FRONT FRAME BREAKER CONVERSION

Separation of the front and back frames is not necessary for kit conversion on GE types AKR-75 or AKR-100 breakers. If the installer wants to separate them for normal maintenance while installing the conversion kit, refer to the appropriate installation and maintenance manuals supplied with the breakers and equipment. Copies of these publications may be obtained from your local GE sales office.

The front frame conversion consists of the following:

1. Installing the flux shifter.
2. Installing the programmer mounting bracket.
3. Installing the programmer wire harness.
4. Installing the communications harness (when required)

Installing the Flux Shifter

The flux shifter is shown in Fig. 3-1. The installation procedure will vary depending on the type of breaker and trip device involved.

ECS OR SST TRIP SYSTEMS

Step 1.

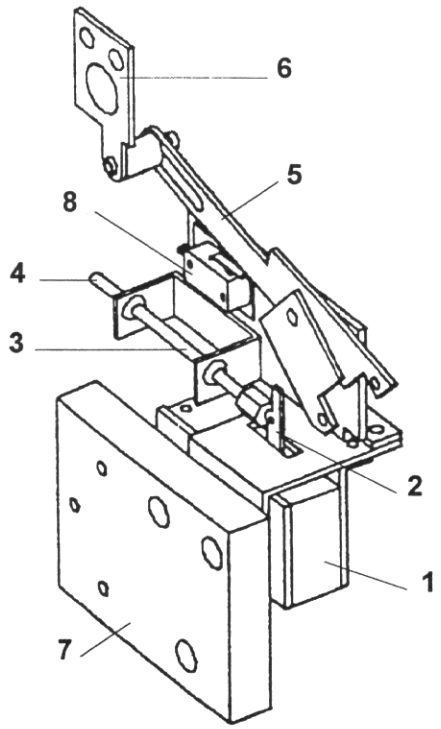
Remove the ECS or SST Programmer.

Step 2.

Remove the existing flux shifter device and the programmer control harness.

Step 3.

Install the new flux shifter, positioning the insulator and programmer connector bracket as shown in Fig. 3-2.



1. Actuator
2. Actuator arm
3. Trip rod
4. Trip rod adjuster end
5. Reset linkage
6. Actuator bracket
7. Mounting base
8. Position switch

Fig. 3-1. Flux Shifter

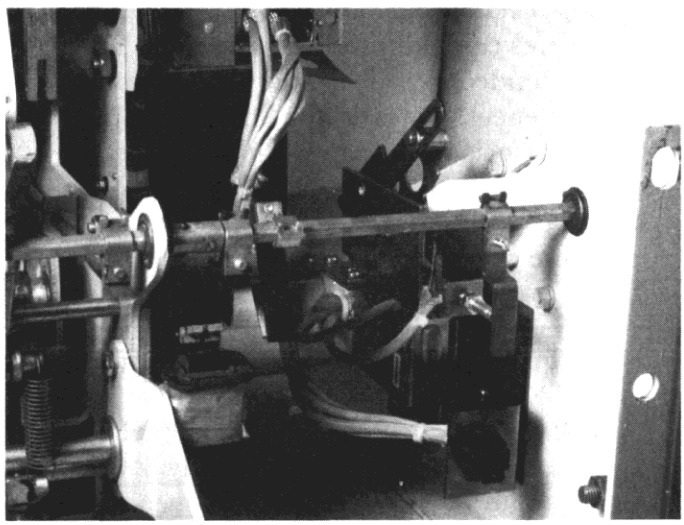


Fig. 3-2. Flux Shifter Installed

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Flux Shifter (con't)

EC OR POWER SENSOR TRIP SYSTEMS

The flux shifter mounting holes must be added to the left side of the front frame. The drill pattern for the required three (3) 0.209 diameter holes is given in Fig. 3-3.

FLUX SHIFTER TRIP PADDLE INSTALLATION

For breakers equipped with an ECS or SST system, the existing flux shifter trip paddle will be used with the new flux shifter.

For all other breakers, the flux shifter trip paddle must be assembled to the trip shaft as shown in Fig. 3-4.

FLUX SHIFTER TRIP PADDLE ADJUSTMENTS

Once the flux shifter and its trip paddle are installed and the breaker frames are reassembled, the following adjustments must be made:

Step 1.

With the breaker in the open position and the mechanism fully charged, set the gap between the trip paddle and the end of the flux shifter trip rod at 0.100 inches. Use a 0.100-inch diameter rod, not supplied, as shown in Fig. 3-4. Set the adjuster end of the trip rod and lock it in place with the jam nut. Note that removal of the buffer stud will make the trip paddle easier to install and adjust.

Step 2.

As the crossbar travels between the "breaker closed" and the "breaker open" positions, the tang of the actuator bracket must clear the buffer stud. If insufficient clearance exists, loosen its two mounting screws and rotate the bracket clockwise to take up mounting hole slack. Retighten screws.

OPTIONAL TEST: The flux shifter assembly may be tested by closing the breaker and applying a 9 V dc power source to the flux shifter leads. The red wire is the positive lead. The breaker should trip.

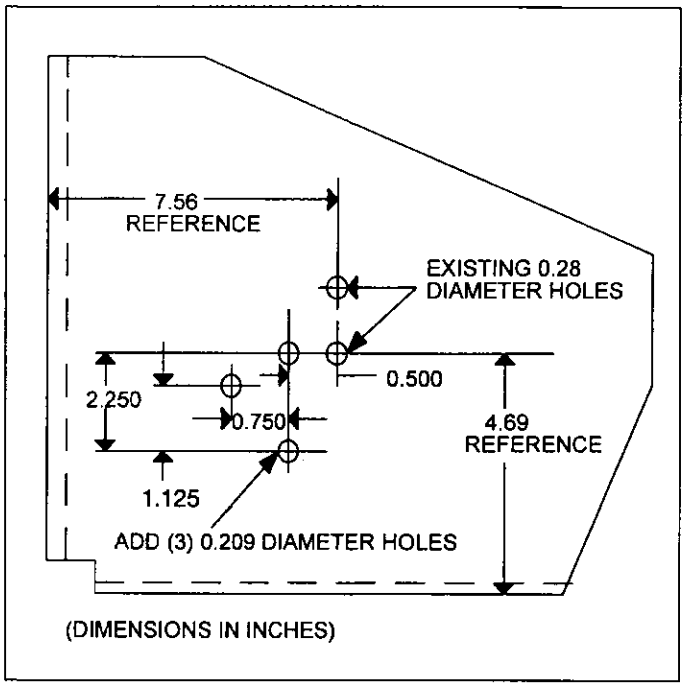


Fig. 3-3. Flux Shifter Mounting Hole Pattern

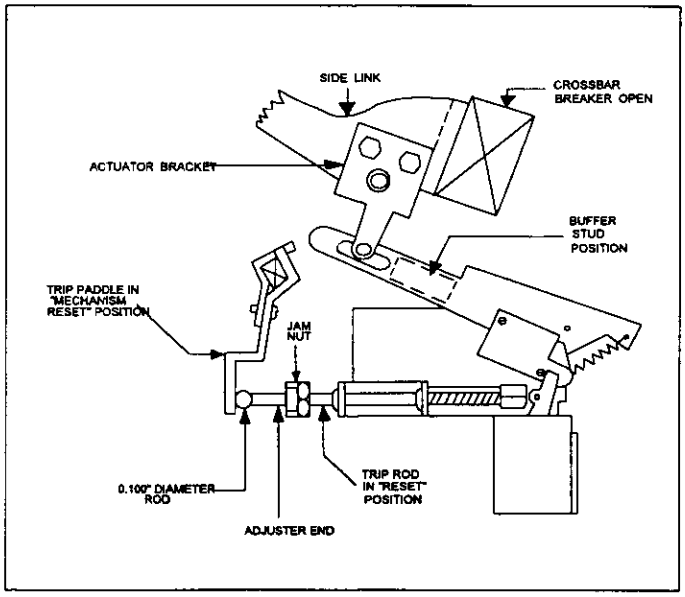


Figure 3-4. Flux Shifter Adjustments

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Programmer Mounting Bracket

The MicroVersa-Trip® Plus or PM programmer mounts to the left side of the front channel. A mounting bracket is shock-mounted to a plate that is assembled to the front channel as shown in Fig. 3-6. Use Loctite® or an equivalent retaining material on the mounting screws for the plate assembled to the front channel.

ECS OR SST SYSTEMS

Replace the existing plate and mounting bracket with the new ones provided. Assemble the mounting bracket to the plate using the holes closest to the front of the breaker (See Fig. 3-5 and 3-6).

EC OR POWER SENSOR TRIP SYSTEMS

The holes for the new plate may have to be added to the front channel. The drill pattern for these holes is given in Fig. 3-7. Once the plate is installed, assemble the mounting bracket to the plate using the holes closest to the front of the breaker (See Fig. 3-6).

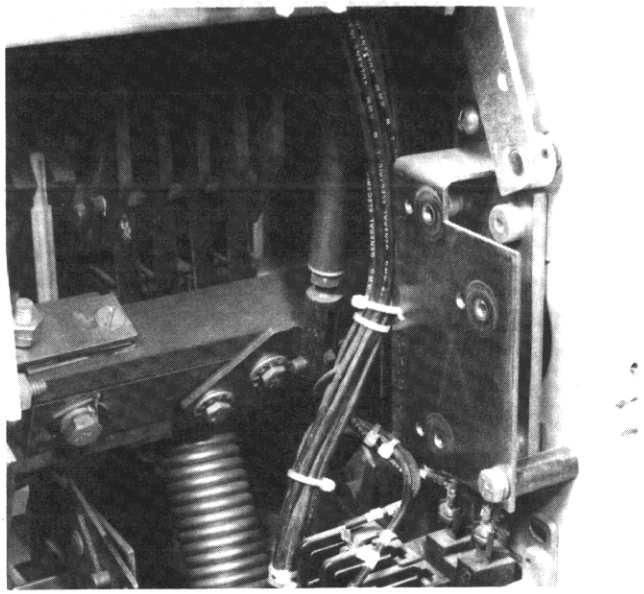


Figure 3-5. Mounting Plate Assembled To Channel

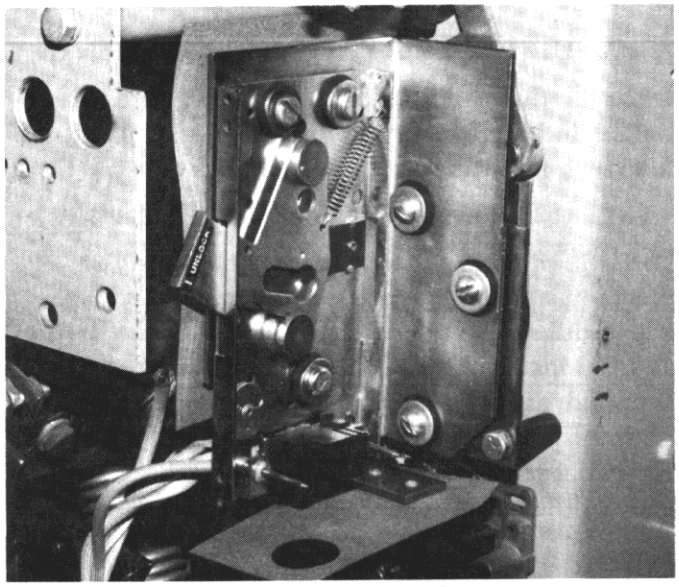


Figure 3-6. Programmer Mounting Bracket And Plate

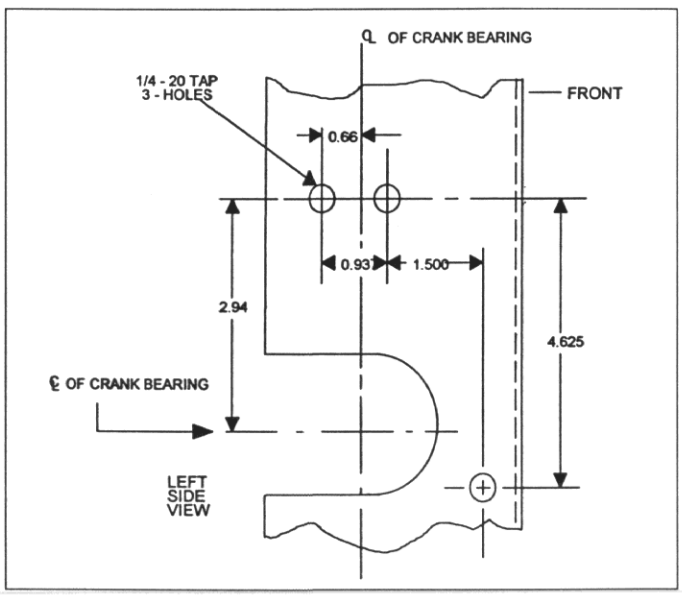


Figure 3-7. Mounting Plate Hole Pattern

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Programmer Harness

The programmer harness consists of the mating 36-pin programmer connector and the 15-pin front frame half of the front/back frame connector.

Step 1.

Assemble the adapter bracket to the 36-pin programmer connector (with bevels to right side) by pushing bracket over notches in ends of plug body (Step 1). Follow Steps 2 through 5 of Fig. 3-10 to complete assembly of programmer harness to programmer bracket.

Step 2.

The 15-pin connector is inserted into the programmer connector bracket which is part of the flux shifter assembly. See Fig. 3-8. Insert the connector so that the Number 1 pin is toward the breaker's top, right-hand side.

Step 3.

Route the harness under the flux shifter base. Attach the harness to this base using the wire keeper provided.

Step 4.

Join the 4-pin programmer harness with the flux shifter leads connector.

Step 5.

Assemble the programmer bracket to the mounting bracket as shown in Fig. 3-9.

CAUTION: Adapter bracket must be installed onto harness plug as shown in Fig. 3-10. Failure to do so will result in harness plug failure and the programmer will not provide any protection.

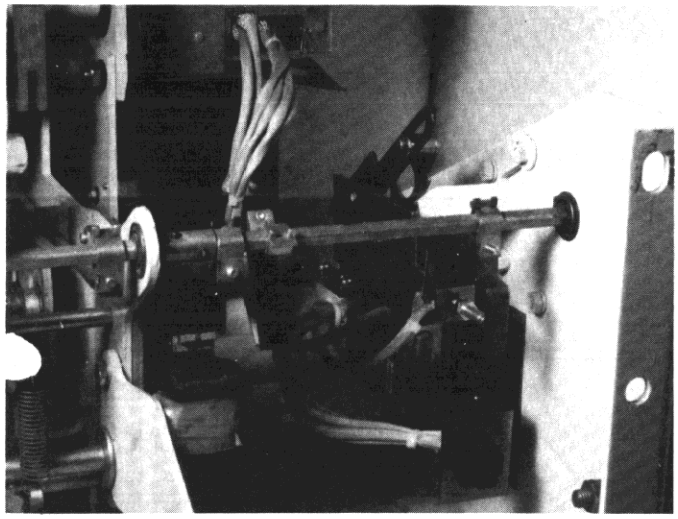


Fig. 3-8. Back Frame Connector Harness

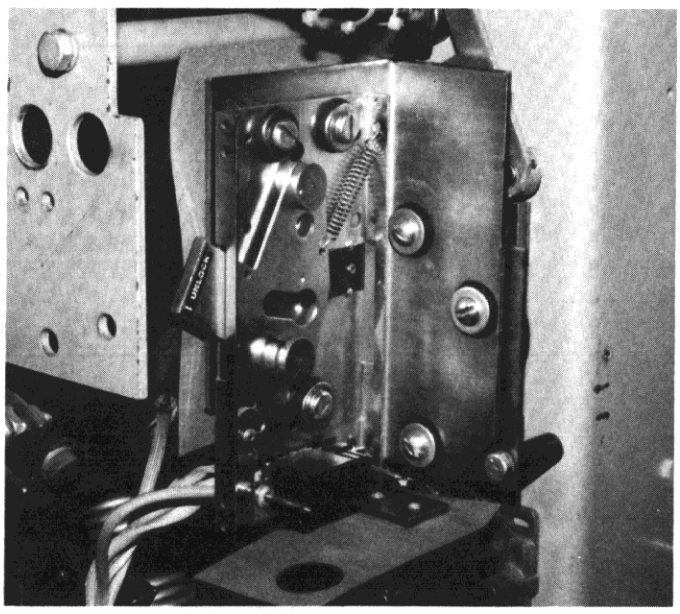


Figure 3-9. Programmer Plate Installation

Installing the Programmer Harness (cont.)

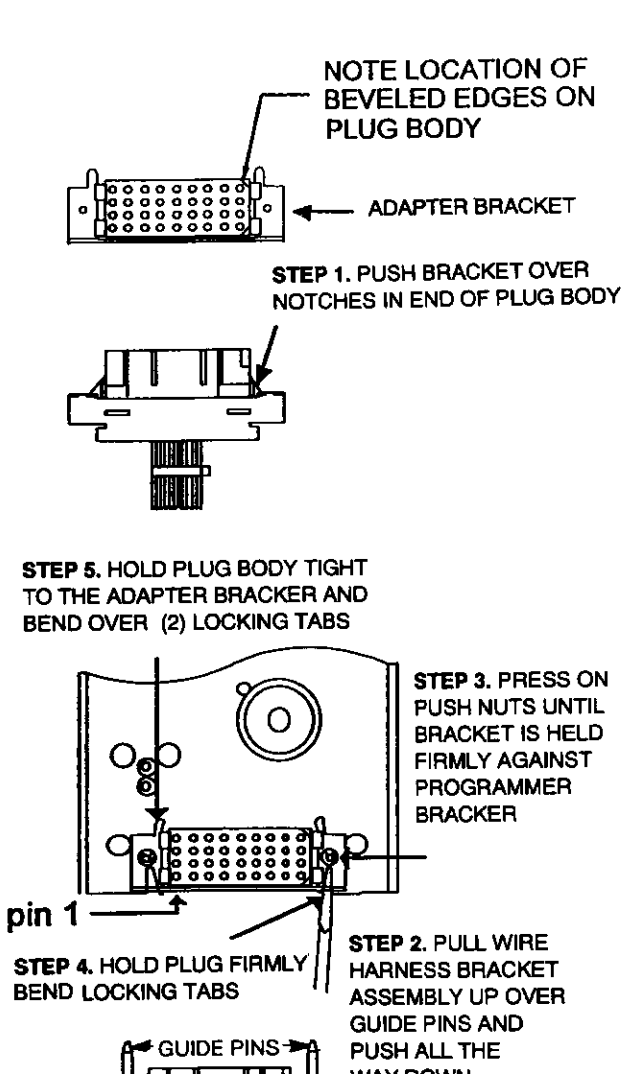


Figure 3-10. Harness Connector

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing The Communications Harness (when required)

The communications harness should be installed on the hinge side of the breaker, whenever possible so the disconnect wire will not get damaged when opening the door. The following example is for an AKR-100 breaker with the door on the left hand side.

Step 1.

Modify the breaker by drilling two mounting holes shown in Fig. 3-11.

Step 2.

Secure the bracket to the inside of the breaker (Fig. 3-12) with #12-24 x ½" screw, #12 washers and nuts.

Step 3.

Route the wire harness down the inside of the side support and over to the bottom of the programmer bracket. See Fig. 3-13.

Step 4.

Attach the label shown in Fig. 3-14 to the front of the breaker and the compartment door as a precaution.

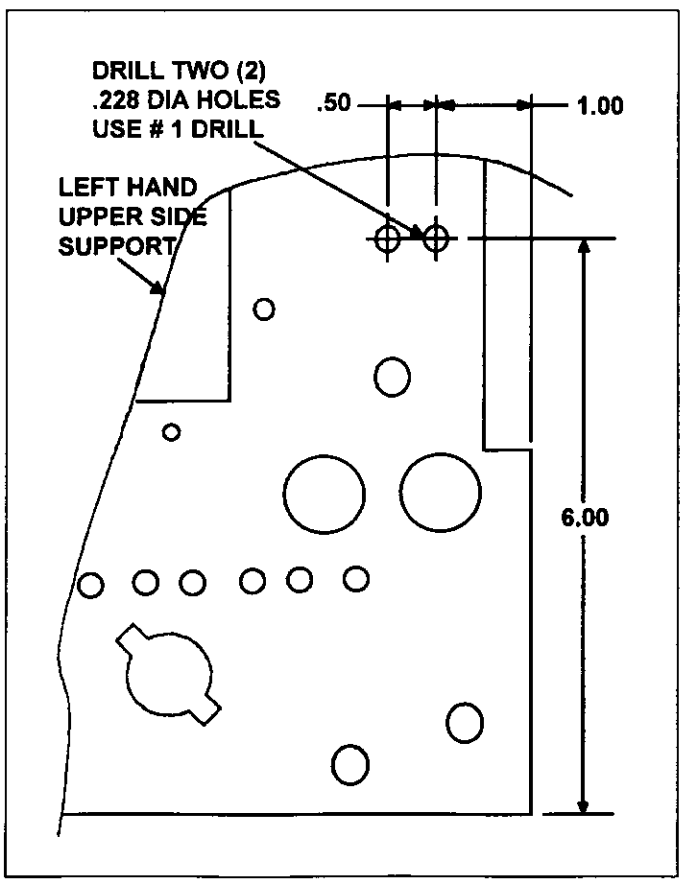
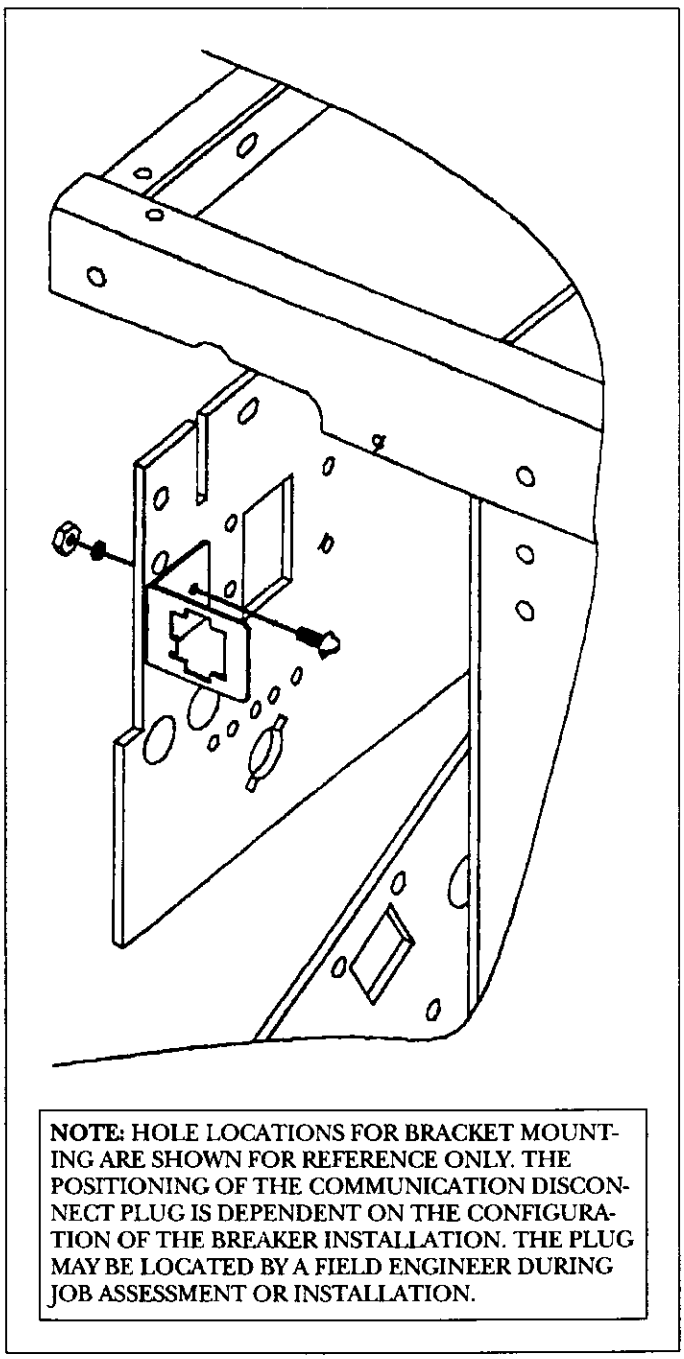


Figure 3-11. Harness Mounting Diagram

If the compartment door hinge is on the right hand side, the same instructions can be used. The wire routing path would follow the path used for the phase sensors discussed in Section 4, p.12.



NOTE: HOLE LOCATIONS FOR BRACKET MOUNTING ARE SHOWN FOR REFERENCE ONLY. THE POSITIONING OF THE COMMUNICATION DISCONNECT PLUG IS DEPENDENT ON THE CONFIGURATION OF THE BREAKER INSTALLATION. THE PLUG MAY BE LOCATED BY A FIELD ENGINEER DURING JOB ASSESSMENT OR INSTALLATION.

Figure 3-12. Bracket Installation

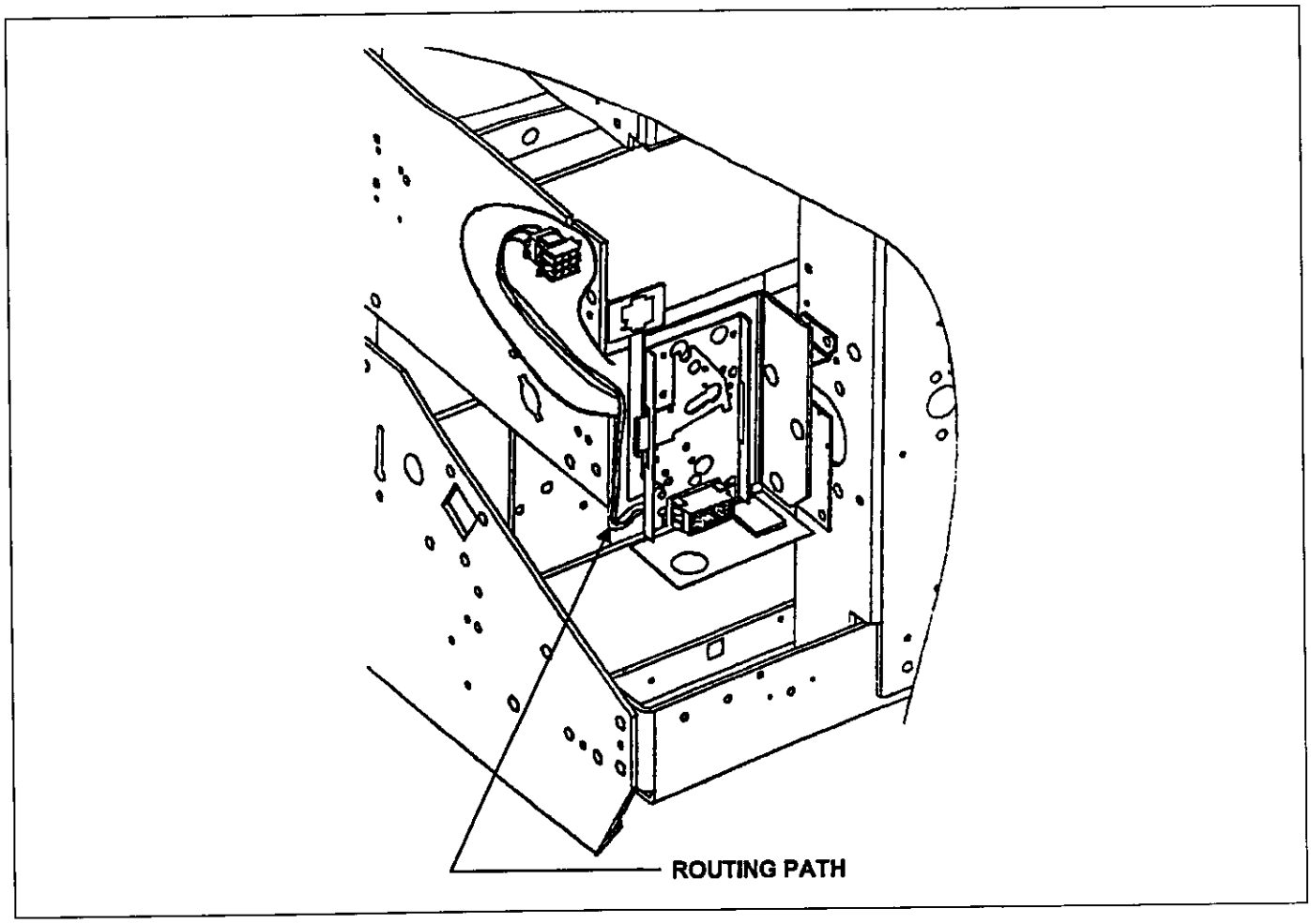


Figure 3-13. AKR 75/100 Communications Wire Routing Path

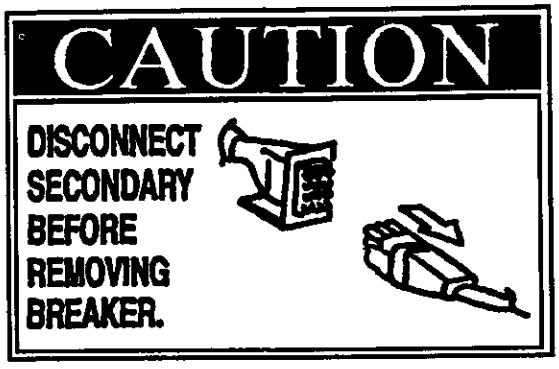


Figure 3-14. Attach Caution Labels On Front Of Breaker And Compartment Door

SECTION 4 BACK FRAME BREAKER CONVERSION

The back frame conversion consists of the following:

1. Modifying the crossbar assembly for the flux shifter reset linkage installation.
2. Installing the phase sensors.
3. Installing the back frame harness.

Modifying the Crossbar

The flux shifter's reset linkage is driven by the actuator bracket. See Fig. 4-1. The actuator bracket must be assembled to the left side link of the left pole, as shown in Fig. 4-2.

If the actuator bracket mounting holes are not in the left side link, the holes must be added. Drill and tap two 5/16"-18 holes using the hole pattern given in Fig. 4-3.

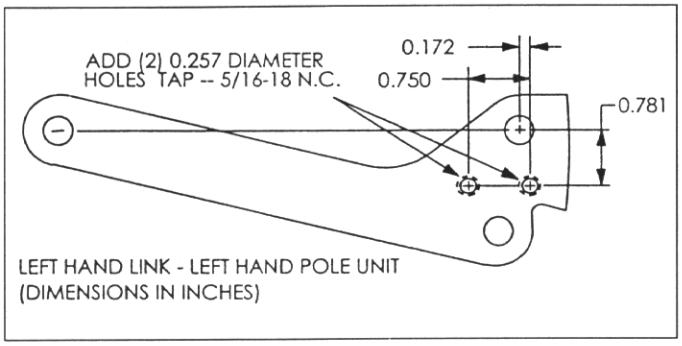


Fig. 4-3. Actuator Bracket Mounting Holes

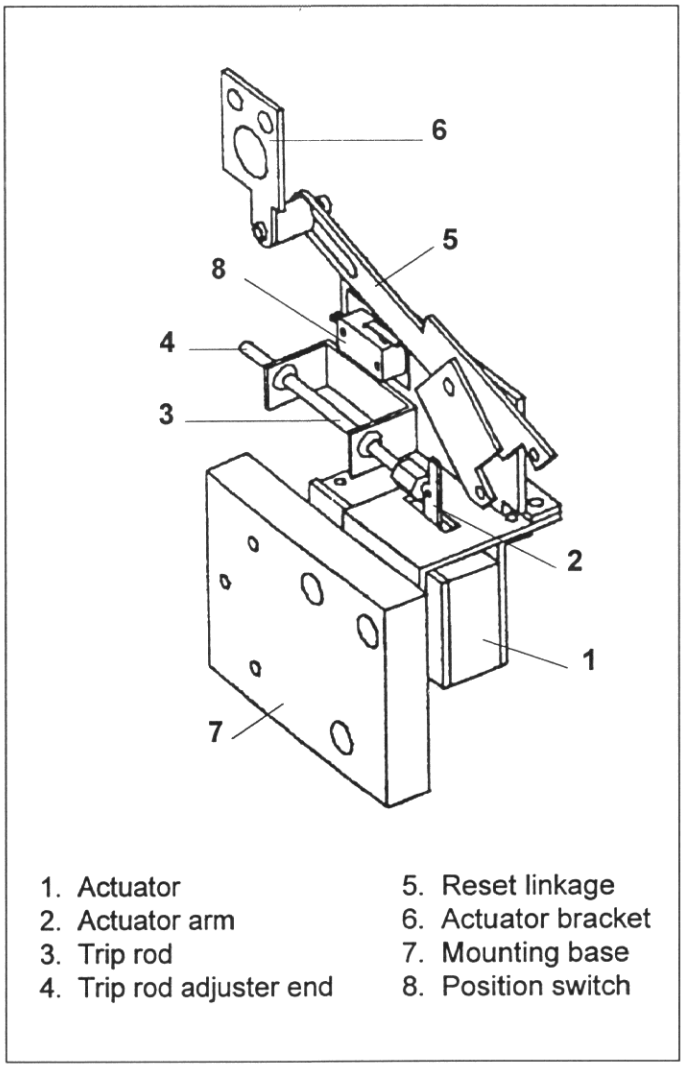


Fig. 4-1. Flux Shifter

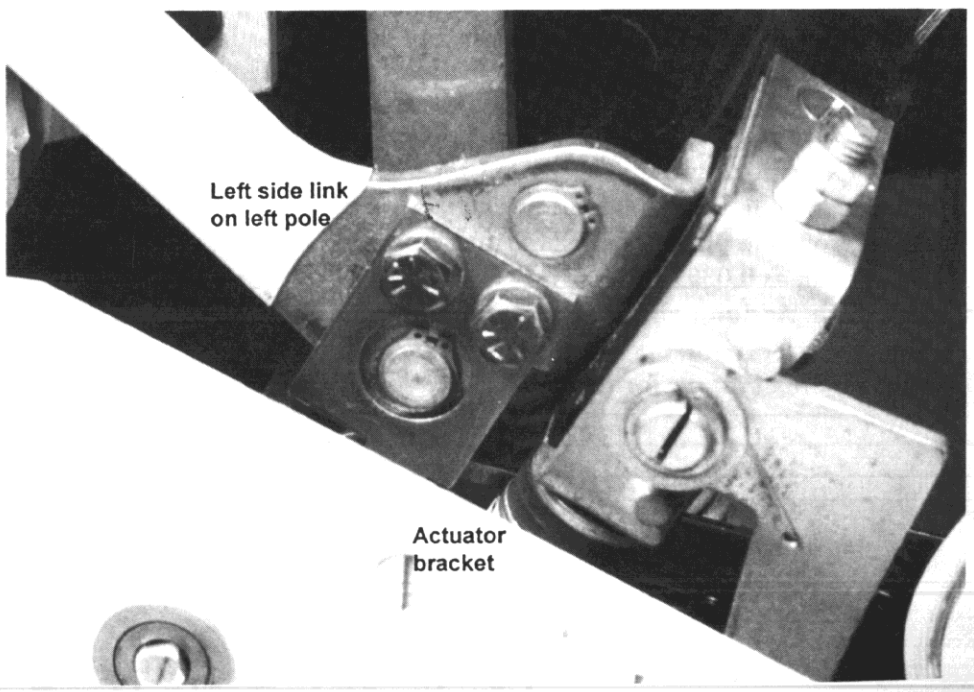


Fig. 4-2. Actuator Bracket Installation

SECTION 4 BACK FRAME BREAKER CONVERSION

Installing Phase Sensors

EC AND POWER SENSOR TRIP SYSTEMS:

Step 1.

Remove the existing trip devices and harnesses.

Step 2.

The phase sensor installation process is broken down in Fig. 4-4 from left to right.

Step 3.

The MicroVersa-Trip® Plus or PM sensors are braced on the stud with locking rings, as shown in Fig. 4-4. Be sure to set the rings deep enough for the primary fingers to engage. The locking ring nut should be tightened in the 12 o'clock position. Position the sensor's anti-turn lugs with the notch in the locking ring.

Step 4.

Insert the wire into the phase sensors; the white wire goes into the topmost spade terminal. Form each sensor's leads downward and through the opening under the phase sensors as shown in Fig. 4-5.

SST TRIP SYSTEMS:

The MicroVersaTrip® Plus or PM sensor is physically identical to the SST sensor. Follow the basic procedure given above and replace the SST with the MicroVersaTrip Plus or PM sensor.

BACKFRAME HARNESS INSTALLATION

Install the back frame harness as shown in Fig. 4-5. Route and tie the wires. Wire ties used to form and secure the harness are provided.

> Note: Occassionally, during current sensor manufacturing, slight separation occurs of the epoxy from the plastic shell. This may amount to as much as 0.030" and has no effect on performance. Additionally, slight surface imperfections are part of the epoxy curing process and have no effect on performance.

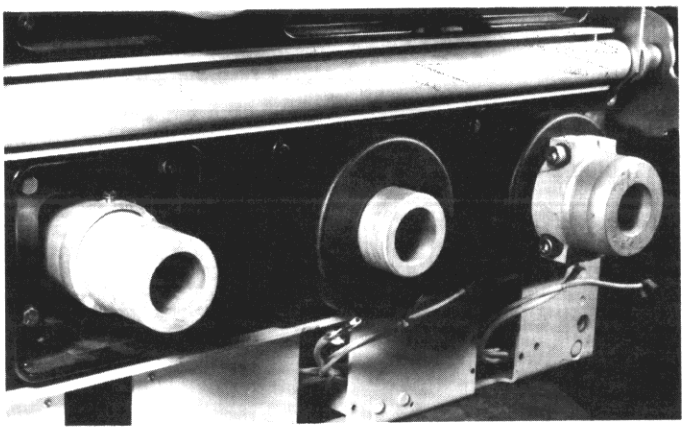


Fig. 4-4. Phase Sensor Installation From Left To Right

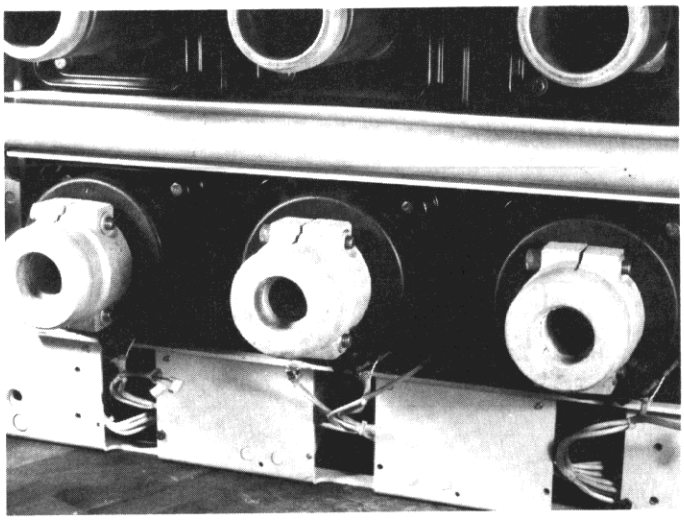


Fig. 4-5. Phase Sensor And Backframe Harness Installed

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

The MicroVersaTrip® PLUS or PM Ground Fault option requires an additional neutral sensor when used on a four-wire system having its neutral grounded at the transformer. The phase sensors are mounted on the breaker. However, the neutral sensor is inserted in the neutral bus, which is part of the equipment. The neutral sensor is connected to the breaker through the 4th-wire neutral disconnect.

STATIONARY BREAKER CONVERSION

The 4th wire disconnect for stationary AKR-75 or AKR-100 breakers is a terminal board which is mounted to the lower front channel as shown in Fig. 5-1.

Step 1.

If the terminal board already exists, just replace the control harness. Maintain the following color code:

White - Common

Black - Tap

Step 2.

If the terminal board assembly is being added, mount it as shown in Fig. 5-1. The mounting holes may have to be added to the front channel. See Fig. 5-1.

DRAW OUT BREAKER CONVERSION

The GE Conversion Kit contains an assembled, ready-to-install, mounting block and bracket for AKD-5, or AKD-6 installation, plus a bracket only for AKD installation. For type AKD equipment, remove the bracket from the mounting block, and replace it with the type AKD bracket (Fig. 5-2).

The 4th wire disconnect for the draw out breaker mounts to the lower back frame. See Figs. 6-1, 6-2.

Step 1.

If the disconnect is existing, just replace the control harness. Maintain the following color code:

White - Common, Black - Tap

Step 2.

If the disconnect is being added, also mount the disconnect assembly.

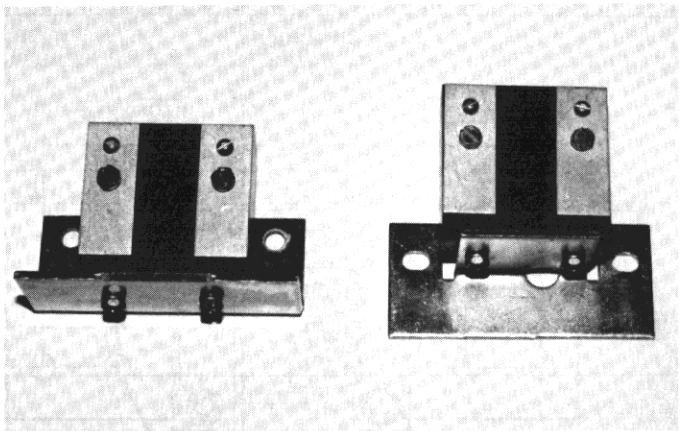


Figure 5-2. 4th Wire Disconnects

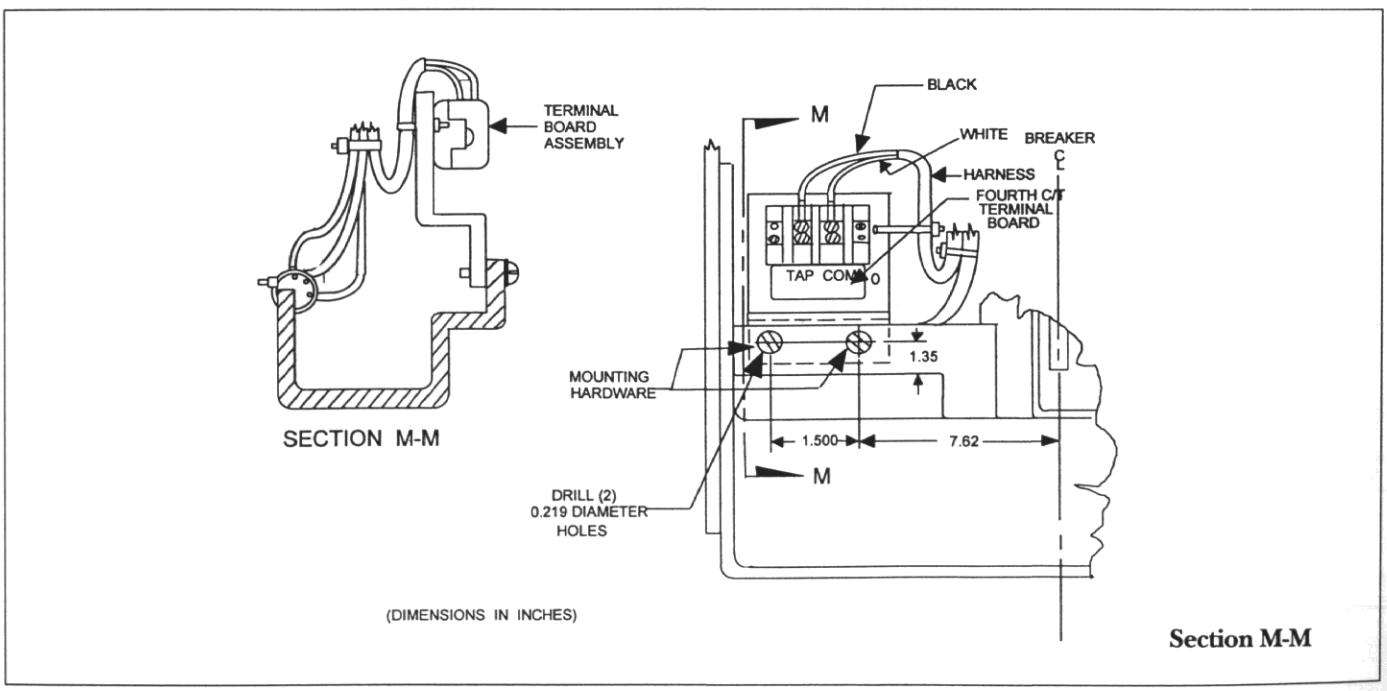


Figure 5-1. 4th Wire Terminal Board Installed

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

Installing the Neutral Sensor

The neutral sensor is an electrical duplicate of the phase sensor, including the taps. Therefore, when taps (if provided) are changed on the phase sensors, the taps on the neutral sensor must be correspondingly positioned. For kits with fixed phase sensors, be sure to use the corresponding tap on the neutral sensor.

Mount the neutral sensor in the outgoing neutral lead, normally in the equipment's bus or cable compartment. Be sure to observe the sensor's line and load directional markings. See Fig. 5-3 for the sensor's bar drilling plan. Make sure that the neutral and phase sensors match, i.e., have the same ampere range.

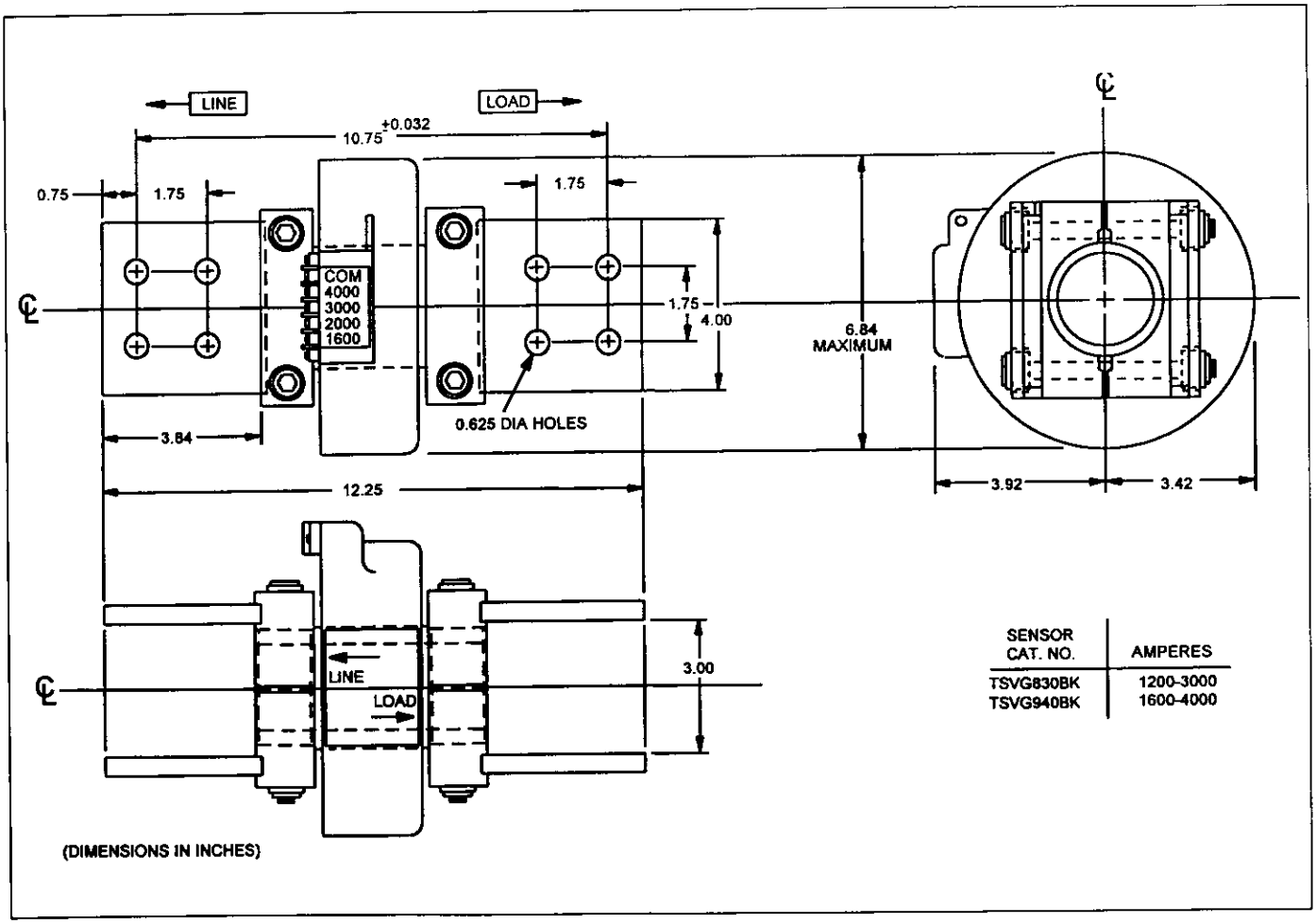
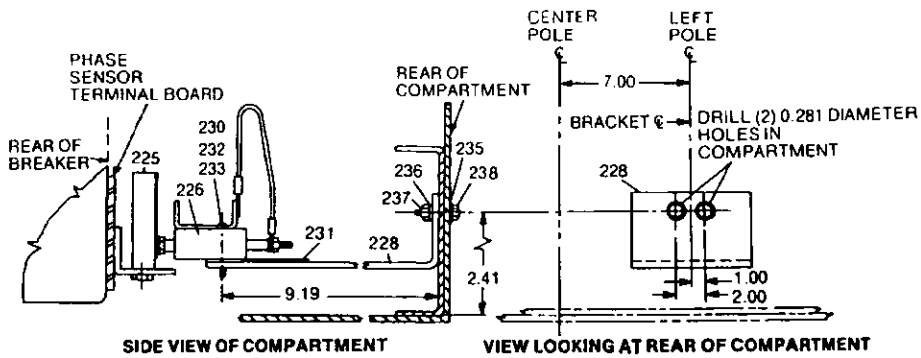


Figure 5-3. Outline Of Neutral Sensor

SECTION 6 EQUIPMENT CONVERSION

The equipment compartment contains the mating portion of the 4th wire disconnect and the neutral sensor outlined in Section 5.

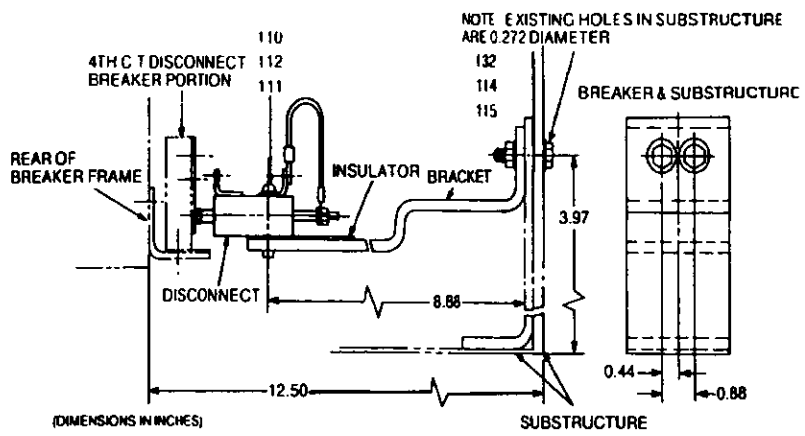
The AKD, AKD-5 and AKD-6 substructure type equipment compartments use the same disconnect assembly. There are different disconnect mounting brackets depending on the type of breaker and equipment involved. The specific breaker conversion kit provides the mounting brackets for each equipment type in which the breaker is used. Refer to Figs. 6-1 and 6-2 for details on mounting-bracket installation.



(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
228. Mounting bracket AK-75 for AKD type compartments
230. 10-32 x 1.375-inch mounting screws
231 Insulation
232. 10# Lock washer
233. 10# Flat washer
235. ¼-20 Flat washer
236. ¼-20 Lock washer
237. ¼-20 Nut
238. ¼-20 x 1.25-inch mounting screws

Figure 6-1. 4th Wire Disconnect-Type AKD-6 Equipment



110 (2) Screws (# 10-32 x 1¾-inch)
111 (2) Lock washers
112 (2) Flat washers
114. (2) Flat washers
115. (2) Lock washers
132. (2) Screws (¼-20 x 1¼)

Figure 6-2. 4th Wire Disconnect-Substructure

SECTION 7 INSTALLING THE PROGRAMMER

The programmer is attached to the bracket mounted to the left side of the breaker's center channel, as shown in Fig. 7-1. The guide pins on this bracket mate with the holes on either side of the programmer box. The guide pins provide the necessary alignment for the connector engagement. The locking lever engages with the pin, which is assembled to the programmer frame, and secures the programmer to the mounting bracket. See Fig. 7-2.

INSTALLATION

The AKR-75 and AKR-100 mounting bracket is shown in Fig. 7-1. To install:

Step 1.

Insert the guide pins into the hole and push on the programmer, engaging the connectors.

Step 2.

Release the locking lever, securing the programmer.

Step 3.

Verify that the locking lever actually engages the programmer pin. To remove the programmer, pull the locking lever out, thus releasing the programmer pin and remove.

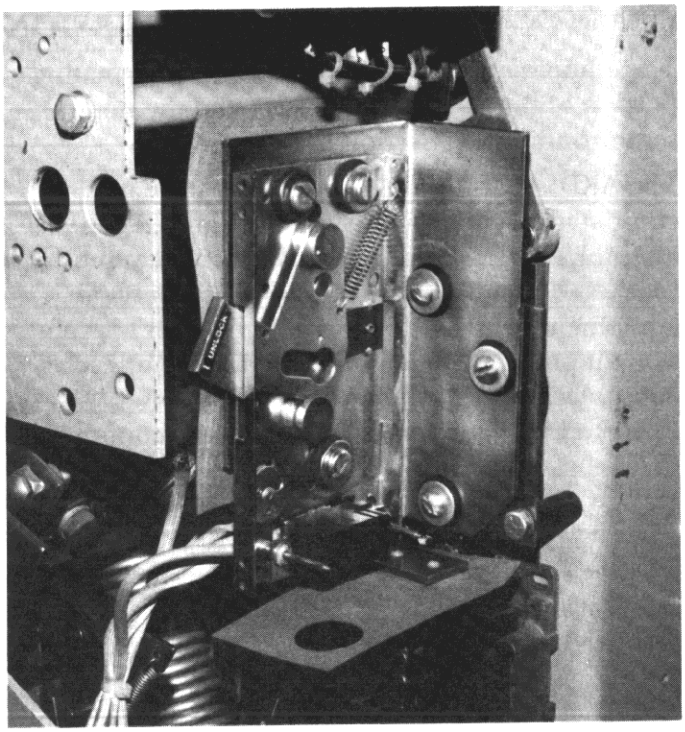


Figure 7-1. Programmer Plate Installation

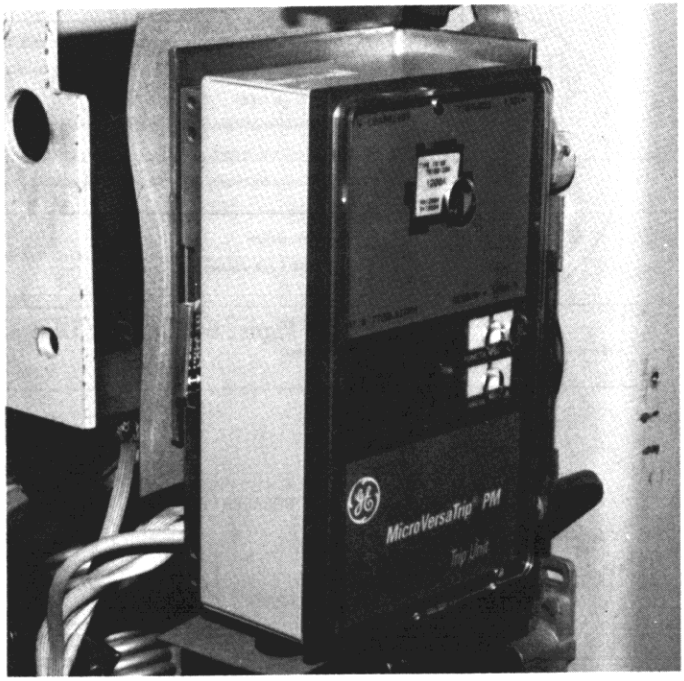


Figure 7-2. Programmer Mounting Bracket And Trip Unit

SECTION 8 TESTING AND TROUBLESHOOTING

Once the breaker has been converted, but before it is energized, it must be tested. See below for troubleshooting details.

TESTING

Before installing a converted breaker back into service, perform the following steps:

Step 1.

Verify that the programmer is securely installed. The phase sensors must not be energized if they are open-circuited.

Step 2.

Megger the breaker primary circuit using a 1,000-Volt Megger.

Step 3.

To verify that the breaker has been properly retrofitted, a primary injection test should be performed on each phase. This test will check the CTs, bus, wiring harness, flux shifter,and trip unit as a complete system. A high current, low voltage power supply should be connected across each line and load terminal to simulate an overcurrent fault. The programmer long-time may be set at 0.5 to minimize the breaker stress. When ground fault is installed, the test can be performed by wiring two adjacent poles in series. This will prevent the breaker from tripping due to an unbalance current flow. **Do not attempt to use test kit Cat. No. TVTS1 or TVRMS on this programmer.**

TROUBLESHOOTING

When malfunctioning is suspected, first examine the circuit breaker and its power system for abnormal conditions such as:

1. Breaker not tripping in proper response to overcurrents or incipient ground faults.
2. Breaker remaining in a trip-free state due to mechanical interference along its trip shaft.
3. Inadvertent shunt trip activations.

> **WARNING:** Do not change taps on the current sensors or adjust the trip unit settings while the breaker is carrying current.

False Tripping Breakers Equipped with Ground Fault

When nuisance tripping occurs on breakers equipped with the ground fault trip element, a probable cause is the existence of a false "ground" signal. Each phase sensor is connected to summing circuitry in the programmer. Under no-fault conditions on 3-wire load circuits, the currents add to zero, and no ground signal is developed. This current sum will be zero only if all three sensors have the same electrical characteristics. If one sensor differs from the others (i.e., different rating or wrong tap setting), the circuitry can produce output sufficient to trip the breaker. Similarly, discontinuity between any sensor and the programmer unit can cause a false trip signal.

The sensors and their connections should be closely examined if nuisance tripping is encountered on any breaker whose MicroVersaTrip® Plus or PM components have previously demonstrated satisfactory performance. After disconnecting the breaker from all power sources, perform the following steps:

Step 1.

Check that all phase sensors are the same type (ampere range).

Step 2.

Make sure that the tap settings on all three-phase sensors are identical.

Step 3.

Verify that the harness connections to the sensors meet the polarity constraints indicated by the cabling diagram, see Fig. 8-1.

Step 4.

On ground fault breakers serving four-wire loads, check that the neutral sensor is properly connected. See cabling diagram Fig. 8-1. In particular, the following:

A. Verify that the neutral sensor has the same rating and tap setting as the phase sensors.

B. Check continuity between the neutral sensor and its equipment-mounted secondary disconnect block. Also check for continuity from the breaker-mounted neutral secondary disconnect block through to the female harness connector.

C. If the breaker's lower studs connect to the supply source, then the neutral sensor must have its load end connected to the source.

D. Make sure that the neutral conductor is carrying only that neutral current associated with the breaker's load current (neutral not shared with other loads).

Step 5.

If the preceding steps fail to identify the problem, then measure the sensor resistances. Since the phase and neutral sensors are electrically identical, their resistance should closely agree. See Table 8-1.

Table 8-1. Resistance Values

Breaker Frame Size	Ampere Tap	Resistance In OHMs Between Common And Tap Terminals
AKR-75	1200 1600 2000 3000	20-24 28-34 37-44 61-72
AKR-100	1600 2000 3000 4000	36-43 47-55 75-88 108-127

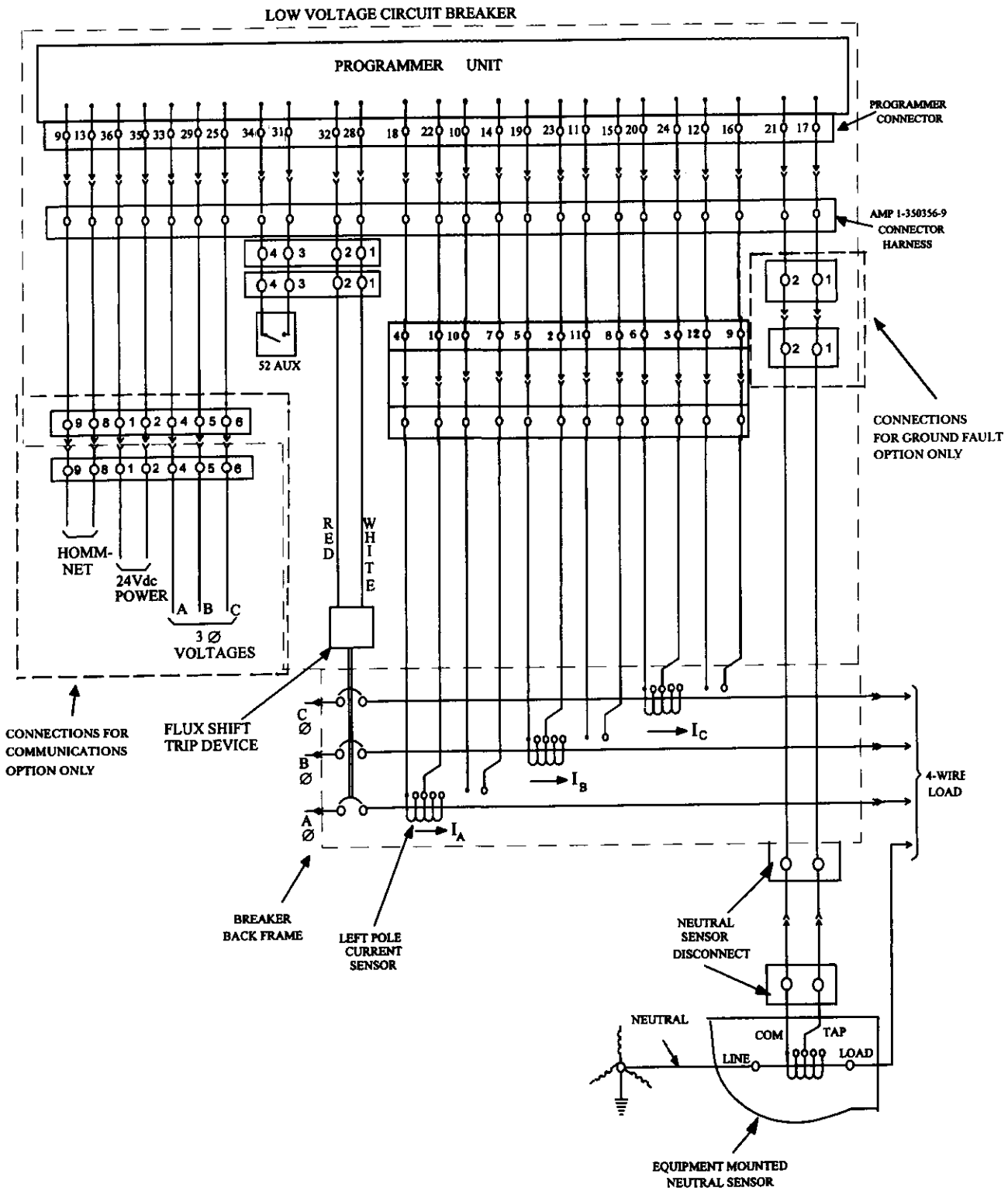


Figure 8-1. Cabling Diagram—MicroVersa-Trip® Plus and PM With Ground Fault On Four-Wire Load

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 GE Company.

GE Electrical Distribution & Control

General Electric Company
41 Woodford Ave., Plainville, CT 06062

GEH-5964 0994 PSA