MicroVersaTrip® Plus and PM Conversion Kits

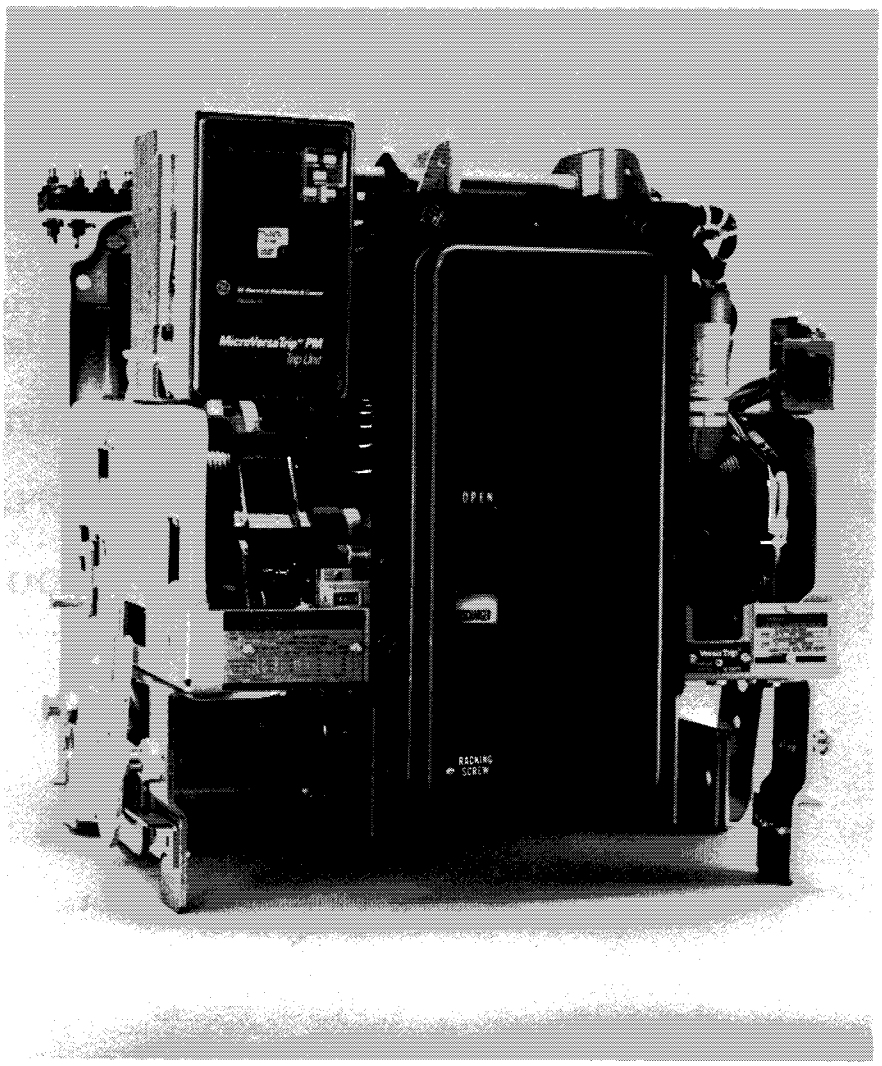
For GE Types AKR-30, AKR-50, AKJ-50, AKRU-30, AKRU-50, AKR-30H, AKR-50H, AKRT-50, AKRT-50H, AKJT-50, AKJT-50H Low Voltage Power Circuit Breakers

INTRODUCTION

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

MicroVersaTrip Plus and MicroVersaTrip 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 and PM Conversion Kits on GE Types AKR-30, AKR-50, AKJ-50, AKRU-30, AKRU-50, AKR-30H, AKR-50H, AKRT-50, AKRT-50H, AKJT-50, and AKJT-50H Low Voltage Power Circuit Breakers. Each Conversion Kit contains all appropriate material to convert from an existing EC, Power Sensor, ECS or SST trip system or upgrade MicroVersa Trip and MicroVersaTrip RMS-9 trip systems.



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SECTION 1 GENERAL INFORMATION

Conversion kit installation is straightforward. However, careful workmanship and attention to these instructions should be maintained. Familiarity with the breaker will prove helpful. The general approach is to first strip the breaker of its existing trip devices and then install the MicroVersaTrip® Plus or PM components. Following this, the converted breaker is performance-tested prior to being restored 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 ratings. For example, when the breaker's trip elements 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 kit provides an excellent opportunity to perform normal maintenance on the breaker, particularly while the front and back frames are separated. Such procedures are described in installation and maintenance manuals supplied with 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-30, AKR-30H, AKR-50, AKR-50H and AKJ-50 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 steps:

a. Replace the existing flux shifter with the new one provided (see Figure 3-1).

b. Programmer Mounting Bracket installation.

c. Installation of the position switch.

d. Installating the communication harness (when required)

Installing the Flux Shifter

Step 1.

Remove the two (2) screws holding the old flux shifter to the bottom of the breaker frame. Remove the retaining ring holding the reset linkage to the crossbar. Remove the reset spring.

Step 2.

Insert the new flux shifter assembly on the top side of the breaker frame (see Figure 3-2). The two screws removed in Step 1 can be threaded back into the tapped holes on the new flux shifter bracket.

Step 3.

Replace the reset spring removed in Step 1. on the new linkage and connect the reset lever to the crossbar using the retaining ring removed in Step 1. To easily access the retaining ring, it will help to manually rotate the crossbar to the closed position by prying up on the crossbar arm on the left side of the breaker.

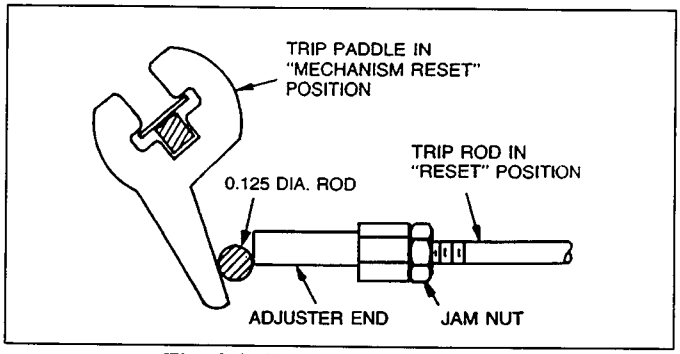

Fig. 3-3. Trip Rod Adjustment

Step 4.

The trip device requires only one adjustment - the trip rod length. As shown in Figure 3-3, the clearance between the trip rod end and the trip shaft paddle is gauged by a 0.125 inch diameter rod. Adjust gap to 0.125 inches. To adjust, place the breaker in the open position with the mechanism charged. Loosen the jamb nut, rotate the adjuster end until the proper gap is attained and retighten the jamb nut.

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.

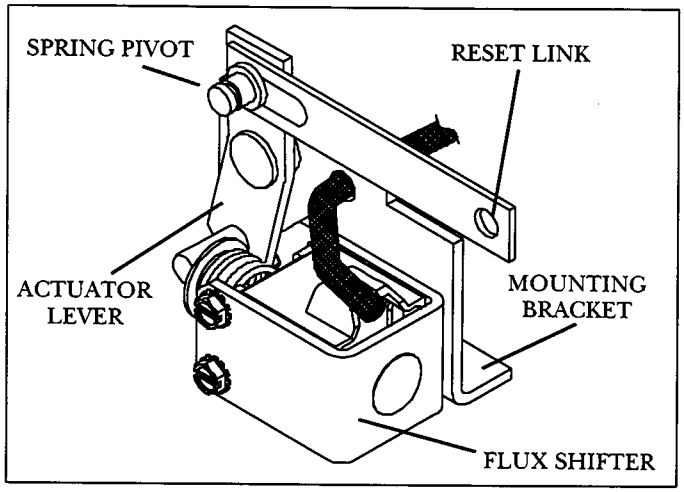

Fig. 3-1. Flux Shifter

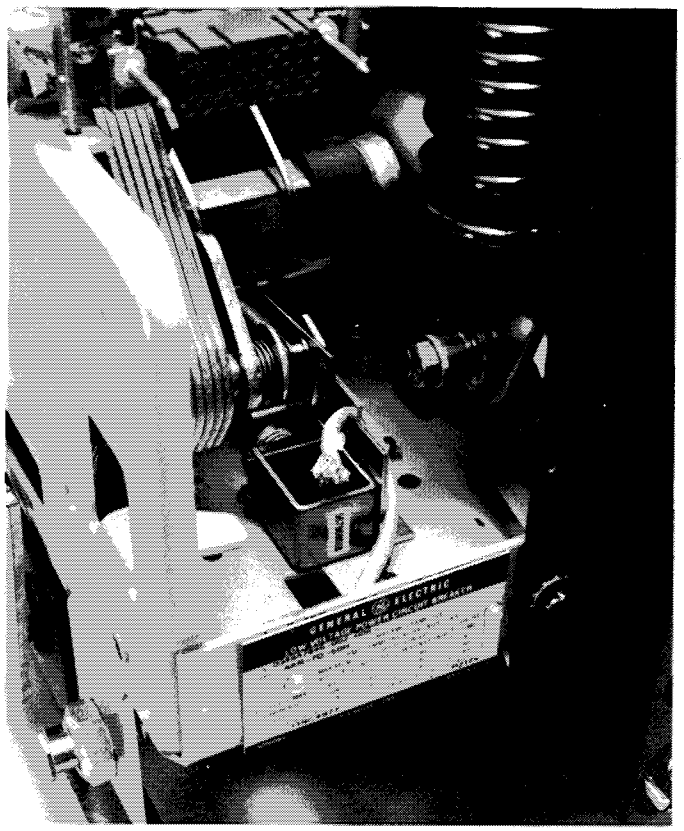

Fig. 3-2. Flux Shifter Installed

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Programmer Mounting Bracket

The programmer mounting bracket is installed in the upper left corner of the frame (see Figure 3-5).

Step 1.

Remove the existing mounting bracket and all other related parts.

Step 2.

If the holes shown in Figure 3-4 are not already on the breaker, they must be drilled. Use #16 tap drill and a #12-24 thread tap.

Step 3.

Brace the bracket against the breaker and control mechanism frames.

Step 4.

Secure the trip unit mounting bracket to the brace with the mounting screws provided (see Figure 3-5).

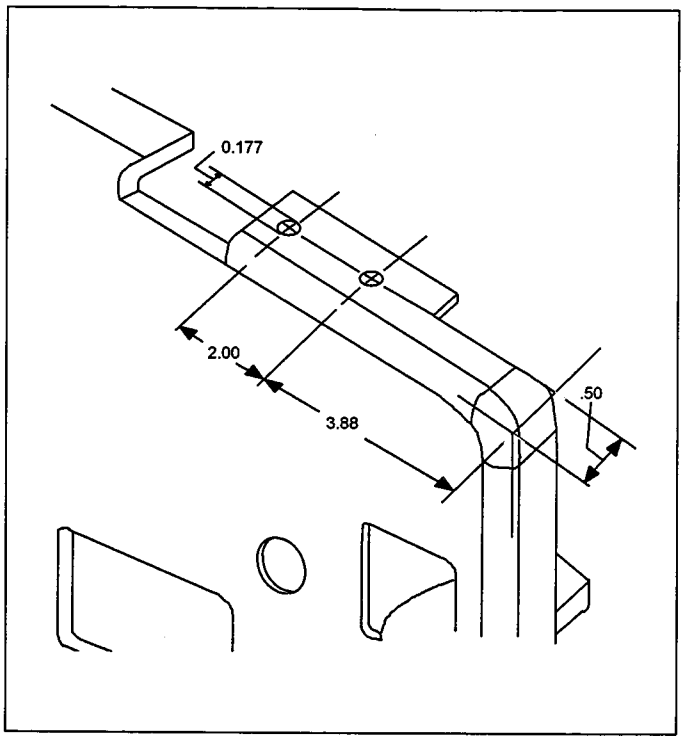

Figure 3-4. Mounting Bracket Drill Holes

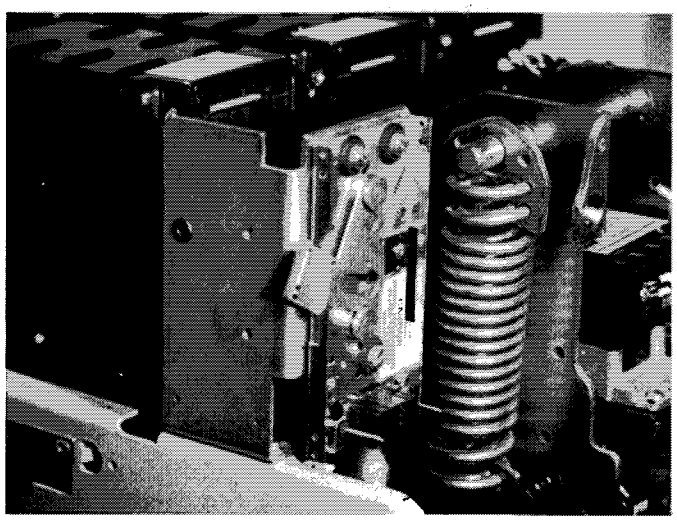

Fig. 3-5. Mounting Bracket

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Position Switch

The position switch is installed in the upper right corner of the frame (see Figure 3-6).

Step 1.

Although it is not required, manually rotating the crossbar to the closed position as in Step 3 of the flux shifter installation will make it easier to install the position switch.

Step 2.

Place the position switch into the frame with the actuation lever under the crossbar arm. Align the two tapped holes in the bracket with the holes in the breaker frame.

Step 3.

Insert the two (2) 6-32 x ½" screws provided with flat and lock washers through the bottom of the frame. Thread into the tapped holes in the position switch bracket

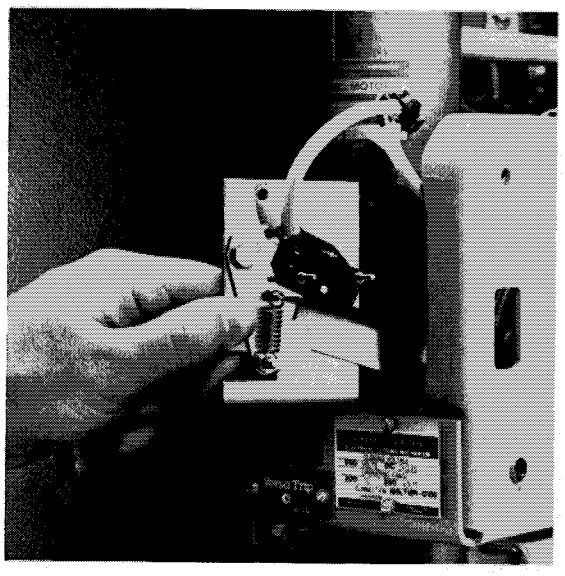

Figure 3-6. Position Switch Installation

SECTION 3 FRONT FRAME BREAKER CONVERSION

Installing the Communications Wiring Harness (When Required)

The communications wiring harness is installed on the right hand side of the breaker front frame above the position switch (see Figure 3-7).

Step 1.

If the two holes shown in Figure 3-7 do not exist, they must be drilled. Drill them for 0.228 dia., using a #1 drill.

Step 2.

Install the coupler bracket using #12 screws, lock washers and nuts.

Step 3.

Wrap wires behind breaker frame (see Fig. 3-8) and tie them to the breaker frame. Refer to Table 3-1 for pin assignments if necessary.

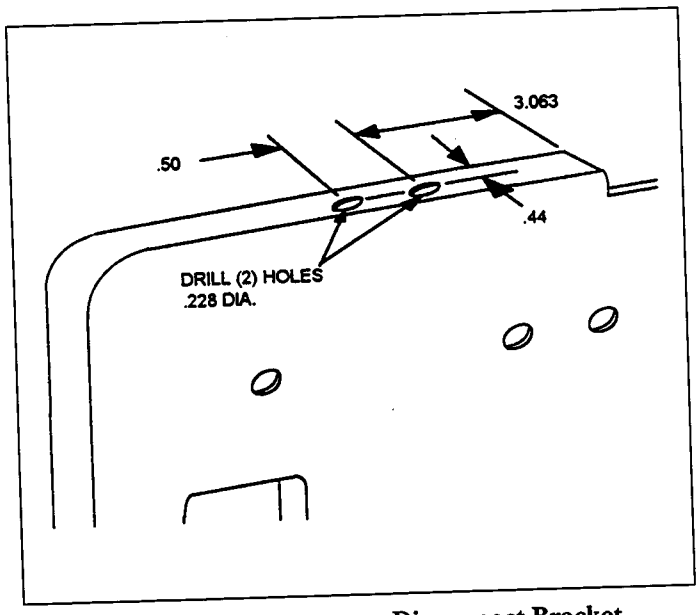

Figure 3-7. Programmer Disconnect Bracket Mounting Holes

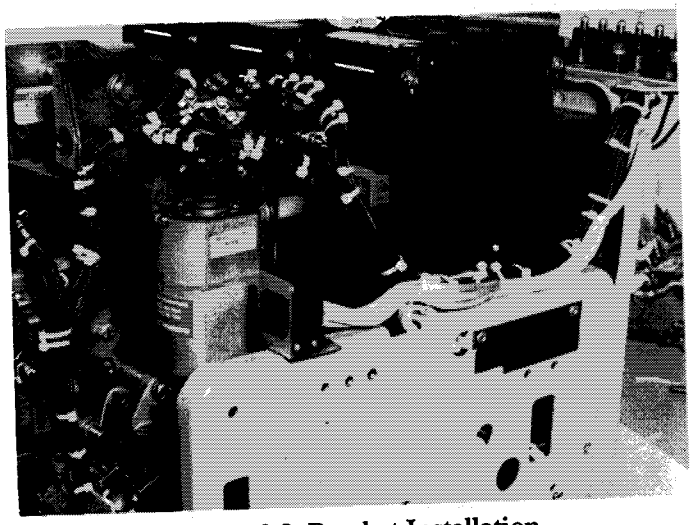

Figure 3-8. Bracket Installation

Figure 3-1. Programmer Disconnect Pin Assignments

Pin Number		
Comm Port	Trip Unit	Wire Color
1	36	Black
2	35	White
3	open	
4	33	White
5	29	Black
6	25	White
7	open	
8	13	White
9	9	Black

SECTION 4 BACK FRAME BREAKER CONVERSION

Installing the Phase Sensors

The MicroVersaTrip phase sensor is shown in Figure 4-1. Except for coil winding, it is identical to the SST phase sensor.

Referring to Figure 4-2, replacement of the SST or ECS phase sensors with the MicroVersaTrip sensors is as follows:

Step 1.

At the rear of the breaker, remove the two Allen-head screws to separate the stud connector from the contact pivot block.

Step 2.

Disconnect the programmer harness from the ECS terminals. Remove the cable ties from the breaker frame.

Step 3.

Loosen the clamp bolt and remove the stud connector. Lift out the existing sensor; if it is prevented from slipping off the sensor stud by adjacent accessories, the sensor stud must be removed from the breaker base. The stud assembly is secured to the base with four bolts which are accessible from the rear of the breaker.

Step 4.

Install the new MicroVersaTrip sensors, positioning them as shown in Figure 4-2.

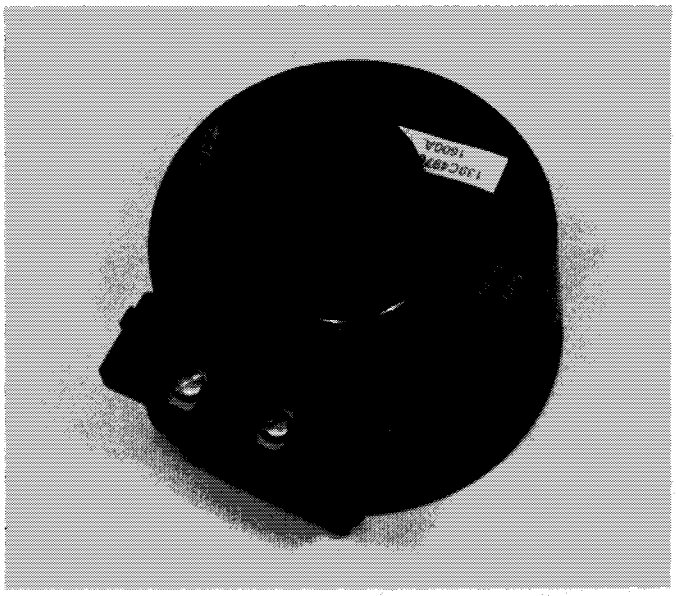

Figure 4-1. MicroVersaTrip PM Phase Sensor

Step 5.

Replace the stud connector, making sure the Allen-head screws and clamping bolt are sufficiently tightened.

> Note: Occassionally, during current sensor manufacturing, a 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.

1. Flux shift trip device
2. Allen-head screws
3. Stud connector
4. Phase sensor
5. Clamp bolt
6. Sensor stud
7. Phase sensor wire harness

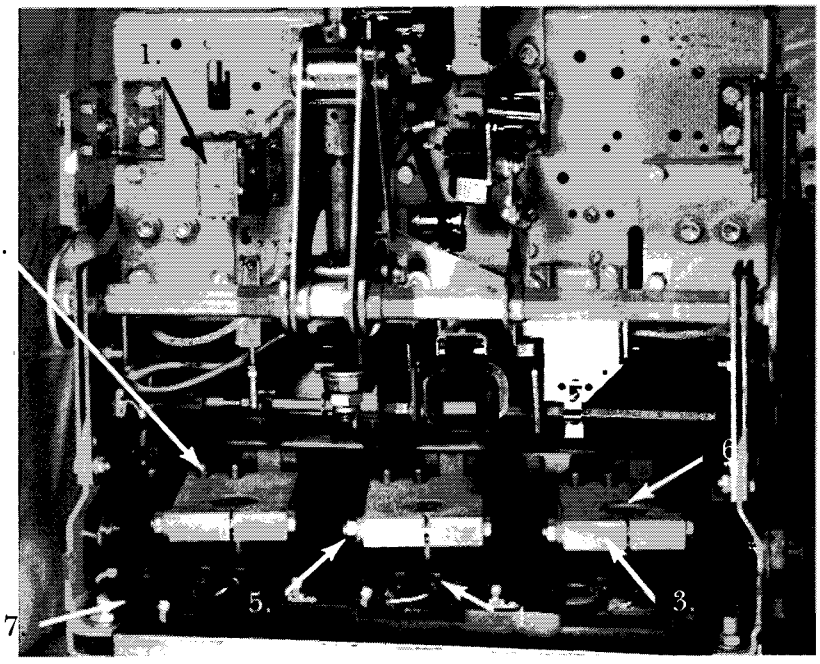

Figure 4-2. MicroVersaTrip PM Device Installation, AKR-50 Breaker

SECTION 4 BACK FRAME BREAKER CONVERSION

Installing the Programmer Wiring Harness

The programmer wiring harness is installed along the same path as the old ECS or SST wiring harness. The following steps must be taken:

Step 1.

Remove the old wiring harness

Step 2.

Install the harness connector on the bottom of the programmer bracket. Follow the steps shown in Figure 4-3 (Note: If the communications harness is not installed, the related pins may be removed first.

Step 3.

Insert the wires along the frame of the breaker. The harness wraps around the back of the breaker and in back of the current sensors. The end of the harness should be brought up to the position switch.

Step 4.

Connect the harness to the current sensors and the position switch. The lead on the position switch should be sent back along the wire path and connected to the lead from the flux shifter.

Step 5.

Tie the wiring harness back against the frame, while making sure that it is kept away from all moving parts.

CAUTION: Adapter bracket must be installed onto harness plug as shown in Fig. 4-3. Failure to do so will result in harness plug failure and the programmer will not provide protection.

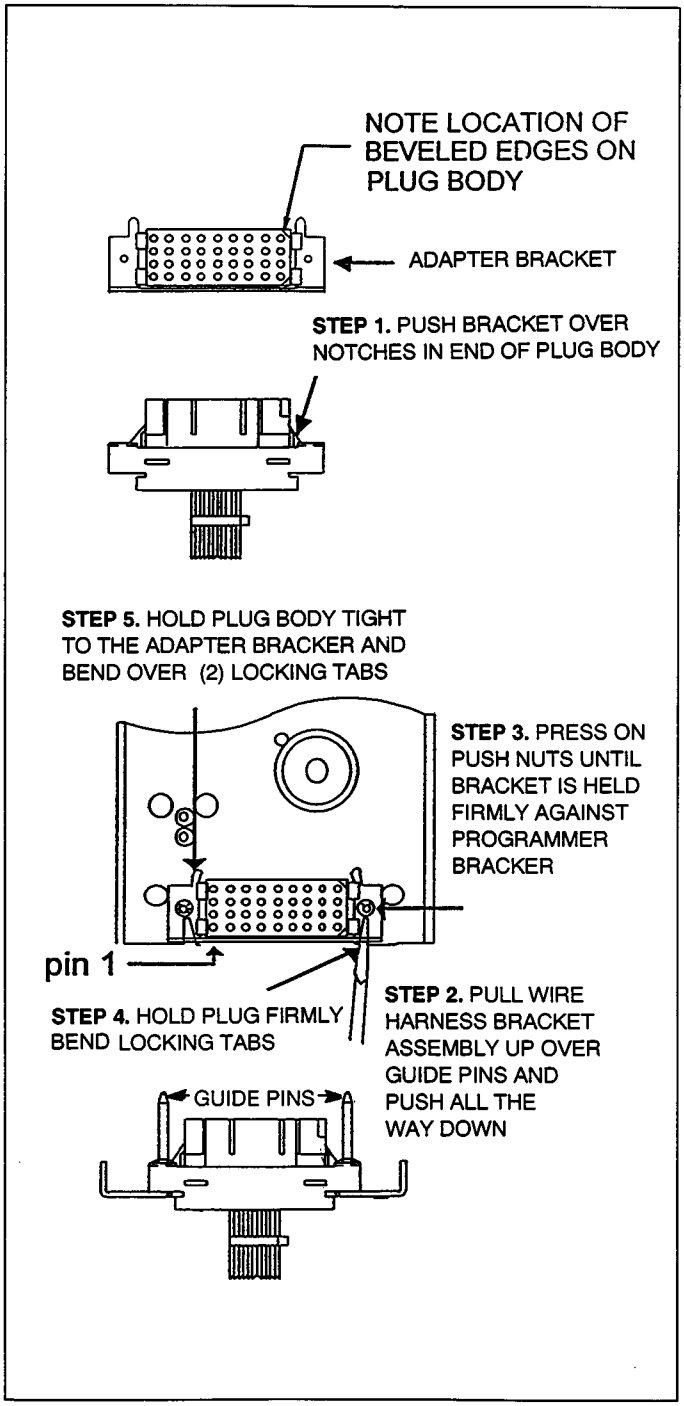

Fig. 4-3. Harness Connector

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

MicroVersaTrip Plus and PM ground fault option requires an additional neutral sensor when used on a 4-wire system with the neutral grounded at the transformer. The phase sensors mount on the breaker, but the neutral sensor is inserted in the neutral bus, which is part of the equipment. The neutral sensor connects to the breaker through the 4th wire neutral disconnect.

Converting Draw Out Breakers

The 4th wire disconnect mounts in one of two locations. For AKD-5 and AKD-6 compartments it mounts to the lower rear back frame on the centerline of the left pole as shown in Figure 5-1. For AKD-8 the disconnect mounts on the right hand side of the breaker frame, next to the communications port as shown in Figure 5-2.

MOUNTING INSTRUCTIONS TYPES AKD-5, AKD-6 SWITCHGEAR

Step 1.

If the disconnect already exists, replace the control harness. Maintain the following color code:

White - Common - Pin 21 of trip unit

Black - Tap - Pin 17 of trip unit

Step. 2

If the disconnect is being added, mount the disconnect assembly and connect to the wiring harness installed in Section 4.

MOUNTING INSTRUCTIONS TYPE AKD-8 SWITCHGEAR

Step 1.

If the disconnect already exists, replace the control harness. Maintain the following color code:

White - Common

Black - Tap

Step 2.

If the disconnect is being added, drill two holes, 0.203 dia., using a 13/64" drill (Figure 5-3). Mount the disconnect to the frame with ¼-20 self-tapping screws. Run the control harness behind the frame alongside the communications harness wires.

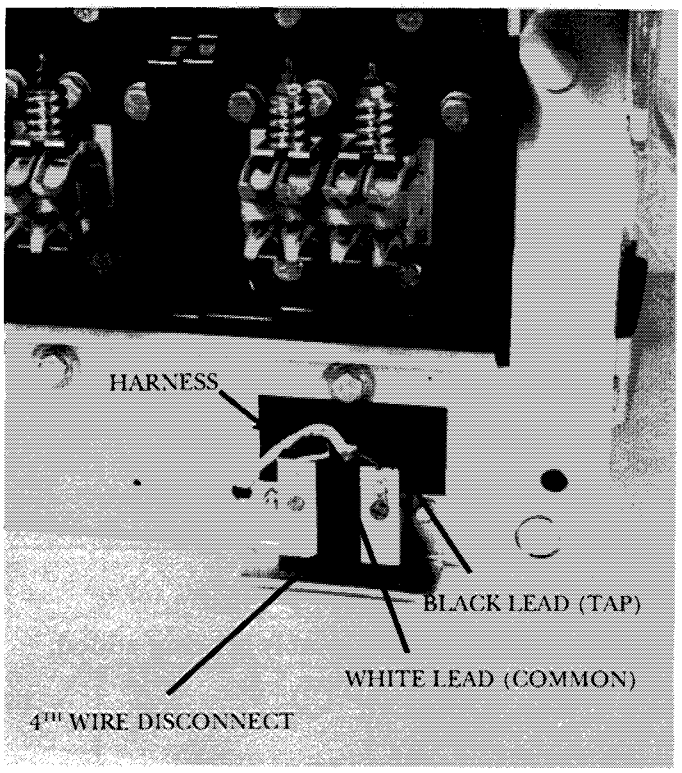

Figure 5-1. 4th Wire Disconnect - Type AKD-5, AKD-6

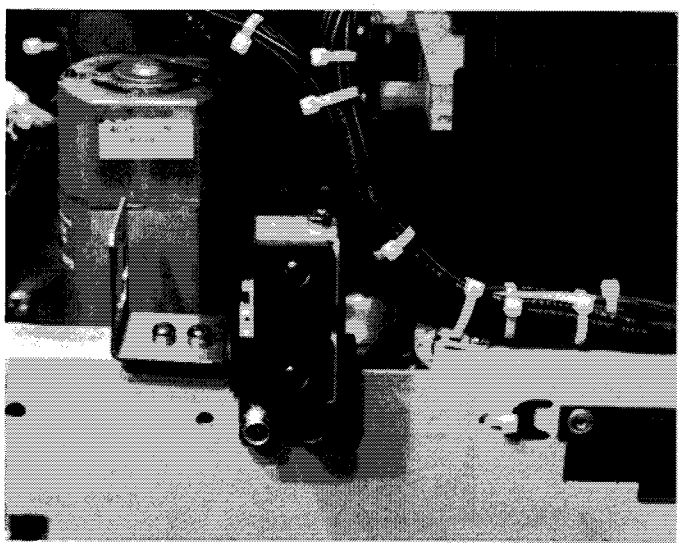

Figure 5-2. 4th Wire Disconnect - Type AKD-8

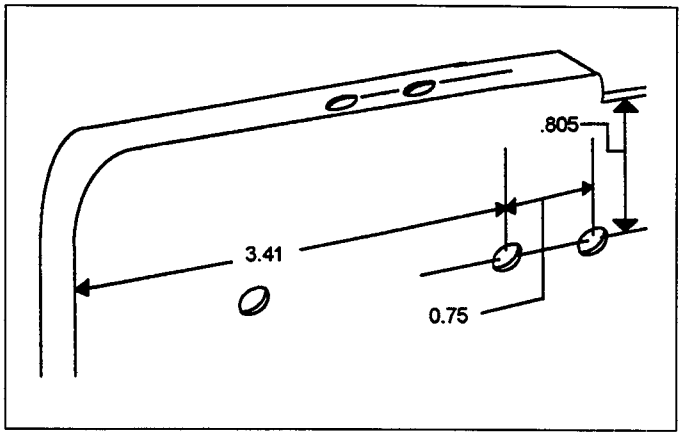

Figure 5-3. 4th Wire Disconnect Installation - AKD-8

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

Converting Stationary Breakers

The 4th wire disconnect is a terminal board located behind the programmer. It is assembled to a bracket attached to the side of the front frame where the racking mechanism support plates would be mounted (see Figure 5-4).

Step 1.

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

White - Common - Pin 21 of Trip Unit

Black - Tap - Pin 17 of Trip Unit

Step 2.

If the terminal board assembly is being added, mount it as shown in Figure 5-4.

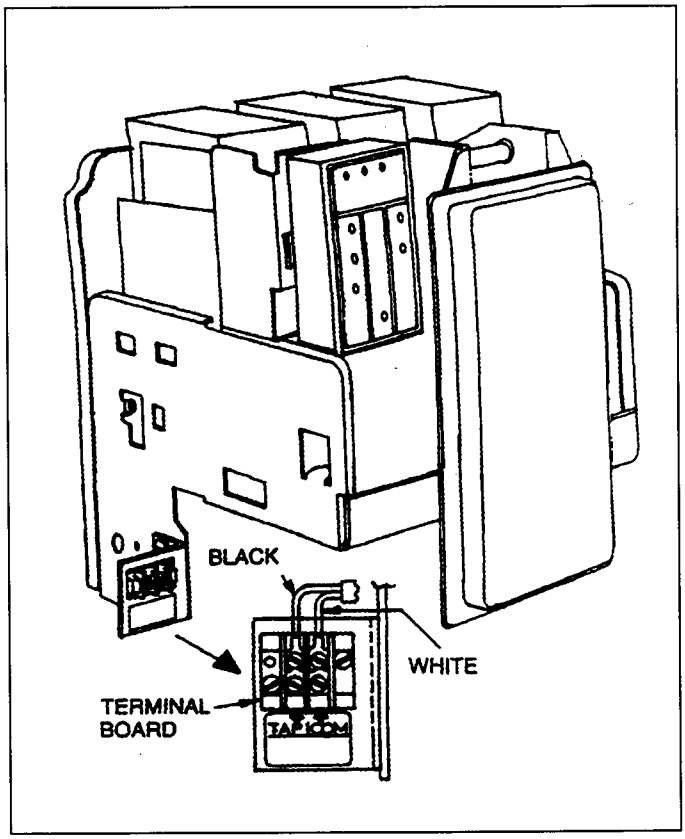

Figure 5-4. 4th Wire Disconnect Stationary Breaker

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

Installing Neutral Sensors

The neutral sensor is an electrical duplicate of the phase 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. Check to insure that the neutral and phase sensors match, i.e., have the same ampere range. Refer to Figure 5-5 for additional neutral sensor installation information.

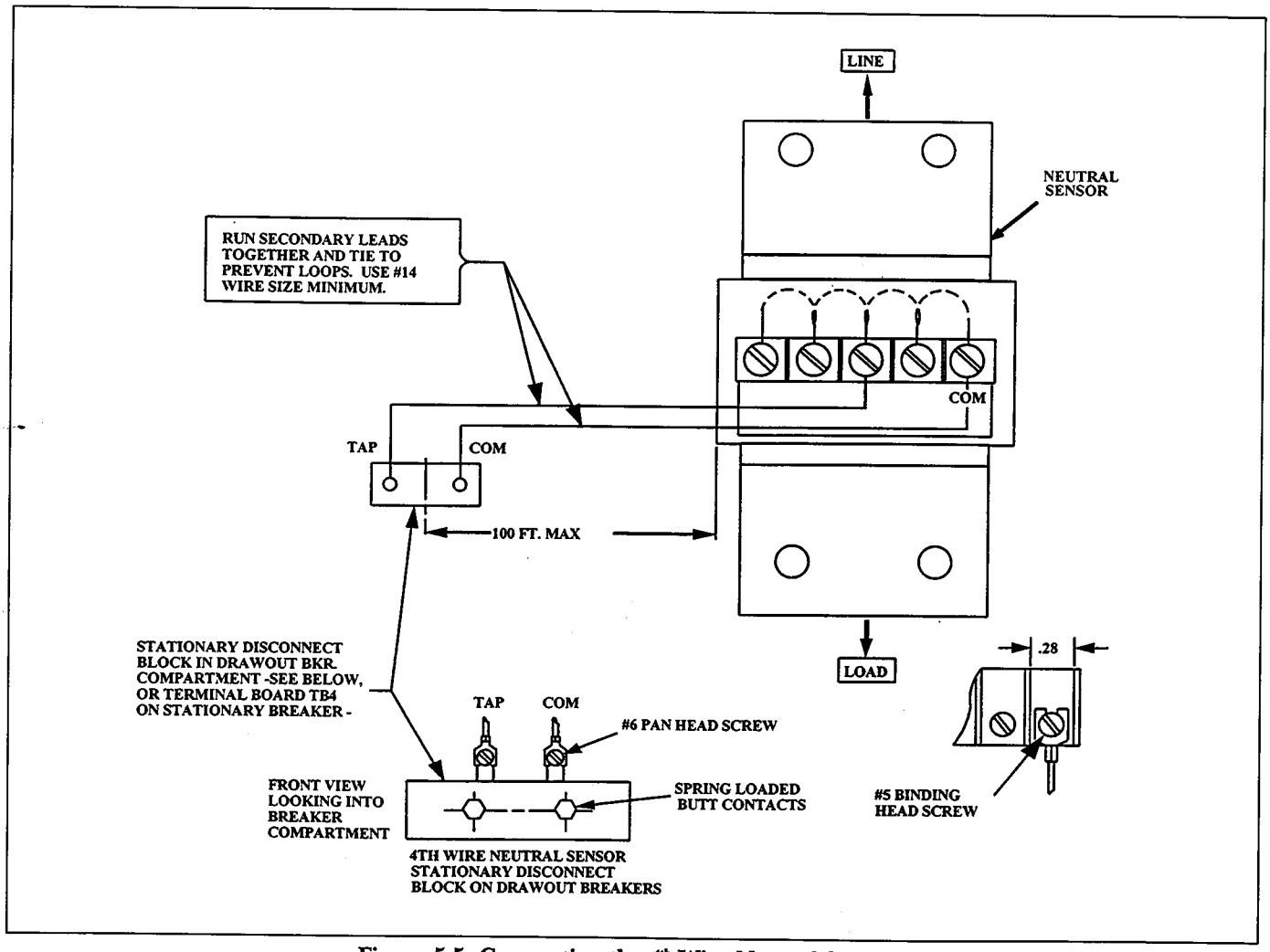

Figure 5-5. Connecting the 4th Wire Neutral Sensor

Installation Notes

- Observe line and load markings when making bus or cable connections.
- Bond sensor on line side only.
- Maintain polarity of sensor secondary leads when connecting to breaker, i.e., tap to tap, com to com.

SECTION 6 EQUIPMENT CONVERSION

The equipment compartment contains the mating portion of the 4th wire disconnect.

Types AKD-5, AKD-6 switchgear and substructure-type equipment compartments use the same disconnect assembly. The support bracket for the disconnect assembly is different for each equipment type. This conversion kit provides the brackets. Refer to Table 6-1 and Figure 6-1 for mounting bracket installation details.

Table 6-1.

Item #	Description
1	Breaker portion of 4th-wire disconnect
2	Mounting brackets
3	10-32 mounting screws
4	10# lock washer
5	10# flat washer
6	¼-20 mounting screws

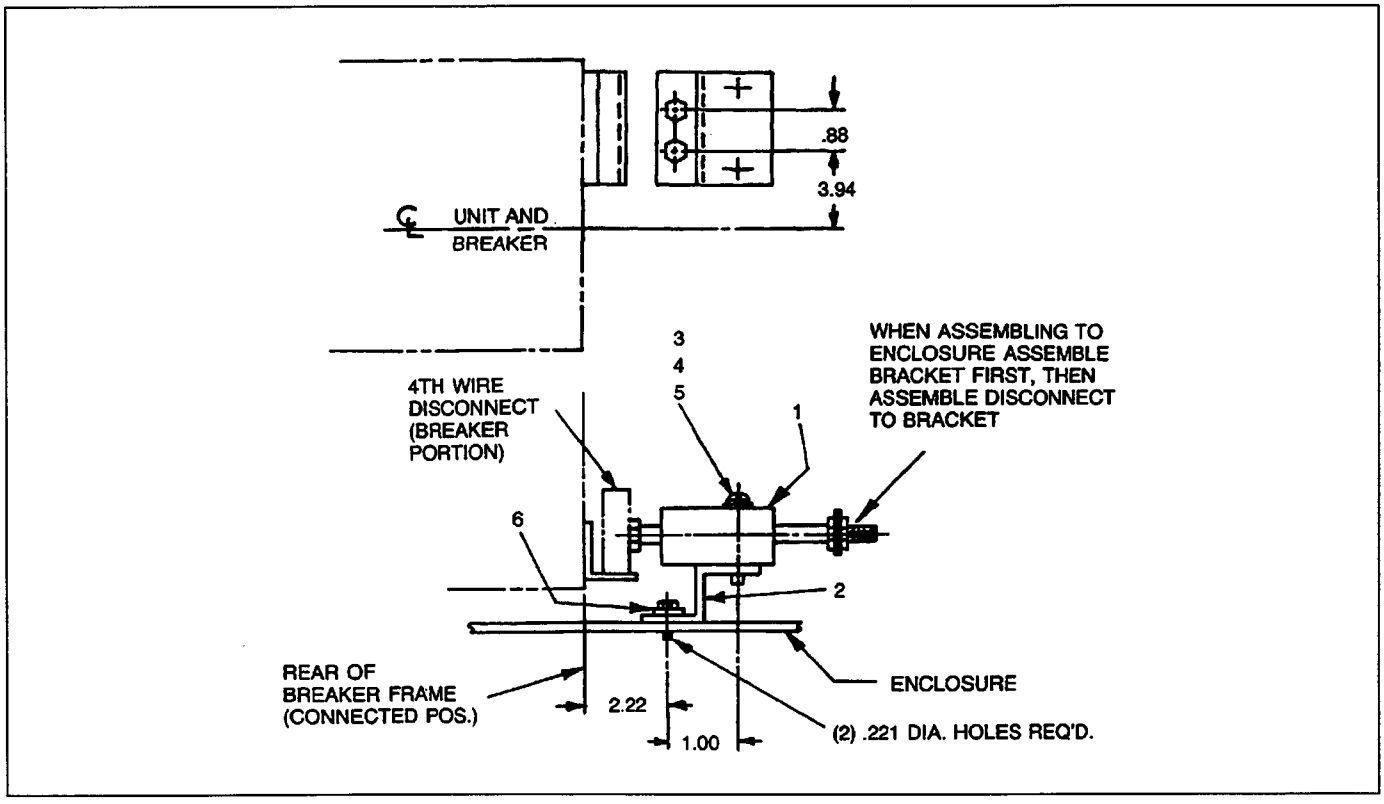

Figure 6-1. 4th Wire Disconnect Installation - Types AKD-5 and AKD-6

SECTION 7 INSTALLING THE PROGRAMMER

The programmer is attached to the bracket mounted to the left side of the breaker's center channel (see Figure 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.

Step 1.

Insert the guide pins into the hole and push on the programmer. This will engage the connectors and release the locking lever which will move in.

Step 2.

Verify that the locking lever actually engaged the programmer pin.

To remove the programmer, pull the locking lever out, releasing the programmer pin. Then, remove the programmer.

Figure 7-1. Programmer Trip Unit Installed

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 programmable trip unit 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 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 trip 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.

SECTION 8 TESTING AND TROUBLESHOOTING

FALSE TRIPPING BREAKERS EQUIPPED WITH GROUND FAULT (CONT'D)

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. See Fig. 8-1.

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. The coil resistance of the MicroVersaTrip flux shifter is approximately 7 Ohms. See Table 8-1 for resistance values of the windings.

Table 8-1. Resistance Values

Ampere Rating	Resistance in Ohms between Terminals
150	10-12
400	27-32
800	58-68
1600	129-151
2000	207-243

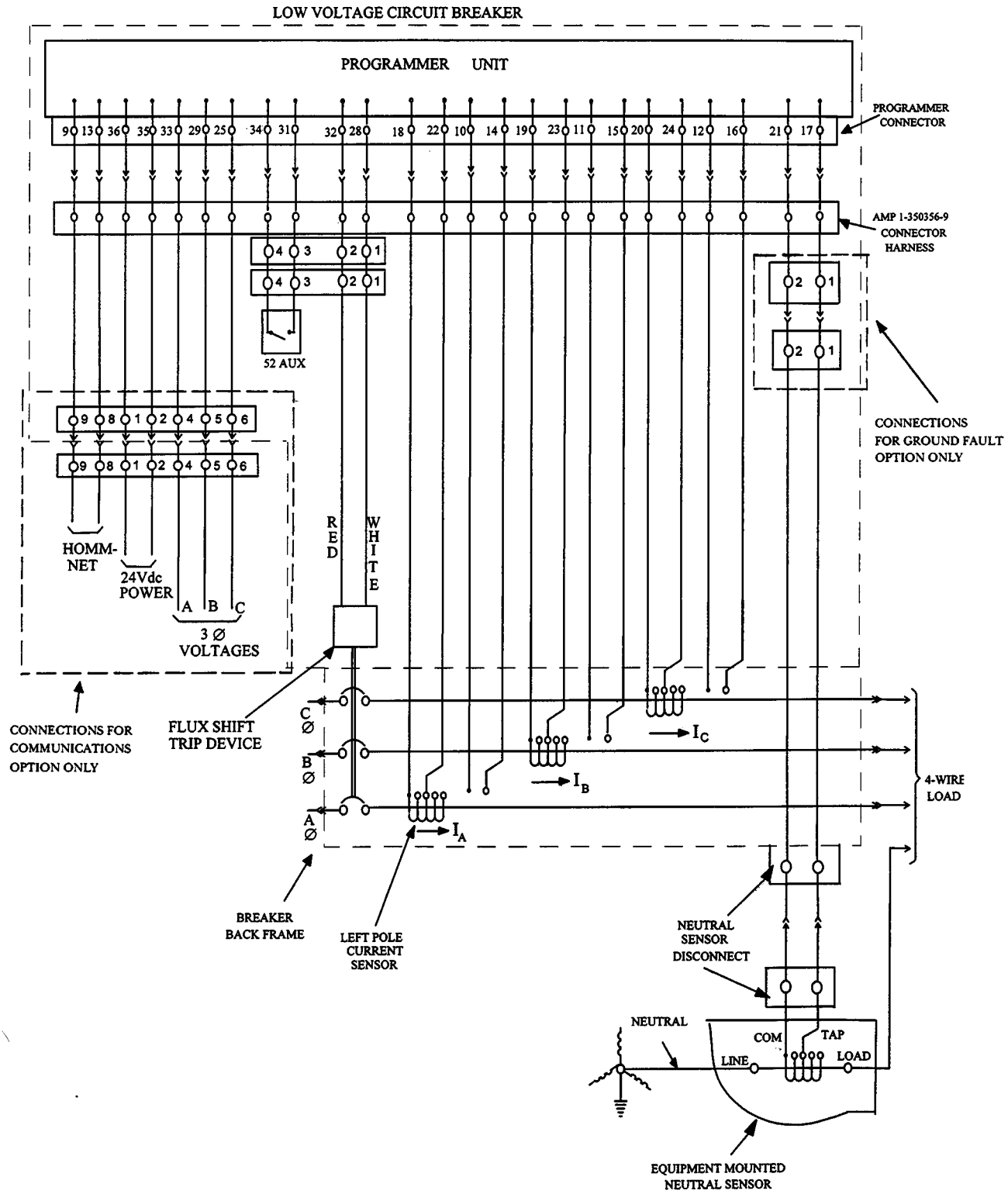

Figure 8-1. Cabling Diagram - MicroVersaTrip Plus and PM with Ground Fault on 4-Wire Load

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

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