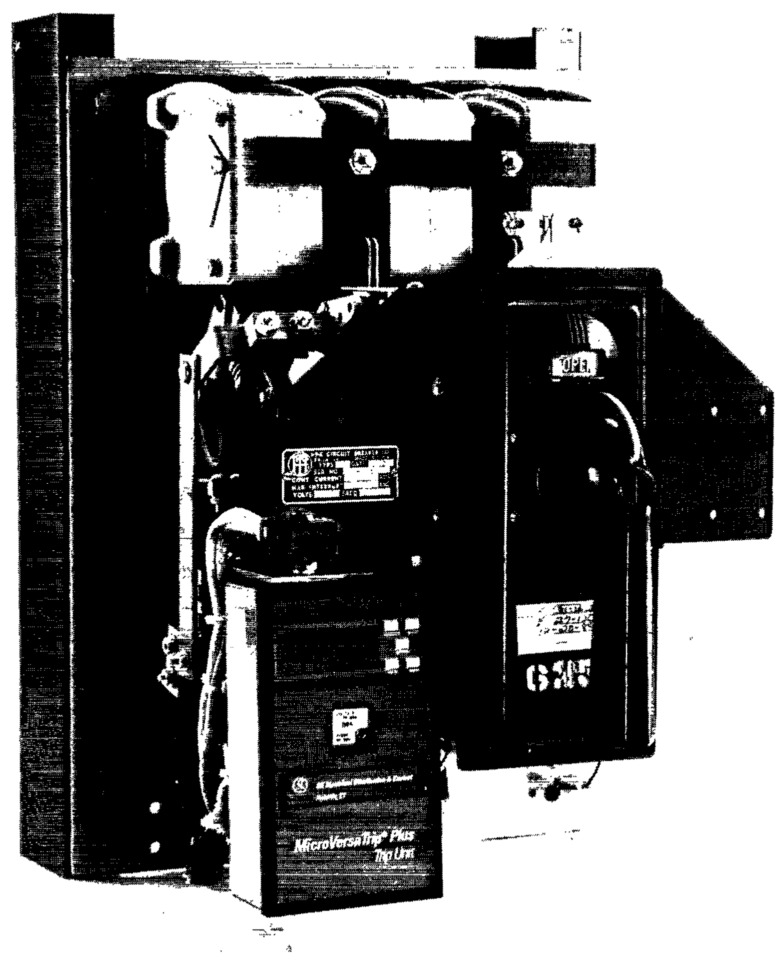
MicroVersaTrip® Plus and PM Conversion Kits

For I-T-E® Type KA Low Voltage Power Circuit Breakers



INTRODUCTION

GE Conversion Kits are designed to upgrade existing I-T-E® 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 I-T-E® Type KA Low Voltage Power Circuit Breakers. Each Conversion Kit contains all the appropriate material to convert from an existing I-T-E® electro-mechanical trip device system.

TABLE OF CONTENTS

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 programmable trip unit 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 correct kit, 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 normally 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 DISASSEMBLING THE BREAKER

I-T-E type KA breaker conversion consists of removing certain breaker components and hardware, resulting in separation of the front and back of the breaker frame. Some components and hardware can be discarded while others are to be saved for reuse. After the disassembly is completed, the new GE Conversion Kit components are installed and the breaker is reassembled. It is then ready for testing and return to service.

First, remove the breaker to a clean, well lighted work bench and place it in the upright position, so both the front and back are easily accessible.

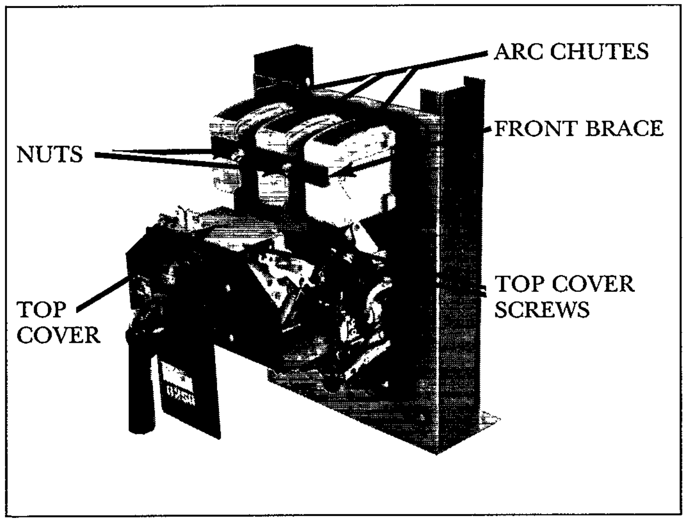


Fig. 1. Arc Chutes

Component Removal

Step 1.

Remove the arc chutes (one per phase) by removing the (2)5⁄16-18 nuts holding the front brace using a 9⁄16 wrench. The front brace (Fig. 1) holds the arc chutes in place. Save the arc chutes, nuts, and retainer brace for reuse.

Step 2.

Remove the (4) small Philips head screws holding the top front cover (Fig. 1). Save the cover and hardware.

Step 3.

Remove the connection pins holding the movable contact arms (Fig. 2, one per phase). Each connection pin is held in place with a small horseshoe clip. Save the connection pins and clips.

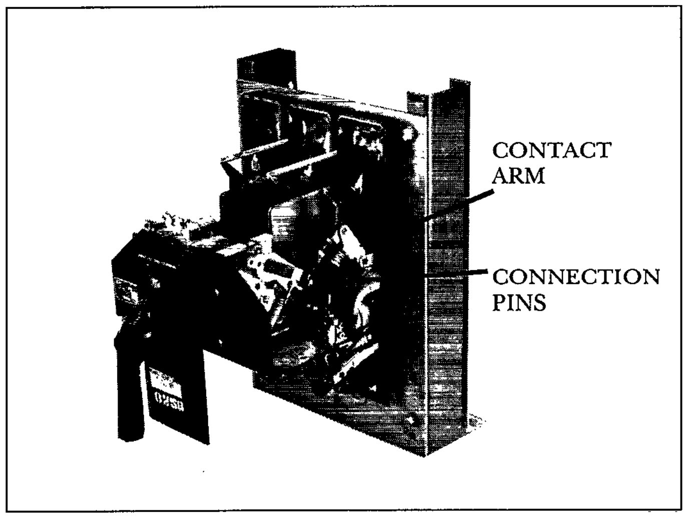


Fig. 2. Top Cover and Connecting Pins

SECTION 3 DISASSEMBLING THE BREAKER

Component Removal (cont'd)

Step 4.

From the back of the breaker, remove the (4)⅜-16 Philip's head screws holding the front mechanism to the breaker frame (Fig. 3). Save the hardware.

Step 5.

Separate the breaker front and back frames (Fig. 4).

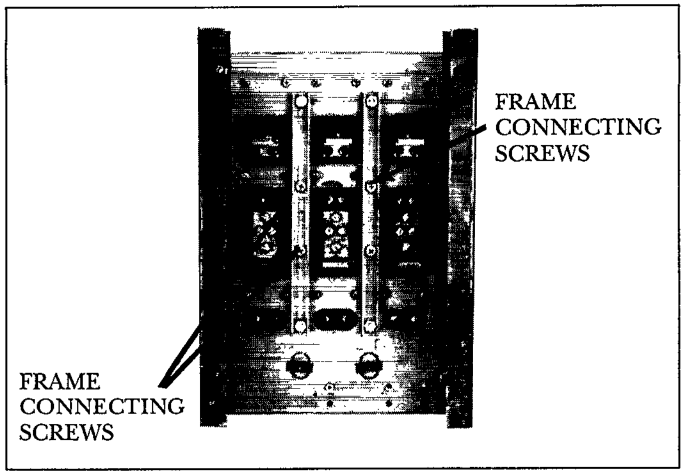


Fig. 3. Screws Holding Breaker Front and Back Frames Together

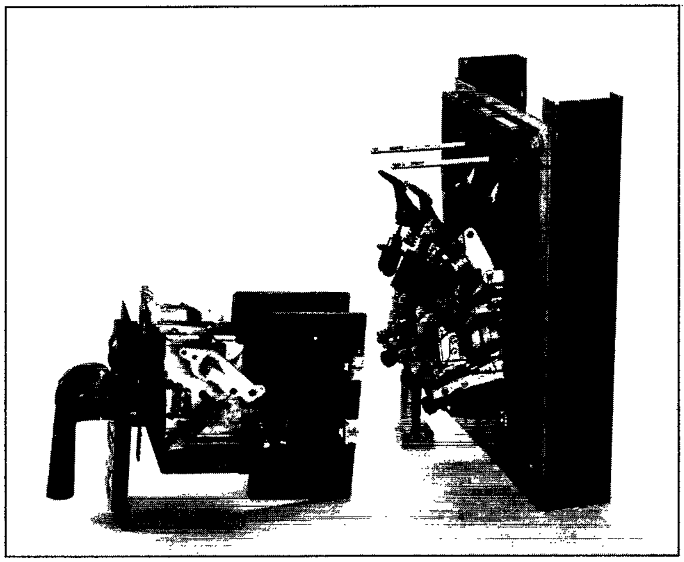


Fig. 4. Breaker Front and Back Separated

SECTION 3 DISASSEMBLING THE BREAKER

Component Removal (cont'd)

Step 6.

From the back breaker frame, remove (4) ¼-20 x ⅝" screws per phase in the load terminal and save them. Remove the (4) ¼-20 x ⅝" screws per phase in the plastic base that cradles the load bus (Fig. 5) and discard them.

Step 7.

Remove and discard the (2) ¼-20 x ⅝" Philip's head screws per phase holding the electromechanical trip unit connections to the movable contact structure (Fig. 6).

The breaker is now completely disassembled and ready for installation of the GE Micro VersaTrip® Conversion Kit (Fig. 7).

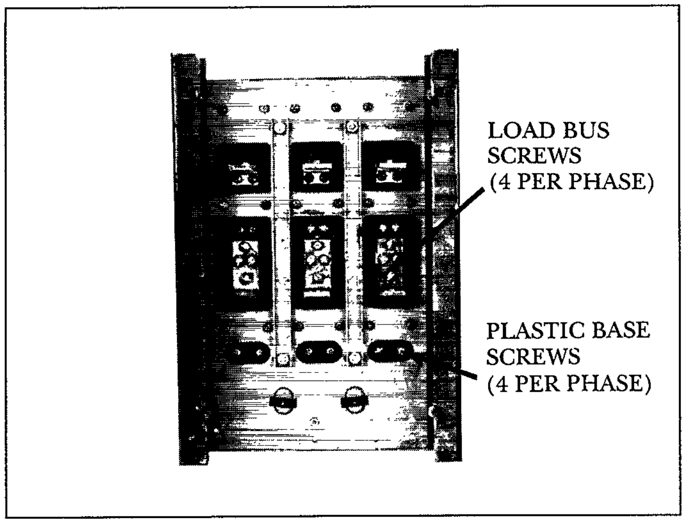


Fig. 5. Load Bus and Plastic Base

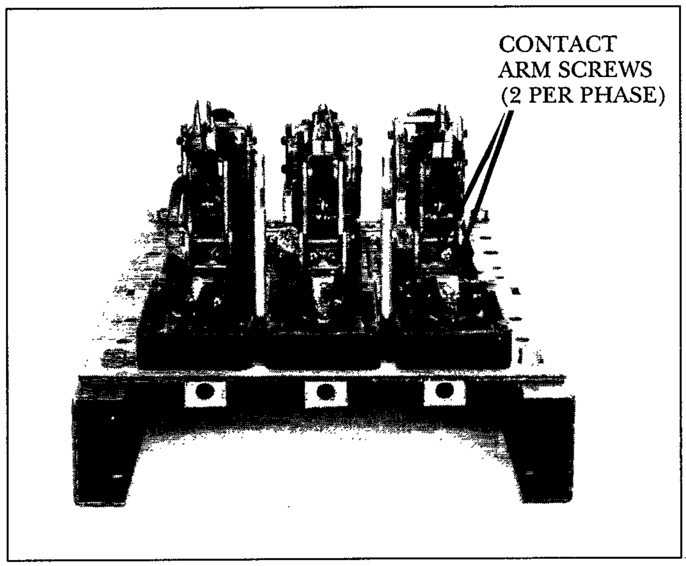


Fig. 6. Contact Arm Connections

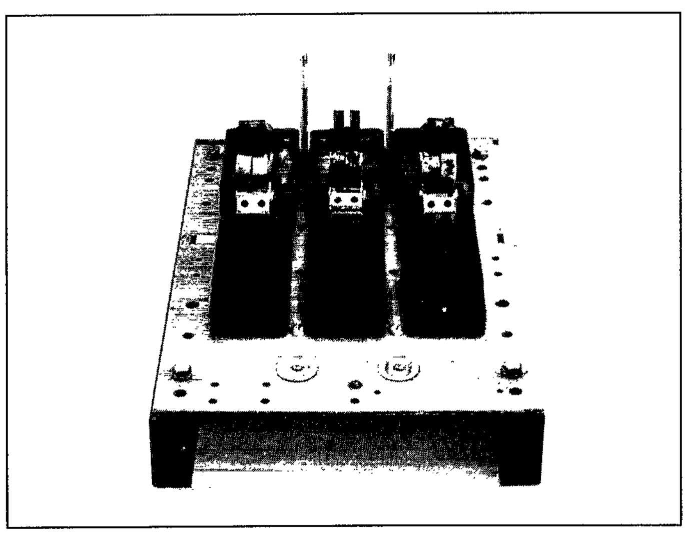


Fig. 7. Disassembled Back Frame

SECTION 4 INSTALLING THE CONVERSION KIT

Phase Sensors (CT's)

The I-T-E® KA conversion kit phase sensor (CT) and associated bus must be assembled before installation.

Step 1.

Position the insulated barrier provided, over the post on the bus (Fig. 8). The foam strip should rest against the end of copper bus.

Step 2.

Fit the CT on the post and add the spacer provided (Fig. 8). Place the top copper bus strap over the CT and insert the ⅜-16 x 1" bolt provided with a nut and lock washer (Fig. 9). Tighten the bolt finger-tight for now.

Step 3.

Mount each of the three CT assemblies to the front of the back frame. Place the insulated barrier provided under each copper assembly. Insert the ¼ -20 x 1" screws provided, (2) per phase, through the slots in the bus bars (Fig.10). Fasten them with a plain washer, lock washer, and nut on the top side.

Step 4.

Insert the (2)¼ -20 x ⅞" screws and lock washers provided, connecting the contact arm assembly to the CT assembly. Retighten to 45 in-lbs.*

Step 5.

Use a torque wrench to tighten the bolts inserted in Step 2. Tighten them to 200 in-lbs.* (Fig. 10).

Step 6.

Reinstall the load terminals removed in Step 6 on page 5 using the original hardware. Retighten to 45 in-lbs.*

> * **IMPORTANT NOTE:** Steps designated by an (*) are critical electrical integrity connections. They must be correctly tightened for proper operation. Failure to tighten properly will cause a breaker failure resulting in property damage or personal injury

> **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.

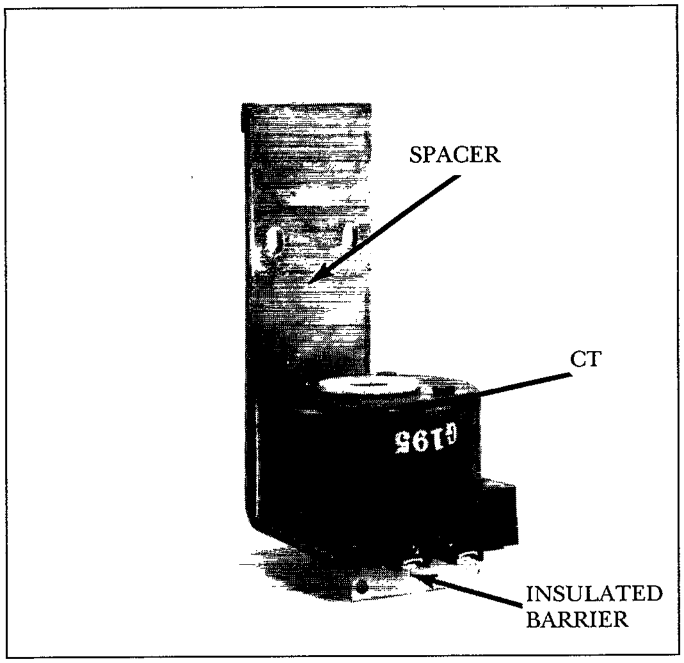


Fig. 8. Positioning the CT

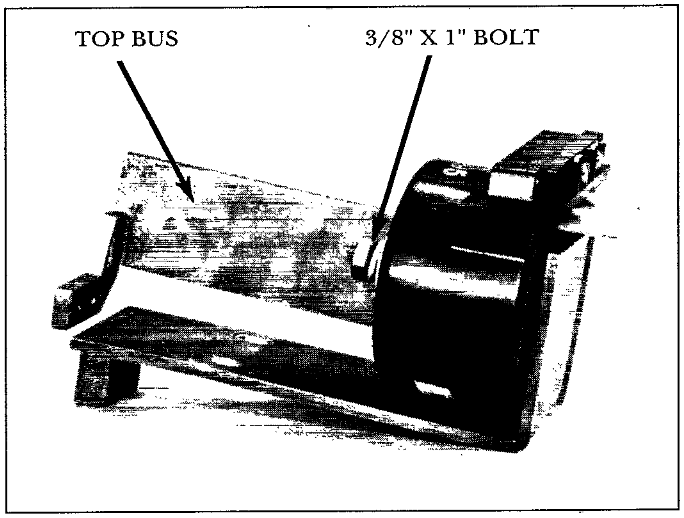


Fig. 9.CT Bus Assembly

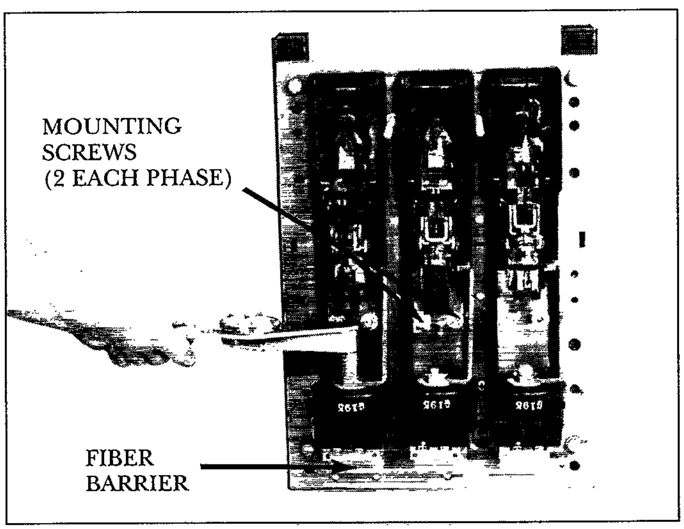


Fig. 10. Tightening the CT Bus Assembly

SECTION 4 INSTALLING THE CONVERSION KIT

Trip Paddle

Step 1.

From the front frame, remove and discard the trip paddle located on the left side of the breaker as you face it (Fig. 11).

Step 2.

Use the (2)8-32 x ¾" screws, lock washers, and nuts to mount the new trip paddle provided (Fig. 12). Be sure to mount the new trip paddle in the two outside holes—NOT the holes used for the old trip paddle.

Step 3.

The front and back breaker frames can now be rejoined. Use the (4)Philip's head screws removed in Step 4 on page 5 (See Fig. 13). Make sure that the frames are properly aligned while inserting the screws.

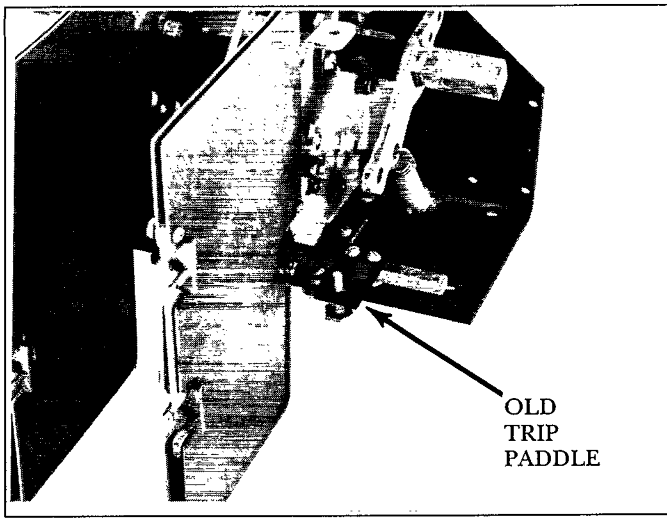


Fig. 11. Removing Old Trip Paddle

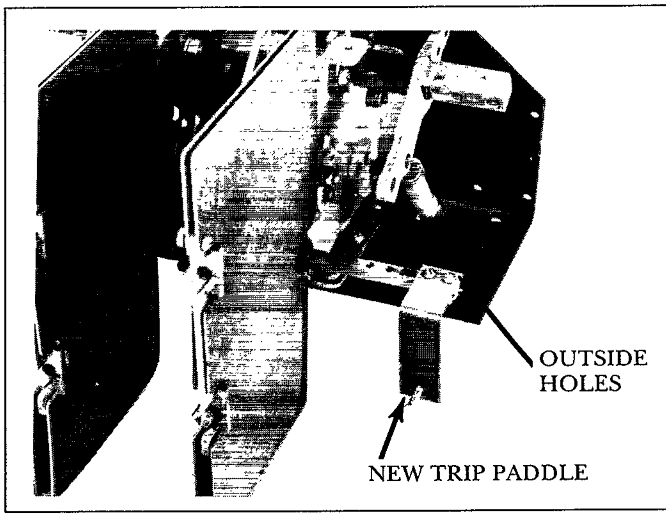


Fig. 12. New Trip Paddle Installed

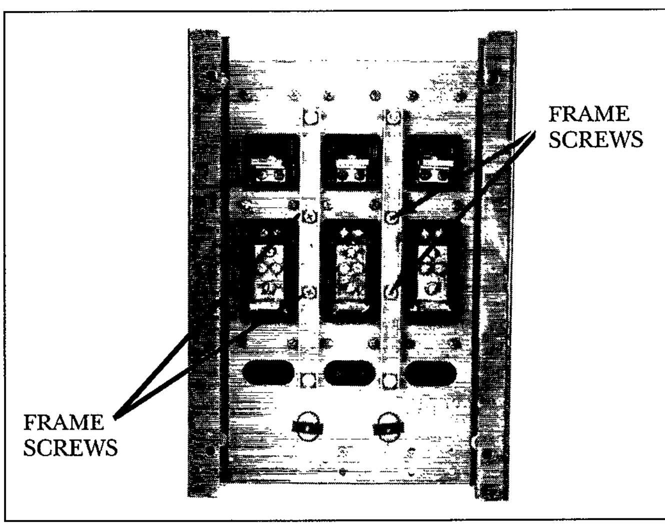


Fig. 13. Rejoining the Front and Back Frames

SECTION 4 INSTALLING THE CONVERSION KIT

Programmer/Flux Shifter Mounting Bracket

Step 1.

Place the rejoined breaker on its back. Mount the new programmer/flux shifter bracket assembly (Fig. 14) to the breaker frame using the existing holes and the hardware provided (Fig. 15). The assembly is mounted under the left side of the front frame. Secure with (2) ¼-20 nuts and lock washers on the top side of the frame.

Step 2.

Connect the end of the reset linkage to the crossbar. The angle bracket on the end of the reset linkage is mounted to the end of the crossbar with (2) ¼-20 x 1⅛" screws, nuts, and lock washers provided (Fig. 16).

Step 3.

Connect the opposite end of the flux shifter reset linkage to the flux shifter reset arm. The link slides over the stud on the reset arm and is held in place with the nut and washer already provided on the stud (Fig. 16).

FLUX SHIFTER ADJUSTMENTS

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

With the breaker in the CLOSED position, the gap between the trip paddle adjuster and the end of the flux shifter should be 1/16 of an inch. Use a ¼" wrench or nut driver to adjust the screw. It may help to gage the air gap with a 1/16" diameter rod or drill (not provided). The best approach is to adjust the breaker in the open position, then check it in the closed position.

> **IMPORTANT NOTE:** Extreme caution must be used when working on a closed breaker. DO NOT reach your hands into the mechanism while adjusting the flux shifter.

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

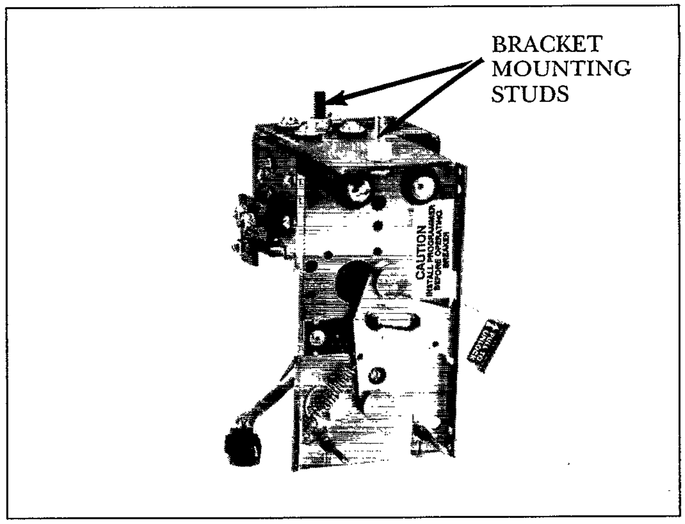


Fig. 14. Programmer/Flux Shifter Assembly

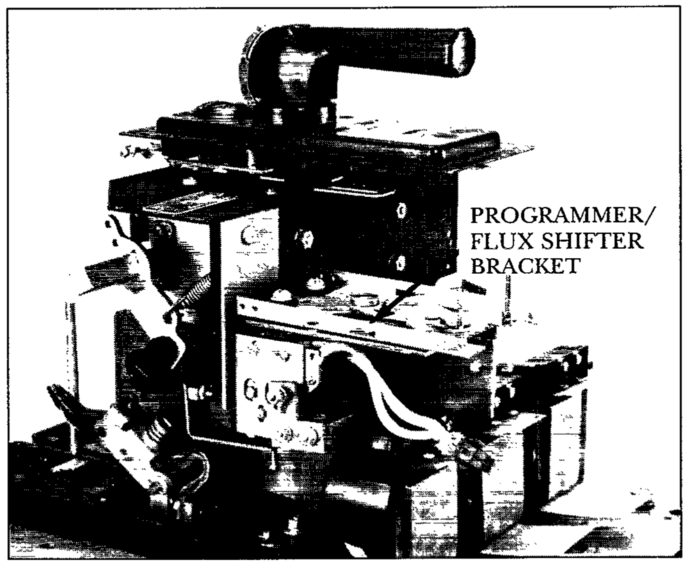


Fig. 15. Assembly Mounted to Breaker Frame

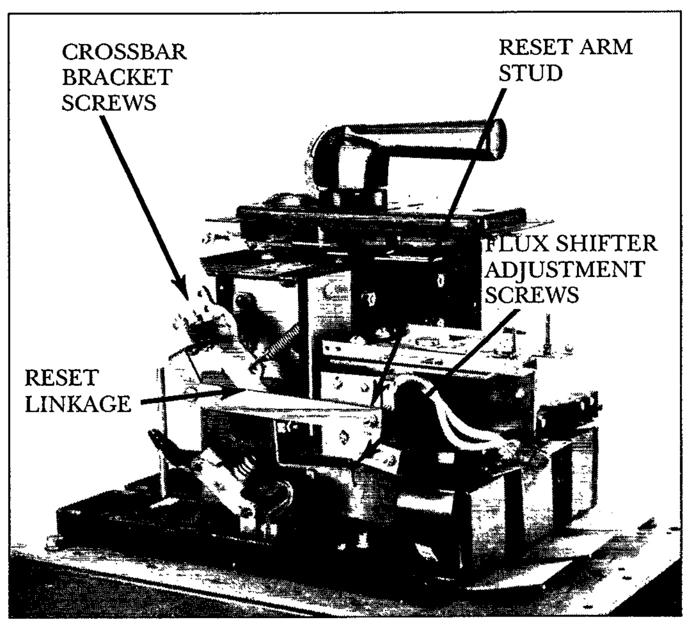


Fig. 16. Connecting the Flux Shifter Reset Linkage

SECTION 4 INSTALLING THE CONVERSION KIT

Programmer Wiring Harness

The programmer wiring harness consists of a mating 36-pin programmer connector and the associated wires.

Step 1.

Assemble the adapter bracket to the 36-pin programmer connector (with bevels to right side) by pushing the bracket over the notches in the ends of plug body. Follow Steps 2-5 of Fig. 17 to complete assembly of programmer harness to programmer bracket.

Step 2.

Join the 4-pin connector on the programmer harness to the 4-pin connector on the flux shifter.

Step 3.

Connect the wire harness leads to the screw terminals on each CT. Make sure they are connected properly. The white wire must be connected to the terminal marked white.

Step 4.

Use the tie wraps provided to tie the harness back against the frame. The harness should be tied to the holes in the fiber barriers at each CT. Make sure that the wires will not interfere with any moving parts (Fig. 18).

> **CAUTION:** Adapter bracket must be installed onto harness plug as shown in Fig. 17. Failure to do so will result in harness plug failure and the programmer will not provide protection.

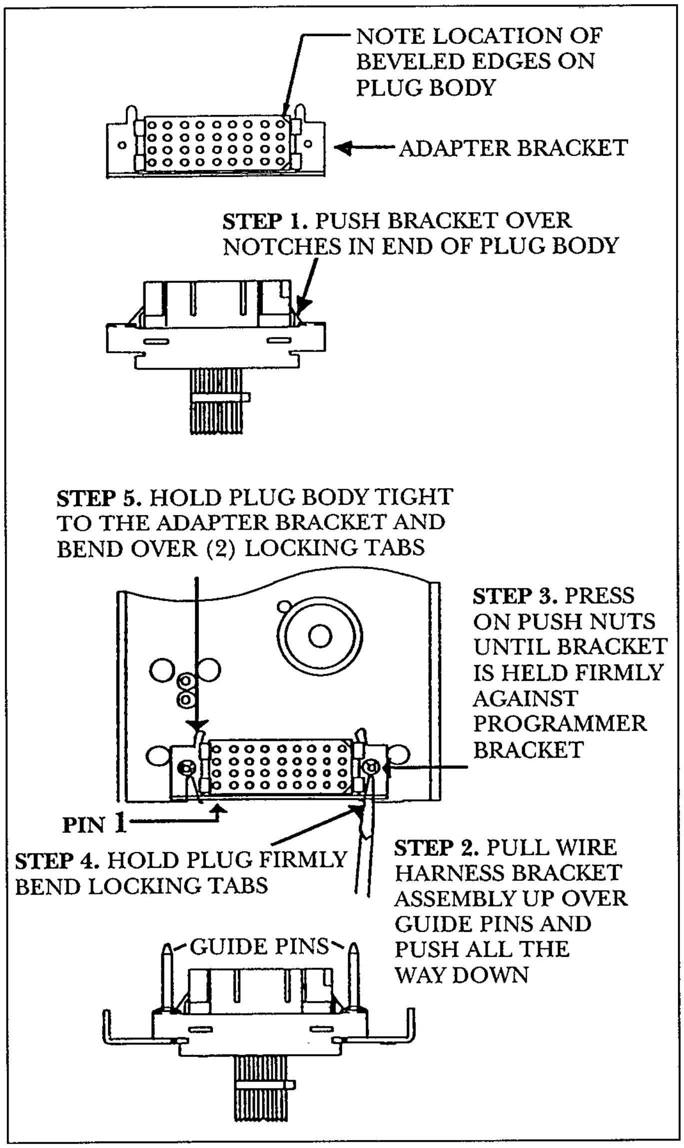


Fig. 17. Harness Connector

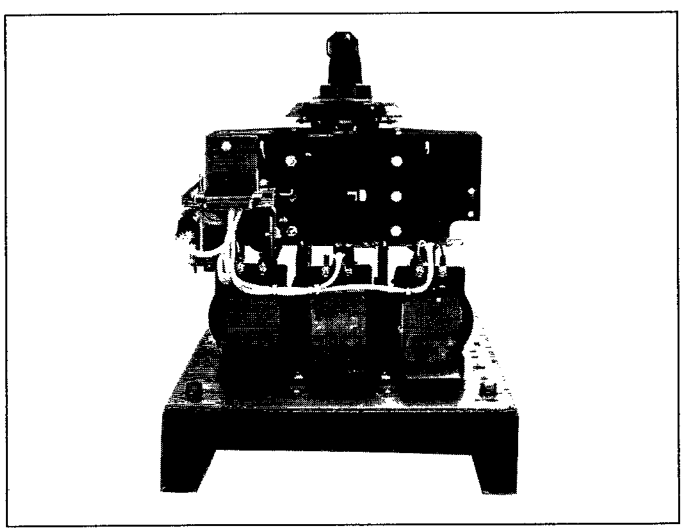


Fig. 18. Programmer Wiring Harness

SECTION 4 INSTALLING THE CONVERSION KIT

Communications Harness (When Required)

The communications harness is provided with every kit, preassembled to the programmer harness. On MicroVersaTrip® Plus kits, when there is no expectation to upgrade to a PM kit in the future, the communications harness can be removed or coiled and tied to the breaker frame.

When the communications harness is installed, it should be tied to the frame in a location where it is accessible in the switchgear. Fig. 19 shows a suggested location. The actual location is dependent on the configuration of the equipment and may be determined by a field engineer. A mounting bracket is provided with each kit for use with the communications harness plug. It may be used instead of wire tieing the harness.

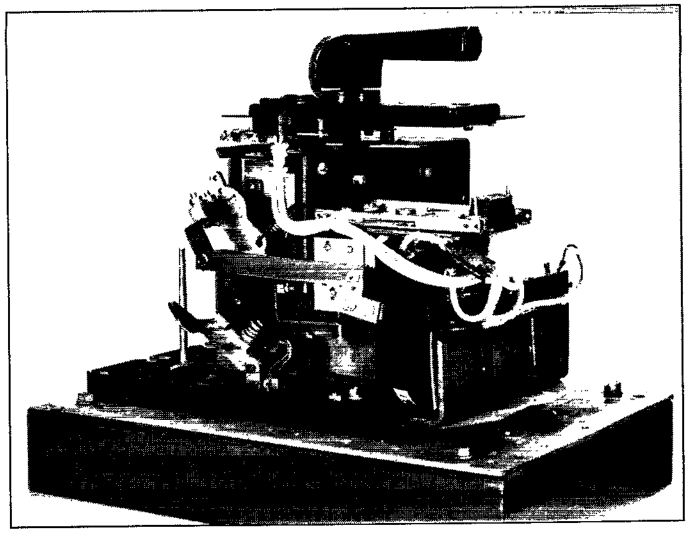


Fig. 19. Communications Wiring Harness

SECTION 4 INSTALLING THE CONVERSION KIT

Programmable Trip Unit

The programmer is attached to the programmer mounting bracket. The guide pins on this bracket mate with the holes on either side of the programmer box. The guide pins provide the neccessary alignment for the connector engagement. The locking lever engages with the pin assembled to the programmer frame, and secures the programmer to the mounting bracket.

TO INSTALL THE PROGRAMMER:

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 upwards (Fig. 20).

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.

ARC CHUTES

To complete the breaker assembly, reinstall the arc chutes, using the existing hardware (Fig. 21).

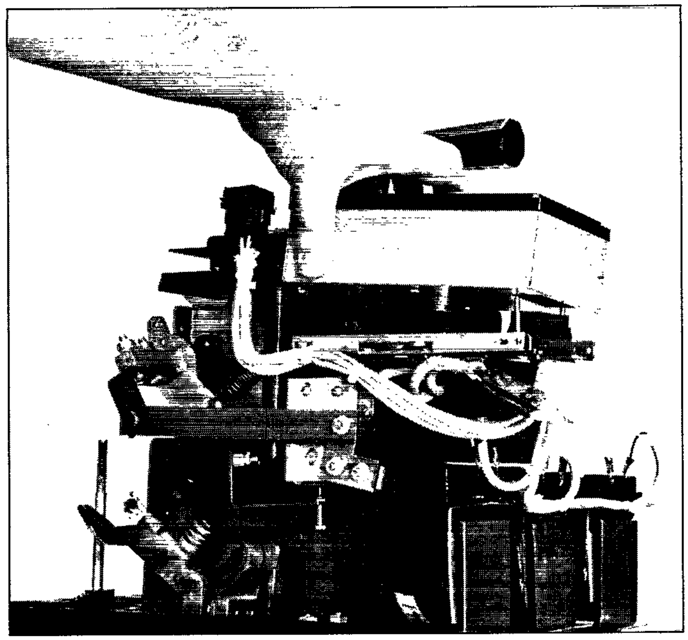


Fig. 20. Connecting the Programmer

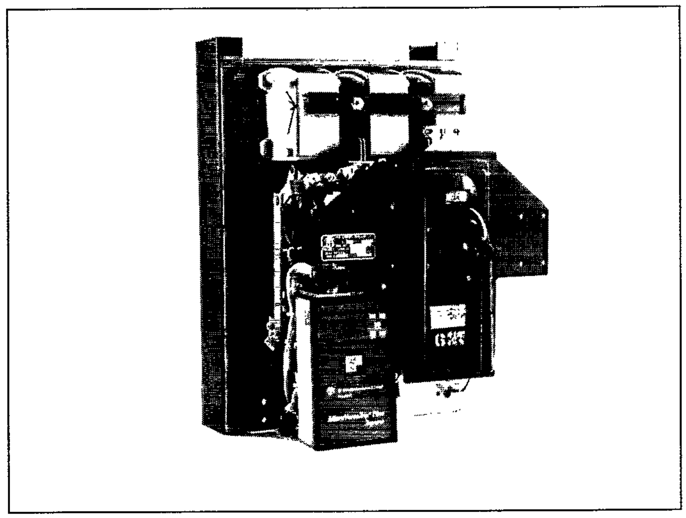


Fig. 21. Completed Breaker Assembly

SECTION 5 FOUR-WIRE GROUND FAULT OPTION

The ground fault option in all four-wire systems requires an additional neutral sensor. The neutral sensor is installed in the neutral bus in the equipment. It is connected to the programmable trip unit through a wire harness provided.

Step 1.

Mount the neutral sensor in the outgoing neutral lead, normally in the equipment's bus or cable compartment (Fig. 22).

Step 2.

Connect the neutral sensor wire harness to the correct taps on the sensor. The tap setting on the neutral sensor must match the phase sensors. Maintain the following color code:

White–Common, Black–Tap

Step 3.

Route the wire through the equipment and connect to the 2-pin connector on the programmer harness. The wire should be tied to the breaker frame in an easily accessible location. It may be located with the communications harness, see Fig. 19 on page 11.

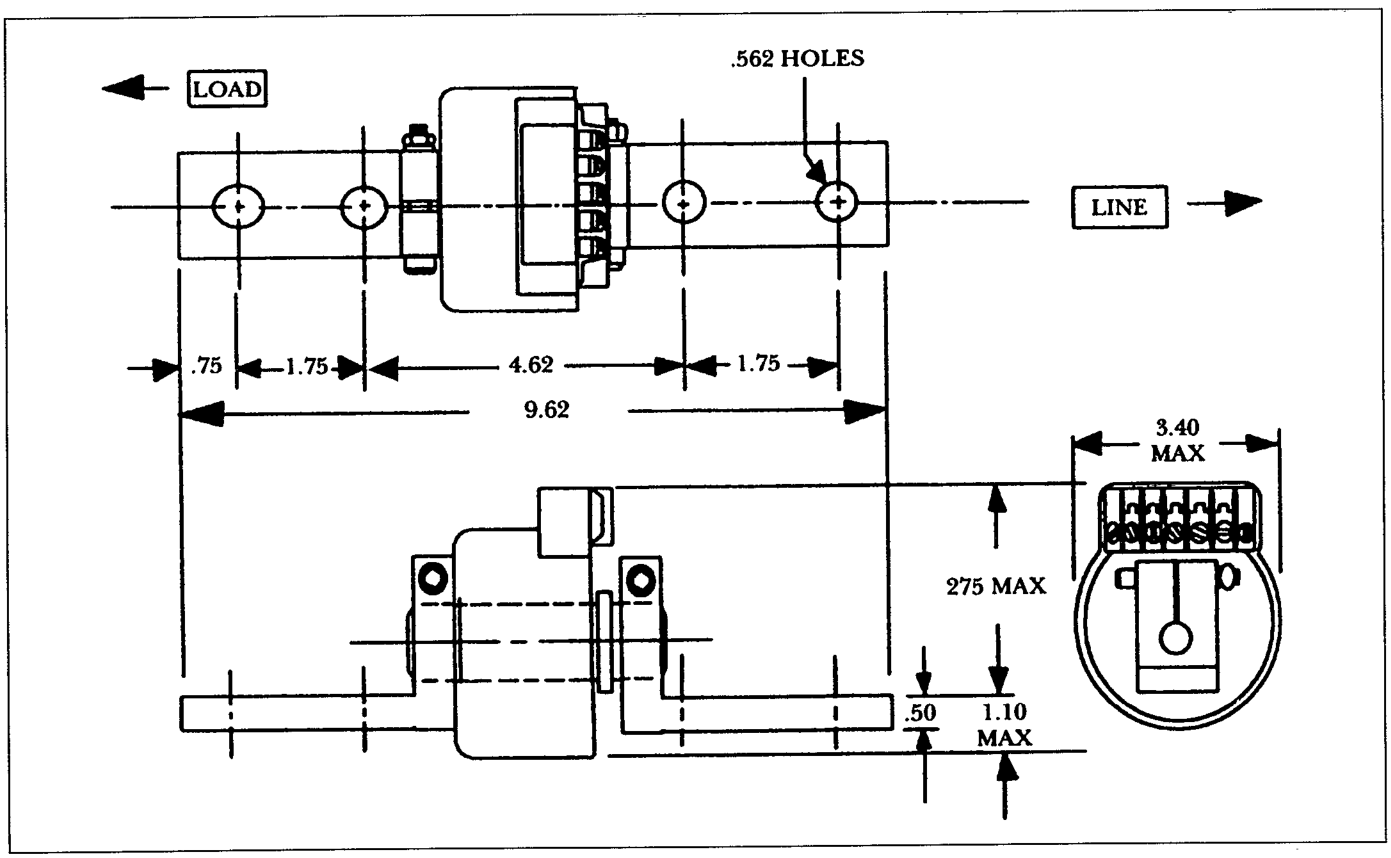


Fig. 22. Neutral Sensor Outline

SECTION 6 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.

Measure the resistance across the line and load terminals for each phase using a Micro-Ohmeter or Milli-Volt tester. Also, measure the resistance across the CT assembly. If the resistance differs considerably from phase to phase, the electrical points may not be properly tightened. Also, it may indicate improper contact wipe.

Step 4.

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 GE 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 programmer 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 in Fig. 23.

SECTION 6 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. 23. 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. 23.

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.

Table 6-1. Resistance Values

Breaker	Ampere CT Rating	Resistance in Ohms
KA	150A	7-15
KA	225A	12-20

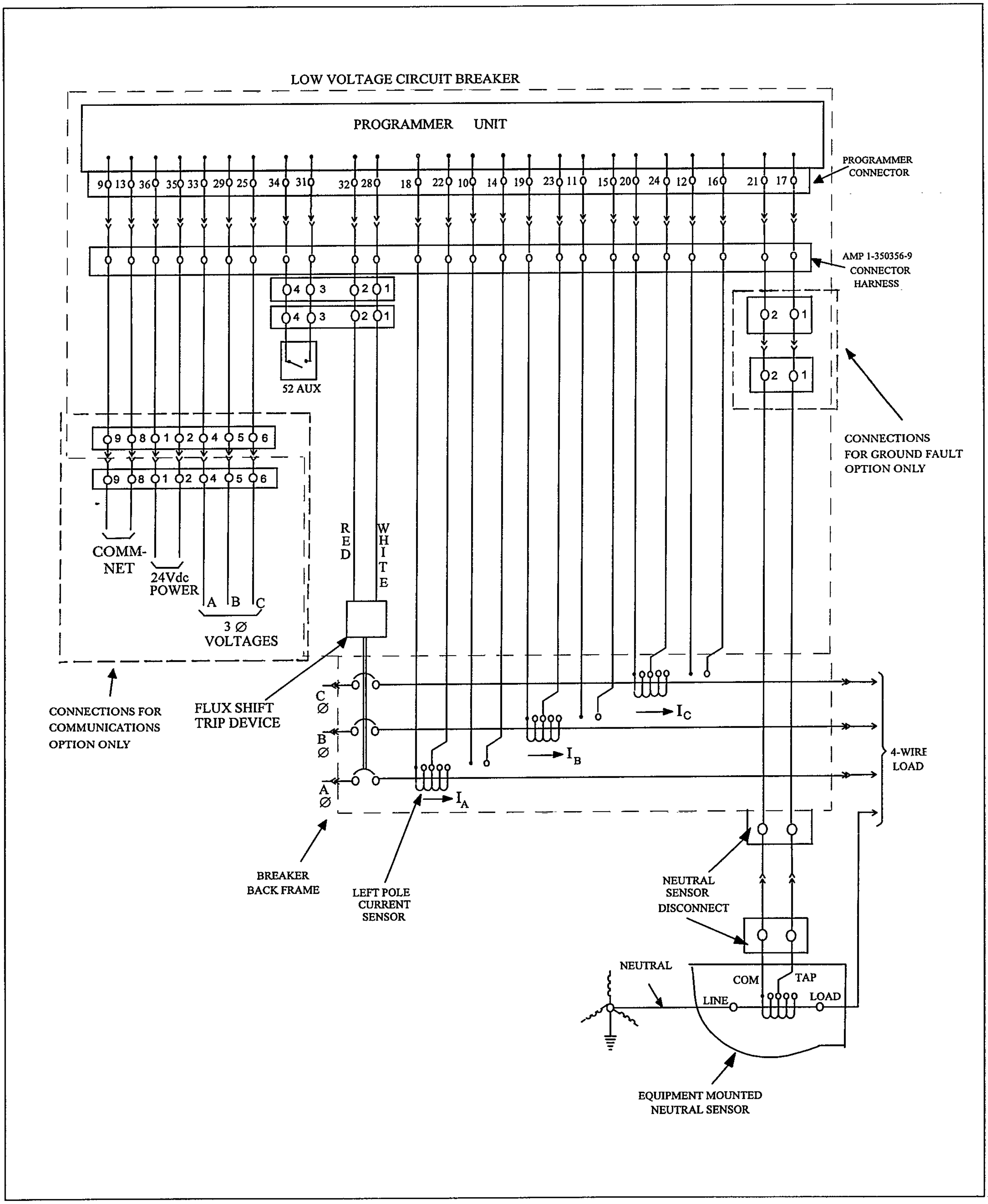


Figure 23. Cabling Diagram - MicroVersaTrip Plus and PM with Ground Fault on 4-Wire Load

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

GEH-6293 1094 PSA