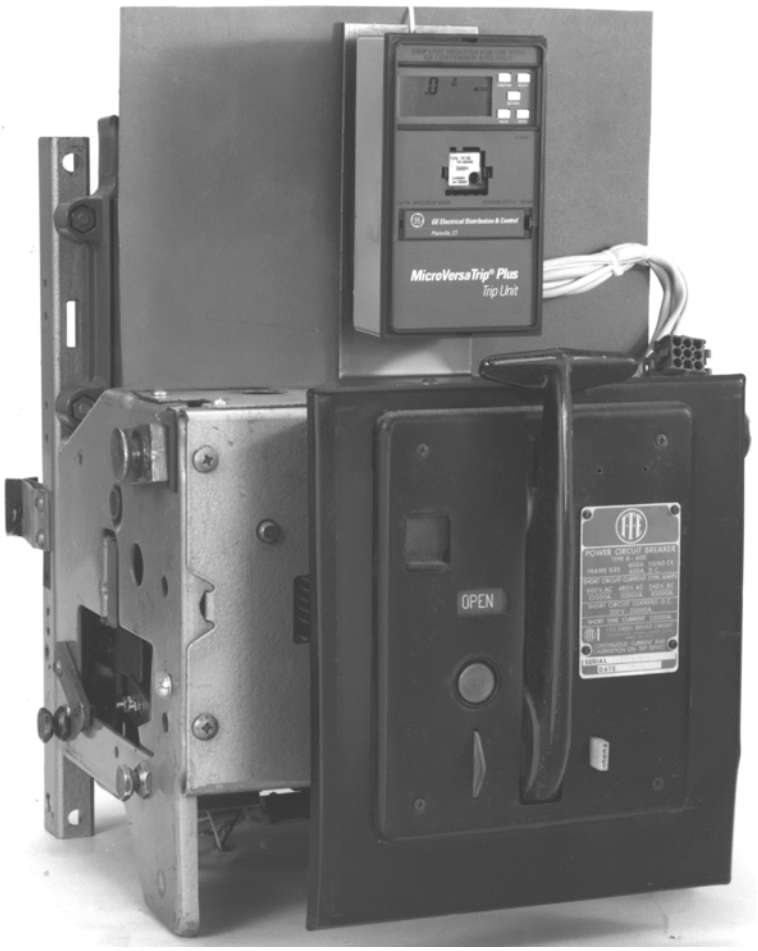
GEH6294 Installation Instructions R04

MicroVersaTrip Plus™ and MicroVersaTrip PM™ Conversion Kits

For I-T-E® Types K-225, K-600, K-800, K-1600, K-2000 Low-Voltage Power Circuit Breakers

INTRODUCTION

ABB owned GE Conversion Kits are designed for upgrading existing I-T-E® low-voltage power circuit breakers, rather than replacing the entire breaker. The Conversion Kits include MicroVersaTrip Plus™ or MicroVersaTrip PM™ Trip Units, representing the latest technological advance in ABB trip systems.



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

This publication covers installation of MicroVersaTrip Plus and MicroVersaTrip PM Conversion Kits on I-T-E Type K-225, K-600, K-800, K-1600, and K-2000 low-voltage power circuit breakers. Each Conversion Kit contains all the components needed to convert from the existing I-T-E electromechanical trip system.

TABLE OF CONTENTS

LIST OF FIGURES

SECTION 1. GENERAL INFORMATION

GE Conversion Kit installation is straightforward, but does require careful workmanship and attention to these instructions. Familiarity with the breaker is highly desirable. The general approach is to first remove the existing trip devices from the breaker, then install the MicroVersaTrip Plus™ or MicroVersaTrip PM™ kit components. Following this procedure, the converted breaker is performance tested before it is returned to service.

The majority of trip unit kit installations do not require any customized assembly work. However, some conversions may involve unusual mounting conditions or accessory combinations that require minor modifications and/or relocation of components. In most instances, this supplementary work can be done on site.

In preparation for the conversion, the installer should verify that the appropriate current sensors and trip unit have been furnished. Whenever a ground-fault trip element is installed on a breaker with a four-wire system, an associated neutral sensor (CT) is required for separate mounting in the equipment.

Ensure that retrofitted breakers are applied within their short-circuit ratings. 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 will govern the application.

As a service-related consideration, the installation of a MicroVersaTrip Plus or MicroVersaTrip PM kit provides an excellent opportunity to perform normal maintenance on the breaker. Such procedures are described in the installation and maintenance manu-als supplied with the breaker and equipment.

SECTION 2. BEFORE INSTALLATION

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

WARNING: Low-voltage power circuit breakers use 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 during 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 on 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 before attempting any installation, maintenance, or modification. Follow all lock-out and tag-out 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 the breaker OPEN and be sure the stored-energy springs are discharged, thus eliminating the possibility that the breaker may trip open or the closing springs discharge and cause injury.

- Trip the breaker OPEN, then remove the breaker to a well-lighted work area before beginning work.

- Do not perform any maintenance that includes breaker charging, closing, tripping, or any other function that could cause significant movement of a draw-out 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® K-Series breakers need not be separated into front and back sections for installation of the conversion kit. The general procedure is to remove and disassemble the trip unit housing, then install the kit.

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

225–800 Ampere Breakers

1. The electromechanical trip units are contained in a common, insulated housing, as shown in Figure
   1. To remove these units, unscrew the five Philips head screws mounting the housing to the back of the breaker. Save the screws for reuse.

> ***NOTE:*** On some I-T-E breakers, the load-side draw-out fingers must also be removed.

2. Remove and discard the two Philips-head screws on each phase, above the copper load terminals, securing the trip units to the contact arm, as shown in Figure 1.
3. Remove the trip unit housing assembly from the back of the breaker, as shown in Figure 2.

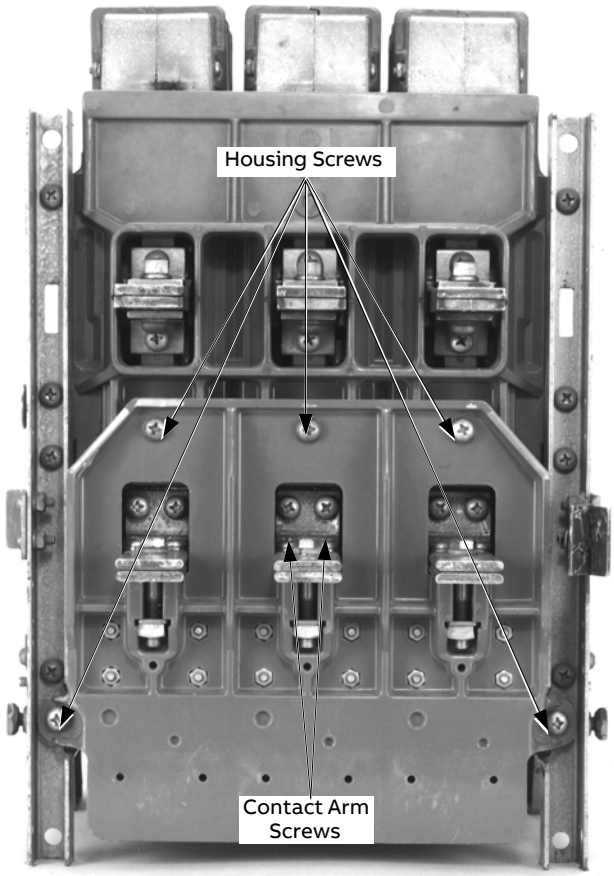


Figure 1. Removing the insulated trip unit housing on K-225, K-600, and K-800 breakers.

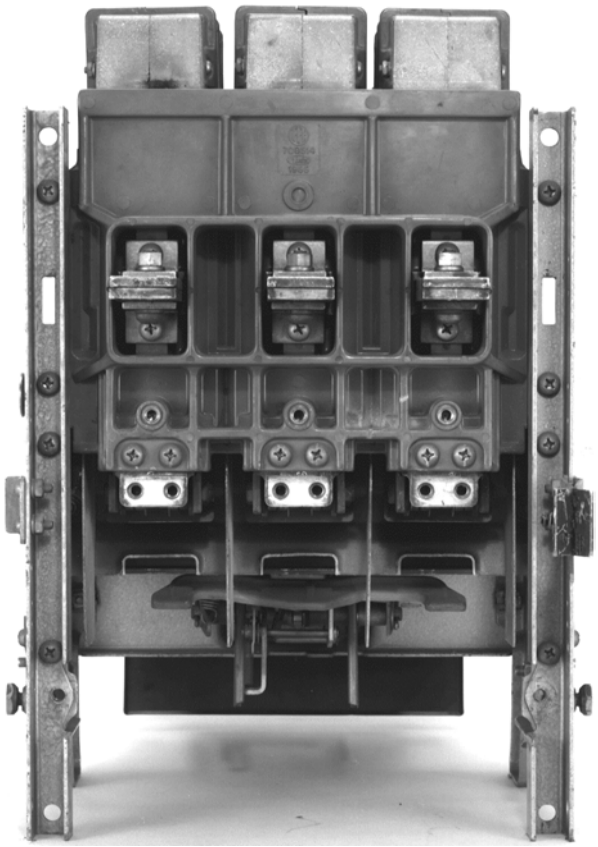


Figure 2. K-225, K-600, and K-800 breakers with the trip unit housing removed.

4. Remove the electromechanical trip units by carefully drilling out the four #10-32 screws in each phase holding the trip units to the housing, as shown in Figure 3.
5. Remove and save the 3/8" bolt, nut, and lock washer holding each phase of the trip units to the bus, as shown in Figure 4. The trip units can be removed and discarded. The breaker is now ready for conversion.

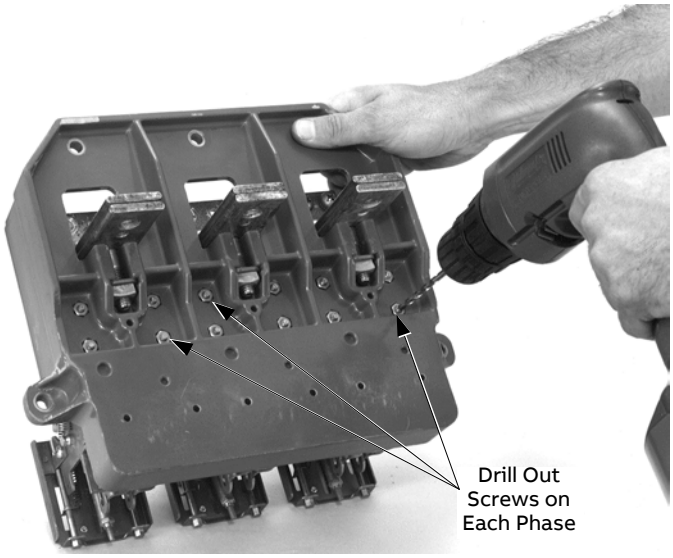


Figure 3. Drilling out the screws holding the trip units to the housing on K-225, K-600, and K-800 breakers.

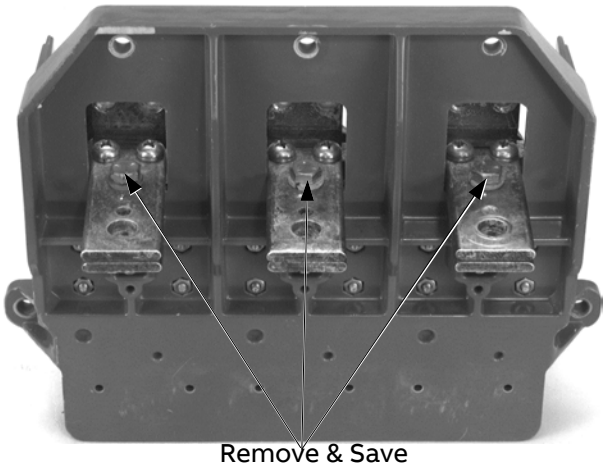


Figure 4. Removing the load-side stabs on K-225, K-600, and K-800 breakers.

1600–2000 Ampere Breakers

On K-1600 and K-2000 breakers, each electromechanical trip unit is contained in its own insulated housing.

1. On draw-out breakers with electrical operators, remove the four screws securing the draw-out contact-block assembly to the back frame of the breaker, as shown in Figure 5.
2. Remove and save the two top and bottom Philip's-head screws at the breaker back securing the trip unit housing to the breaker frame, as shown in Figure 6.

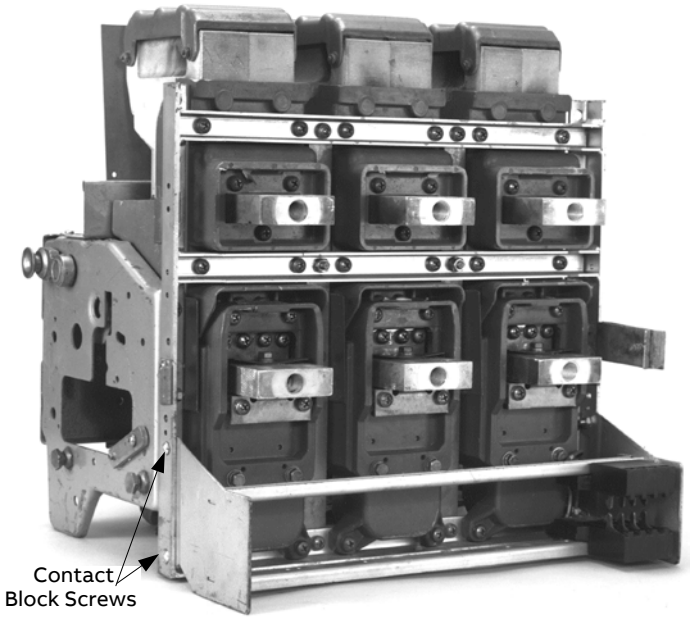


Figure 5. Removing the draw-out contact-block assembly on K-1600 and K-2000 breakers.

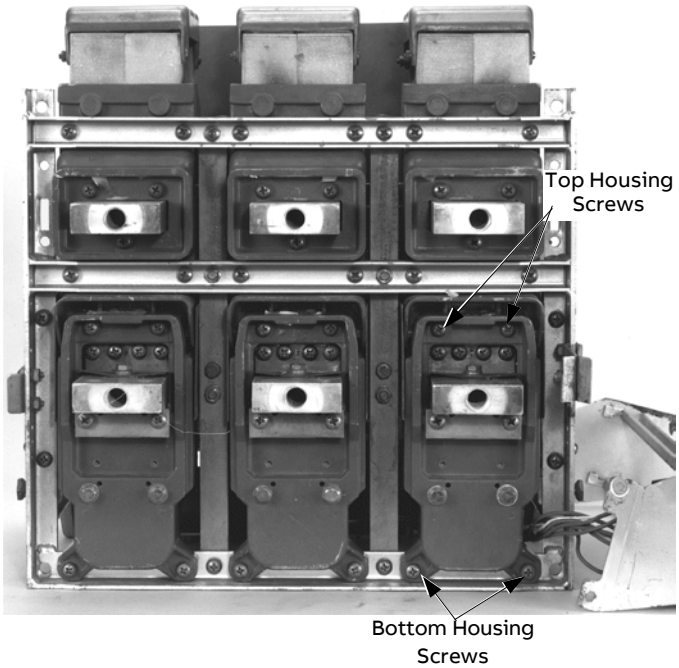


Figure 6. Removing the trip unit housing on K-1600 and K-2000 breakers.

3. Remove and discard the four Philips-head screws above the copper load terminals that connect each trip unit to the contact arm, as shown in Figure 7. Pull the trip unit assemblies out the back of the breaker frame.
4. Carefully drill out the four #10-32 screws securing each trip unit in its housing, as shown in Figure 8.
5. Remove and save the two Philips-head screws at the back and under the load terminals that hold the copper terminal extensions in each trip unit housing, as shown in Figure 8.
6. Remove and discard the hardware holding each copper load terminal to the metal mounting brackets. Separate each trip unit from its housing. Discard the trip units and save the insulated housing, shown in Figure 9, and mounting brackets.

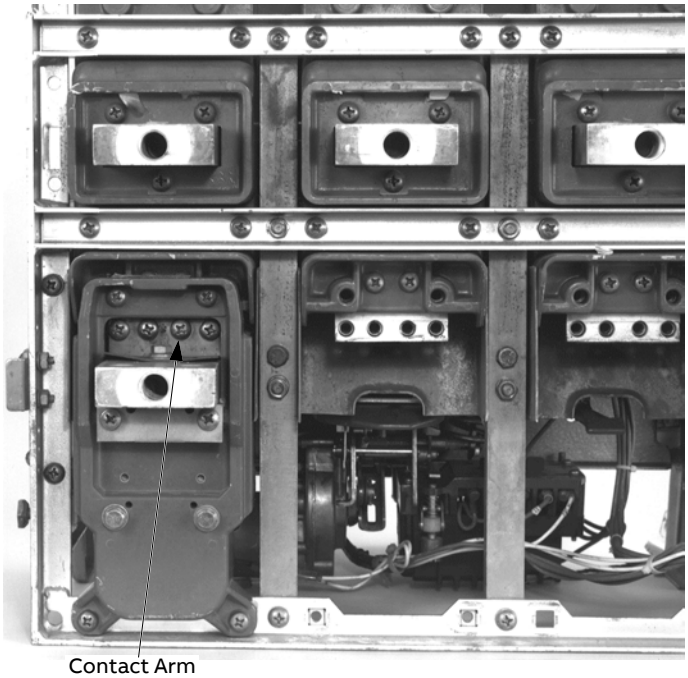


Figure 7. Contact arm connections on K-1600 and K-2000 breakers.

Figure 8. Disassembling the trip unit assembly on K-1600 and K-2000 breakers.

Figure 9. Trip unit housing on K-1600 and K-2000 breakers..

SECTION 4. INSTALLING THE CONVERSION KIT

Installing the Phase Sensors (CTs)

225–800 Ampere Breakers

1. For red insulated-frame breakers only, place the 0.062" alignment shims among each of the four sets of mounting holes on the trip unit housing, as shown in Figure 10.
2. For all 225–800 A breakers, mount the new copper load terminals to the trip unit housing with the four #10-32 x 1¼" screws, nuts, flat washers, and lock washers provided, as shown in Figure 11. At the top of each bus assembly, reinstall the ⅜-16 x 2" bolts removed in step 5 on page 5.
3. Place each CT, one at a time, on the phase bus posts. Place an insulating barrier over the end of each bus post and mount the assemblies to the load terminals, as shown in Figure 12. Insert a 5/16-18 x 1" bolt, with flat and lock washers, and tighten finger tight. The completed trip unit housing is shown in Figure 13.

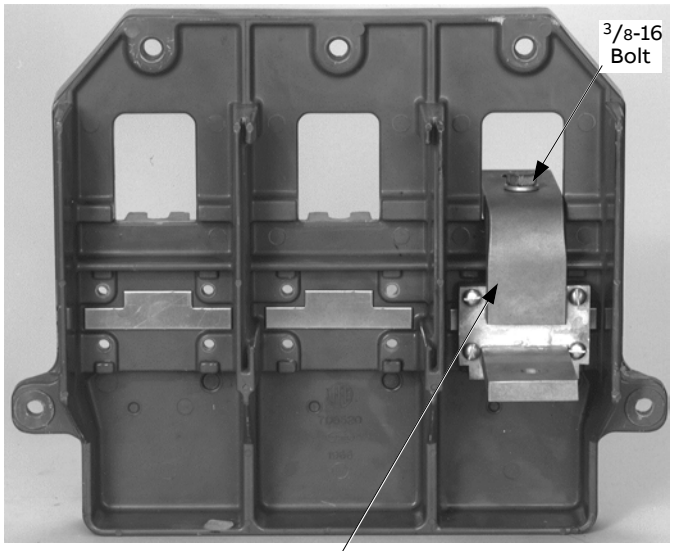


Figure 11. Installing the copper load terminals on K-225, K-600, and K-800 breakers.

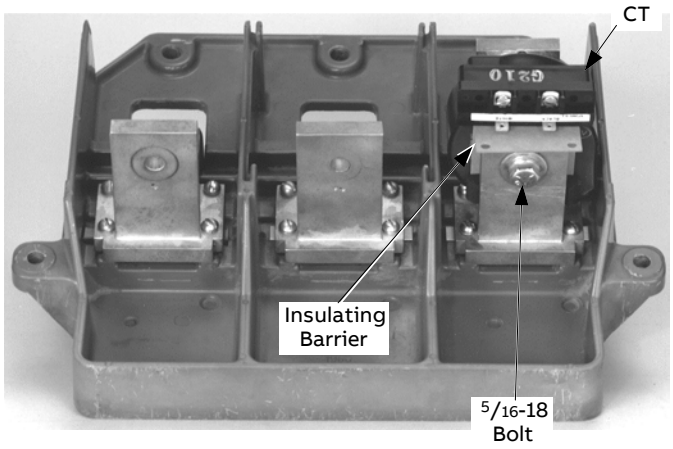


Figure 12. Installing the CT assembly on K-225, K-600, and K-800 breakers.

Figure 10. Placing the alignment shims on red-frame K-225, K-600, and K-800 breakers.

Figure 13. A converted trip unit housing for K-225, K-600, and K-800 breakers.

4. Reattach the trip unit housing to the rear of the breaker housing, as shown in Figure 14, with the five Philips-head screws removed in step 1, page 4. Then connect each of the copper load terminals to the contact arms with the two 5/16-18 x 1 1/8" Philips-head screws, flat washers, and lock washers supplied, .as shown in Figure 1. Leave the screws finger tight.
5. Tighten the bolts installed in step 2 to 200 in-lb, as illustrated in Figure 15.
6. Tighten the two screws in each phase that connect the load terminals to the contact arms to 100 in-lbs. These screws were installed in step 3.

WARNING: Steps 5 and 6 ensure critical electrical integrity connections. The designated bolts must be correctly tightened for proper operation. Failure to tighten these bolts properly will cause a breaker failure, resulting in property damage and/or personal injury.

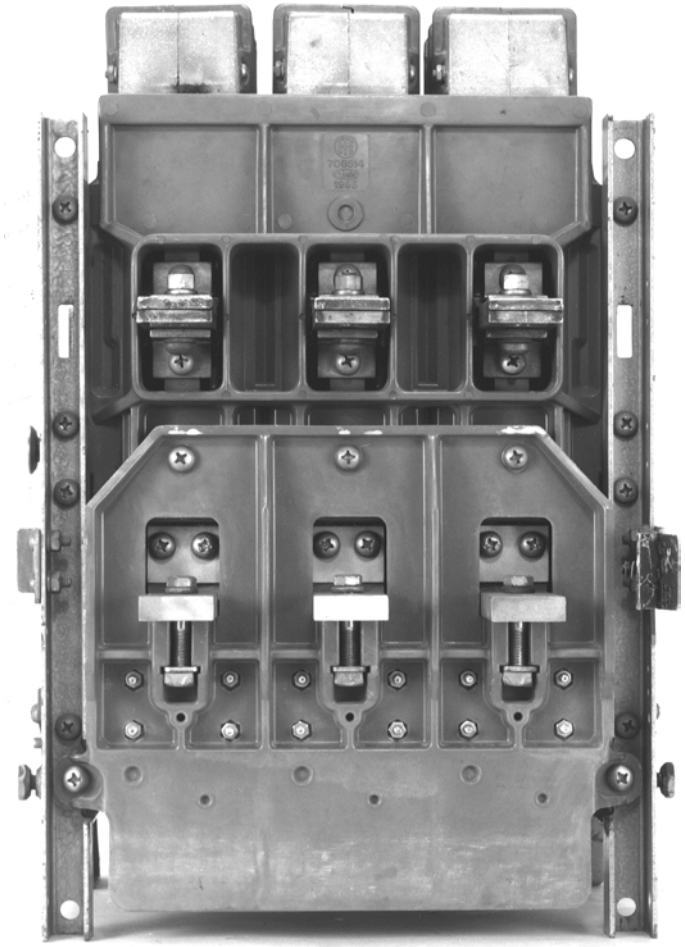


Figure 14. CT assemblies installed on K-225, K-600, and K-800 breakers.

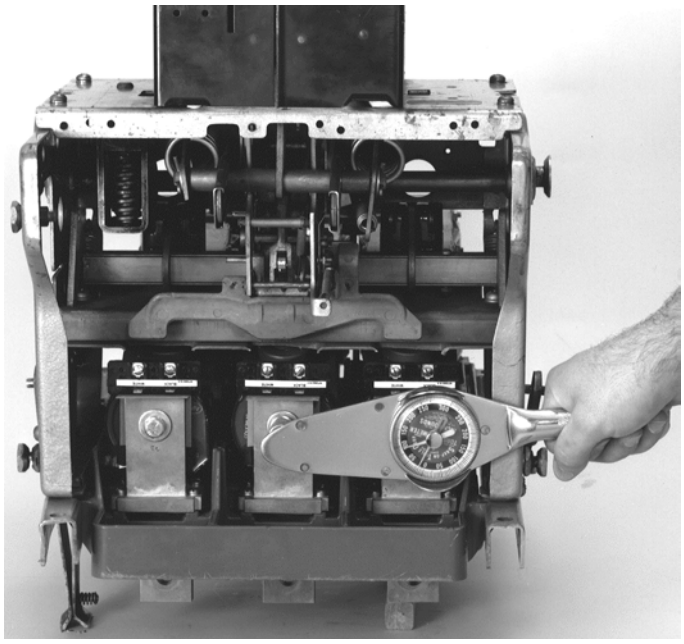


Figure 15. Tightening the CT assembly mounting bolts on K-225, K-600, and K-800 breakers.

1600 Ampere Red-Frame Breakers

1. Mount the brackets removed from the old copper terminals in step 6 on page 6 to the insulated housings, using the screws removed in step 5 on page 6.
2. Mount a new copper load terminal extension to each insulated housing with the two provided 3/8-16 x 1" bolts with flat and lock washers, as shown in Figure 16.
3. Insert two #10-32 x 1 1/4" screws through each insulated housing and secure with flat and lock washers and nuts.
4. Place a copper CT post, CT, and insulating barrier onto each each insulated housing. Insert a 1/2-13 x 1 1/2" bolt with flat and lock washers into each CT post. Leave the bolt finger tight. The completed CT assembly is shown in Figure 17.

Turn to page 11 to continue with step 5 of the procedure.

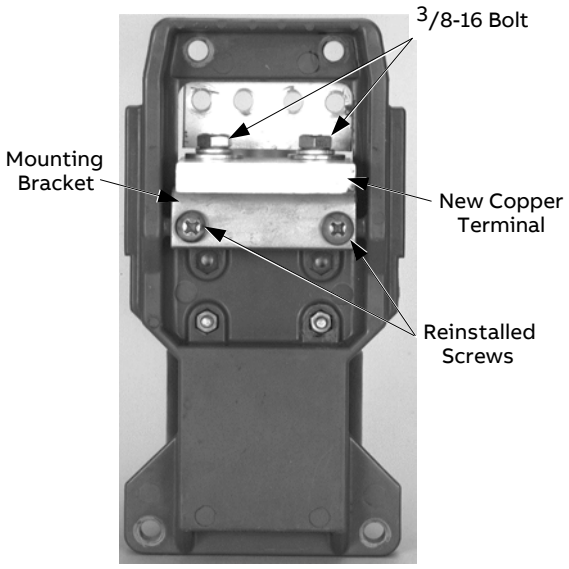


Figure 16. Mounting the terminal assemblies on a K-1600 red-frame breaker.

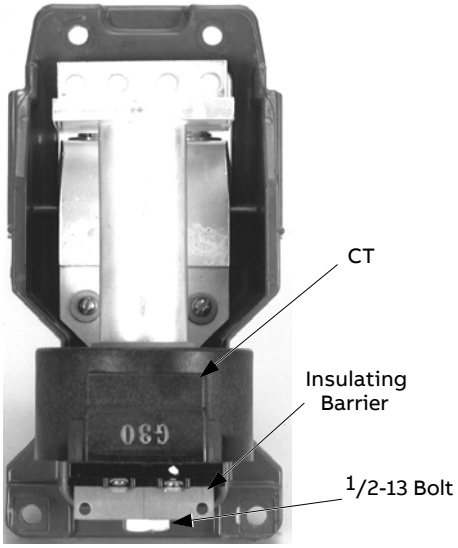


Figure 17. Completed CT assembly for a K-1600 red-frame breaker.

1600 Ampere Black-Frame Breakers

1. Mount the brackets removed from the old copper terminals in step 6 on page 6 to the insulated housings, using the screws removed in step 5 on page 6.
2. Mount a new copper load terminal extension to each insulated housing with the two provided 3/8-16 x 1" bolts with flat and lock washers, as shown in Figure 18.
3. Place a CT and insulating barrier over the copper post on each housing. Secure the assembly with the top copper bus and a 1/2-13 x 1 1/2" bolt with flat and lock washers, as shown in Figure 19. Leave the bolt finger tight. The completed CT assembly is shown in Figure 19.

Turn to page 11 to continue with step 5 of the procedure.

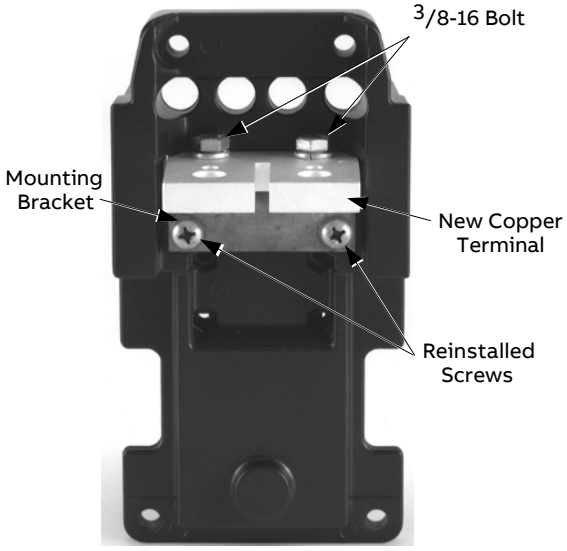


Figure 18. Mounting the terminal assemblies on a K-1600 black-frame breaker.

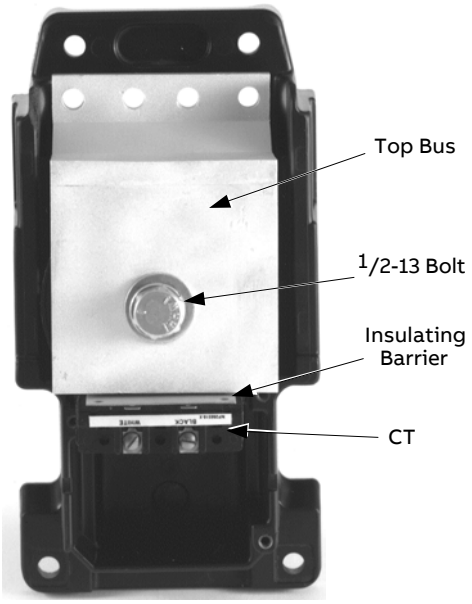


Figure 19. Completed CT assembly for a K-1600 black-frame breaker.

2000 Ampere Breakers

This section applies to K-2000 breakers and to KDON K-1600 red-frame breakers with round primary disconnect fingers.

1. Mount the brackets removed from the old copper terminals in step 6 on page 6 to the insulated housings, using the screws removed in step 5 on page 6.
2. Mount a new copper load terminal extension to each insulated housing with a 5/16-18 x 1 1/2" bolt with flat and lock washers, as shown in Figure 20.
3. Place a copper CT post, CT, and insulating barrier onto each each insulated housing. Insert a 1/2-13 x 1 1/4" Allen-head cap screw with lock washer into each CT post. Leave the bolt finger tight. The completed CT assembly is shown in Figure 21.

Turn to page 11 to continue with step 5 of the procedure.

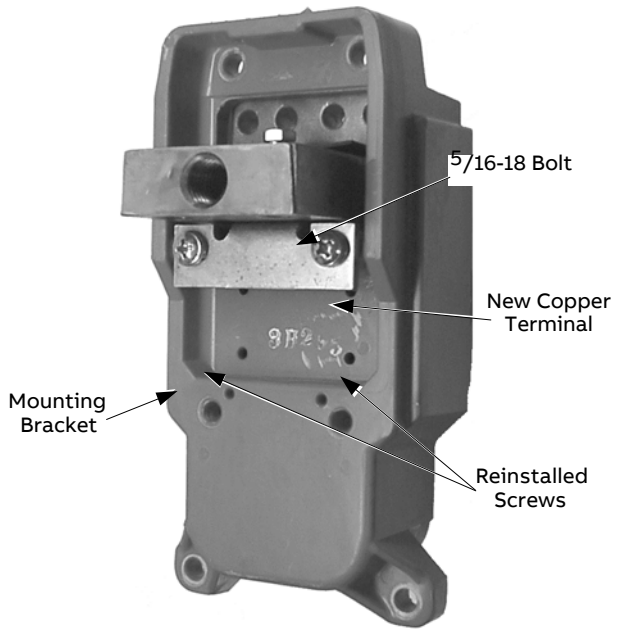


Figure 20. Mounting the terminal assemblies on a K-2000 breaker or KDON K-1600 red breaker with round primary disconnect fingers.

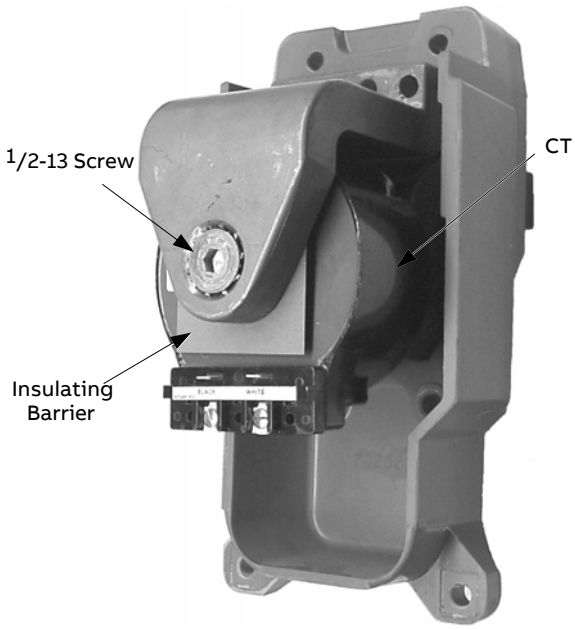


Figure 21. Completed CT assembly for a K-2000 breaker or KDON K-1600 red breaker with round primary disconnect fingers.

1600 and 2000 Ampere Breakers (continued)

5. Cut and remove the C-shaped projection on the insulating phase barrier inside the breaker frame. Remove all but 1/4 of the projection to allow for clearance of the CT bus post, as shown in Figure 22.
6. Reattach the CT assembly housing to the breaker frame, using the hardware removed in step 2 on page 5. Insert four 5/16-18 x 1 3/4" screws with plain and lock washers into each contact arm, as shown in Figure 23. Leave the screws finger tight.
7. Tighten the 1/2-13 CT mounting screws to 300 in-lb.
8. Tighten the contact arm screws above each load terminal to 100 in-lb.

WARNING: Steps 7 and 8 ensure critical electrical integrity connections. The desig-nated bolts must be correctly tightened for proper operation. Failure to tighten these bolts properly will cause a breaker failure, resulting in property damage and/or personal injury.

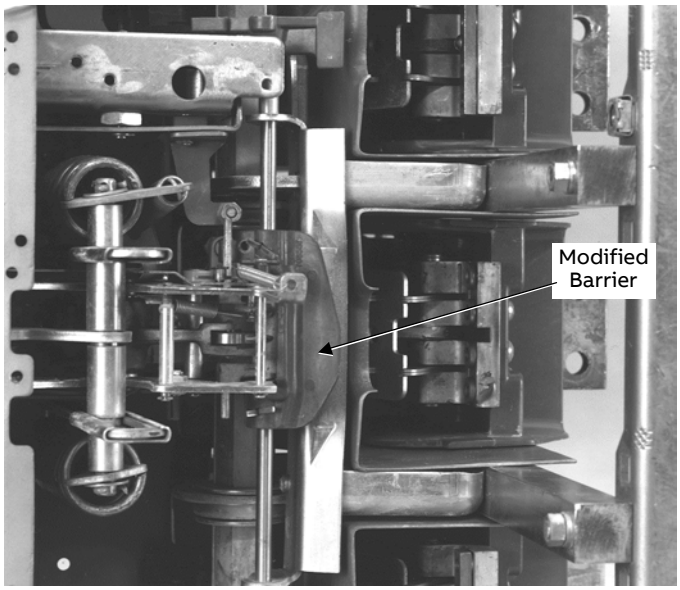


Figure 22. Modifying the C-shaped barrier.

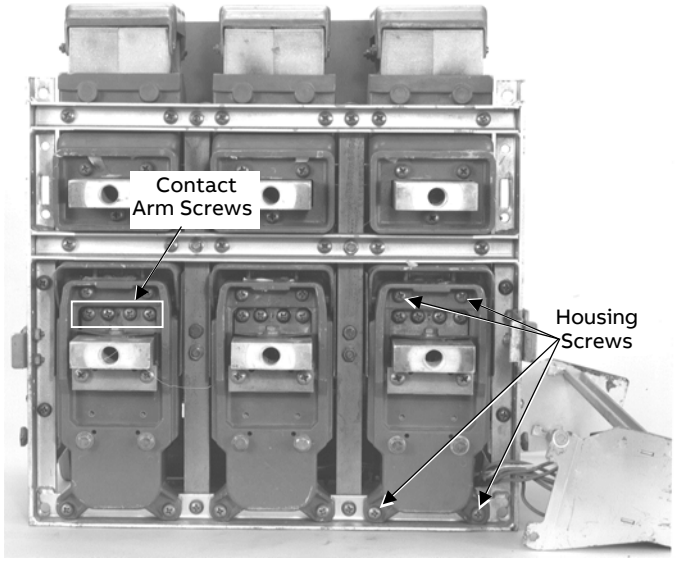


Figure 23. Reassembled K-1600 breaker.

Installing the Flux Shifter

1. Carefully rotate the breaker onto its back so that the bottom of the breaker is accessible.

> ***NOTE:*** If the breaker has already been converted to a solid state trip system, the existing trip actuator and linkage must be removed and discarded.

2. Remove the left-front rack-mounting bolt on the breaker frame. (The head of the bolt has a radial slot cut into it.) Slide the new flux shifter assembly in through the bottom of the breaker. Align the bracket with the hole in the frame from which the mounting bolt was removed. Reinsert the mounting bolt through the hole in the frame, as shown in Figure 24 and Figure 25.
3. On K-225, K-600, and K-800 breakers, insert the 1/4-20 x 1/2" bolt and lock washer provided through the hole indicated in Figure 24. The bolt is threaded into a tapped hole in the flux shifter mounting bracket. On K-1600 and K-2000 breakers, the 1/4-20 x 1/2" bolt is inserted through an unused hole in the side frame, as shown in Figure 25, into a tapped hole in the flux shifter mounting bracket. Also remove the rack-mounting bolt indicated and reinstall it through the other hole in the mounting bracket as shown in Figure 26.
4. Ensure that the reset arm linkage is on the inside of the crossbar arm. Line up the hole in the reset arm with the hole in the crossbar link, indicated in Figure 25. Insert the 1/4" x 3/4" pin provided through the large hole in the side of the breaker frame and into the crossbar and reset links, as shown in Figure 27. Place the two washers and the cotter pin provided on the other end of the pin.

> ***NOTE:*** If an auxiliary switch is mounted on the left side of the breaker, as shown in Figure 25, the auxiliary switch operating arm must be modified. Remove the arm from the switch, then drill out the pin that is connected to the crossbar arm, shown in Figure 28, with a 0.257"-diameter drill. Reattach the operating arm to the auxiliary switch. Place the end of the link over the pin inserted through the crossbar arm and reset link. Use only one washer and the cotter pin to secure the links.

> ***NOTE:*** If the breaker is equipped with a fuse-lockout device, remove the wire ties that attach the fuse-lockout wires to the breaker frame. Slide the flux shifter into place, with the mounting bracket between the fuse-lockout and the frame. Reattach the fuse-lockout wires to the breaker frame with wire ties, as shown in Figure 29.

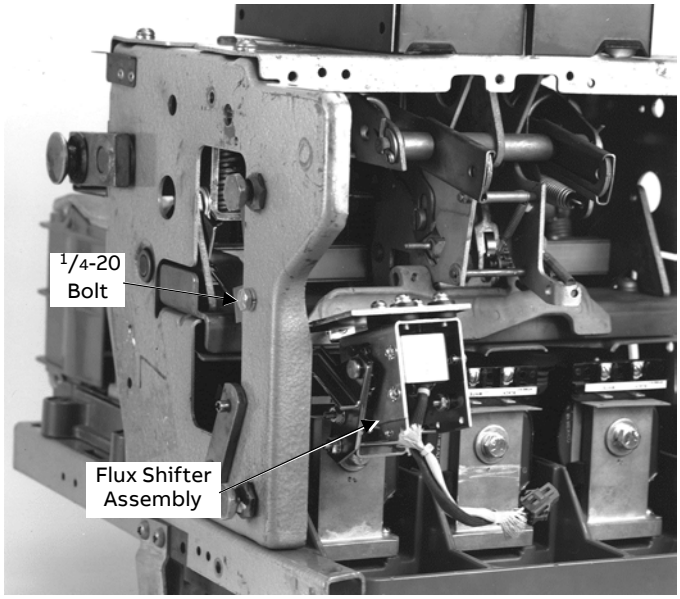


Figure 24. Inserting the flux shifter on K-225, K-600, and K-800 breakers.

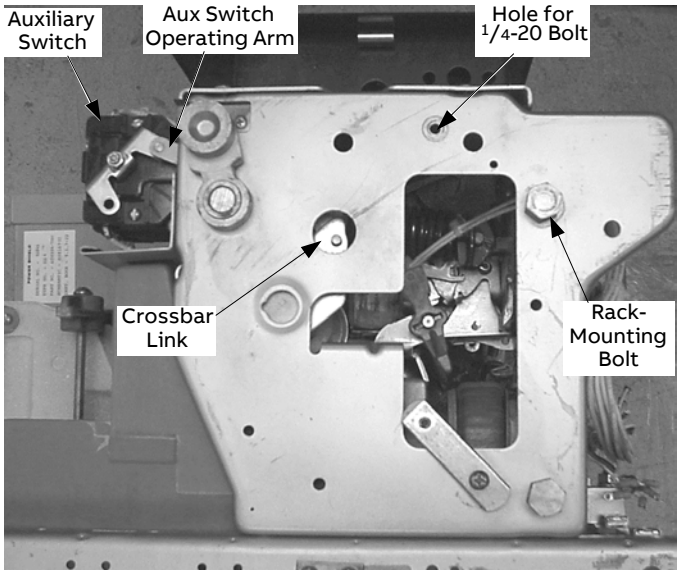


Figure 25. Flux shifter mounting bolt locations on K-1600 and K-2000 breakers.

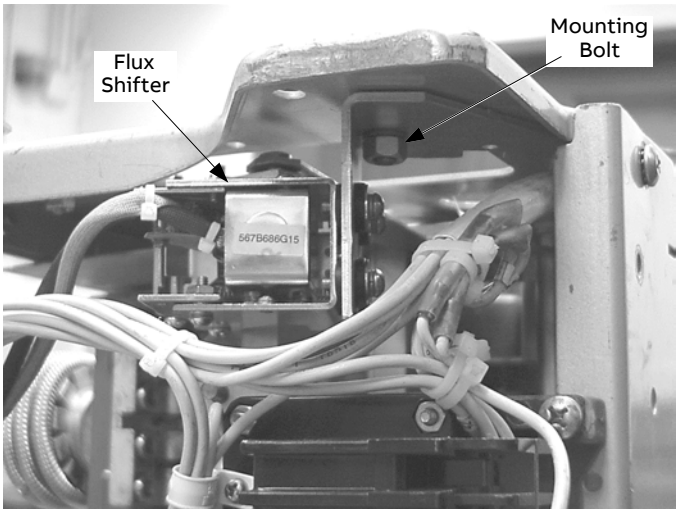


Figure 26. Flux shifter installed on K-1600 or K-2000 breaker.

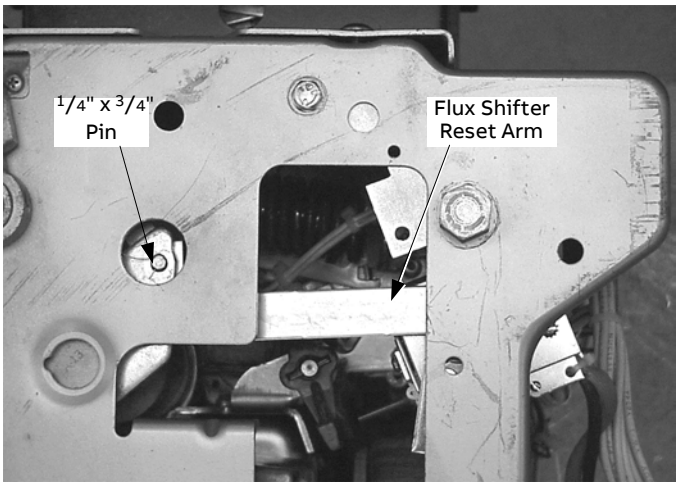


Figure 27. Flux shifter reset arm connected to the crossbar link (K-2000 shown).

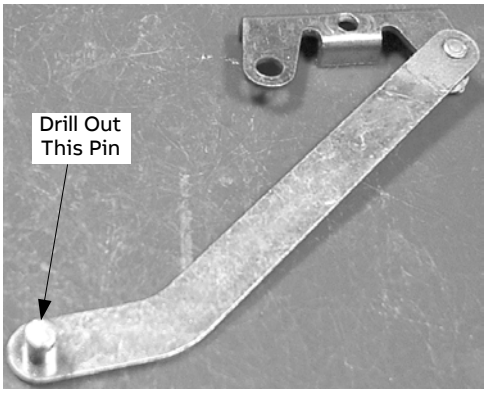


Figure 28. Auxiliary switch operating arm.

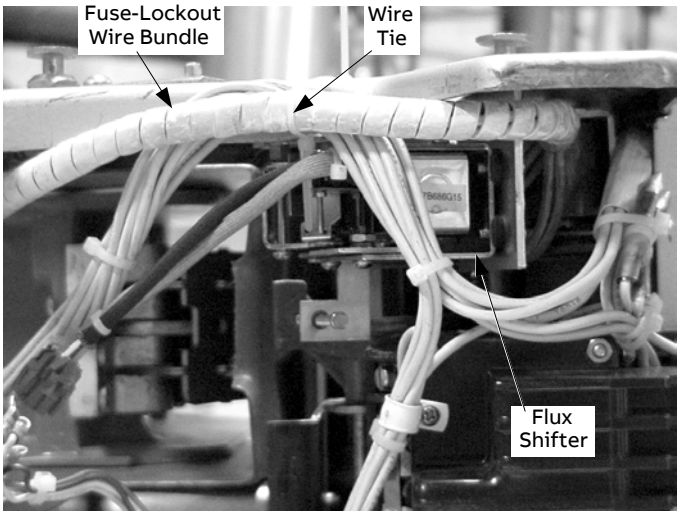


Figure 29. Flux shifter installed on a breaker with a fuse-lockout device.

Flux Shifter Adjustment

After the flux shifter has been installed, the following adjustment must be made:

With the breaker upright in the CLOSED position, the gap between the trip paddle and the flux shifter adjustment screw, shown in Figure 30, should be 1/32". A 1/32"-diameter gage or drill rod (not provided) may help to measure the gap.

If adjustment is necessary, OPEN the breaker, then use a 1/4" wrench or nut driver to turn the adjustment screw. To eliminate play in the trip paddle, gently push on the trip paddle while adjusting the screw.

WARNING: Be extremely careful when working on a CLOSED breaker. DO NOT reach your hands into the mechanism while adjusting the flux shifter.

Optional Test – The flux shifter may be tested by closing the breaker and applying a 9 Vdc power source to the flux shifter leads (the red wire is positive). The breaker should trip.

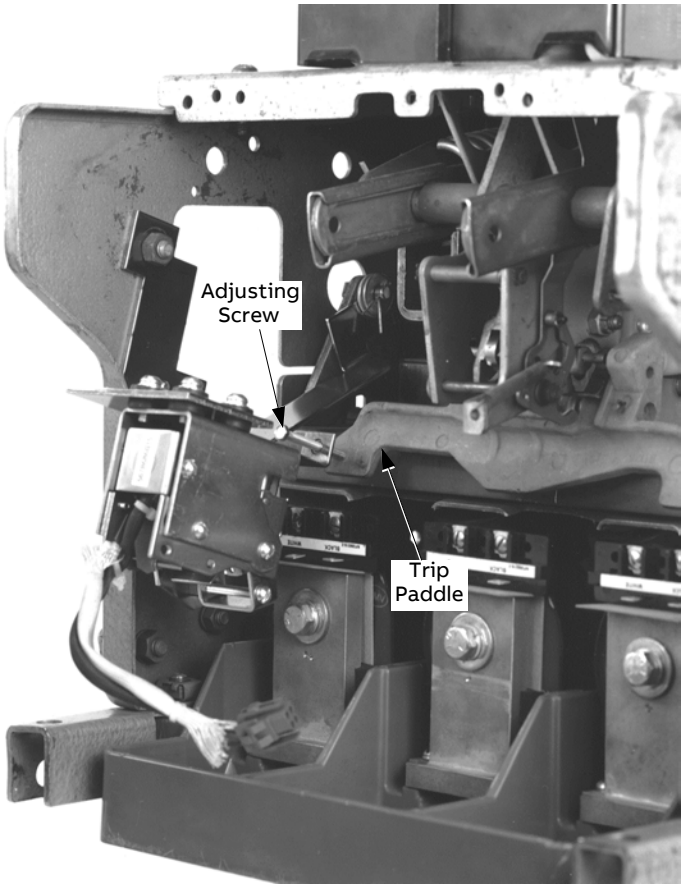


Figure 30. Adjusting the flux shifter (K-225, K-600, or K-800 shown; K-1600 and K-2000 are similar).

Installing the Trip Unit Wiring Harness

Use the following procedure to install the trip unit wiring harness to the mounting plate.

1. The wiring harness includes a 36-pin connector, shown in Figure 31, that must be assembled and installed onto the trip unit mounting plate before the trip unit can be installed.

> ***CAUTION:*** The adapter bracket must be installed onto the trip unit 36-pin connector and trip unit mounting plate as described below. Failure to do so will result in harness plug failure and the trip unit will not provide protection. If the converted breaker is energized or primary injected with the mounting plate not installed or installed improperly, damage will result to the trip unit, wire harness, 36-pin connector, and current sensors. Failure to adhere to these instructions will void all warranties.

2. Slide the adapter bracket onto the 36-pin connector, as shown in Figure 32. Be sure that the beveled corners of the trip unit connector are facing toward the right side, the adapter bracket slides are in place behind the notches on either side of the connector body, and the connector's tabs align with the notches on the bottom of the adapter bracket.
3. Hold the adapter bracket tight to the trip unit connector and bend the two locking tabs on the adapter bracket over the connector body, as shown in Figure 33.

Figure 31. 36-pin trip unit connector.

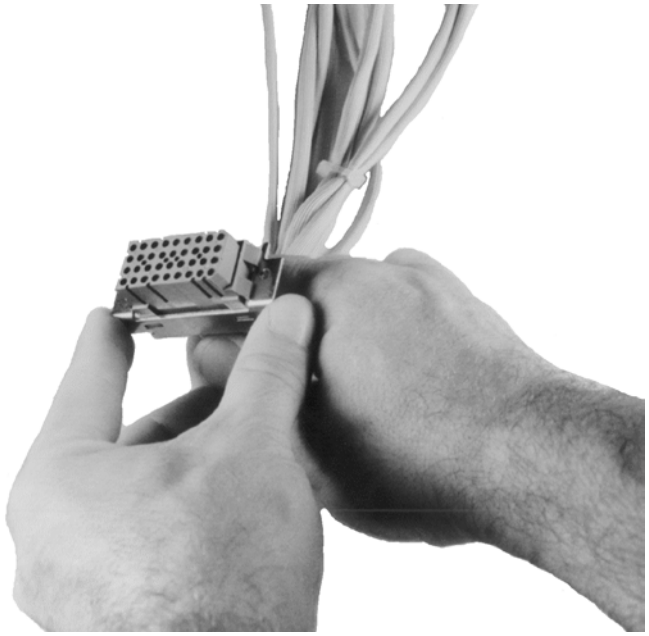


Figure 32. 36-pin connector adapter bracket.

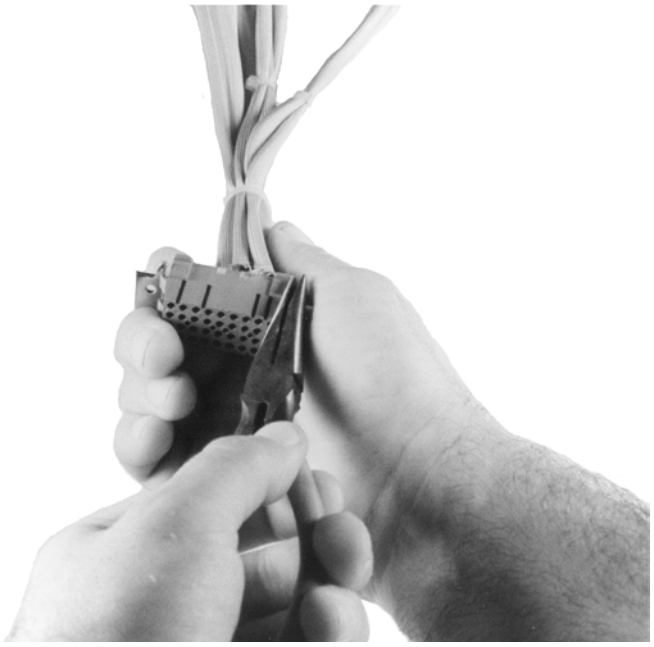


Figure 33. Adapter bracket locking tabs.

4. Slide the adapter bracket and connector assembly over the guide pins of the trip unit bracket. Press the two steel push nuts provided onto the guide pins using a nut driver, as shown in Figure 34, until the assembly is held firmly against the trip unit mounting plate.
5. While holding the adapter bracket and connector assembly firmly in place against the mounting plate, bend the two locking tabs on the mounting plate into the mating notches on the adapter bracket using a screwdriver, as shown in Figure 35. The completed assembly is shown in Figure 36.

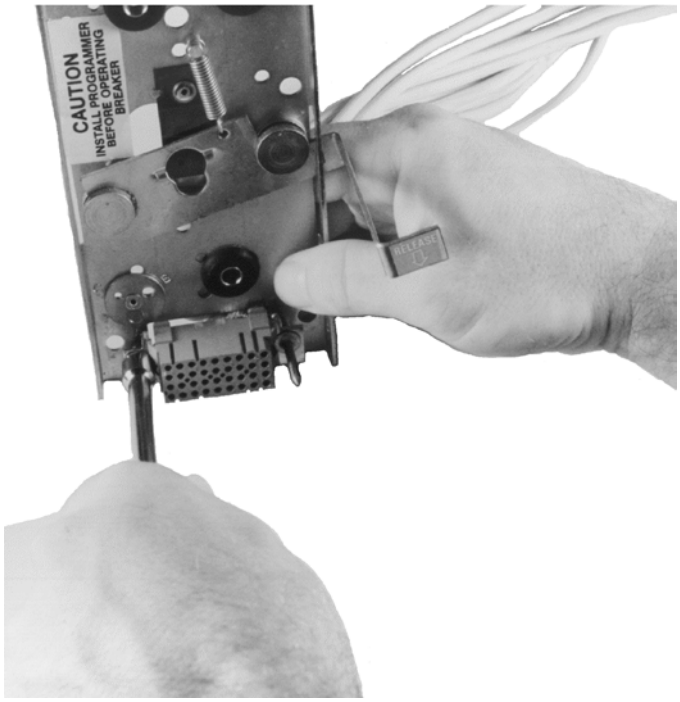


Figure 34. Installing the push nuts onto the guide pins.

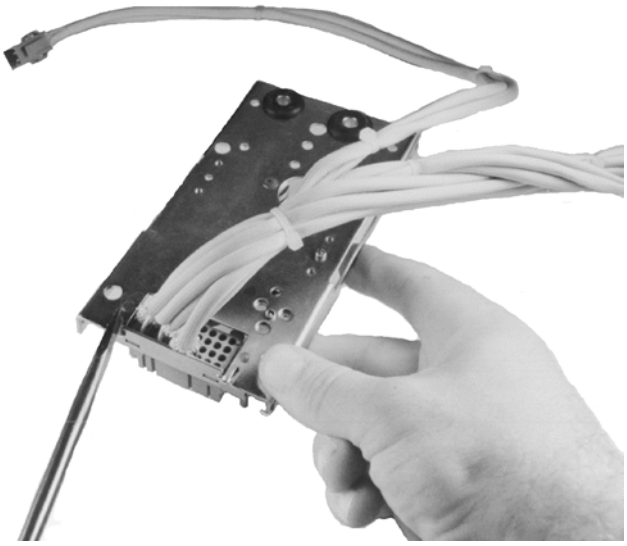
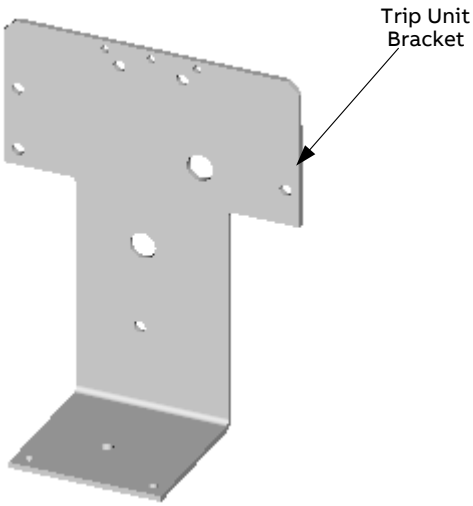


Figure 35. Locking tabs on mounting plate.

Figure 36. Wiring harness attached to the trip unit bracket.



Important Note: This Bracket enables horizontal mounting of the Trip Unit if need arises.

Installing the Trip Unit Mounting Plate

1. Rotate the breaker to the upright position. Remove the Philips-head screws at the front of the top cover, as shown in Figure 37.
2. Mount the trip unit bracket and wiring harness assembly to the top cover with the two screws removed in step 1. Install the insulating barrier between the arc chutes and the bracket, as shown in Figure 38. Use three wire ties to fasten the barrier to the trip unit bracket.

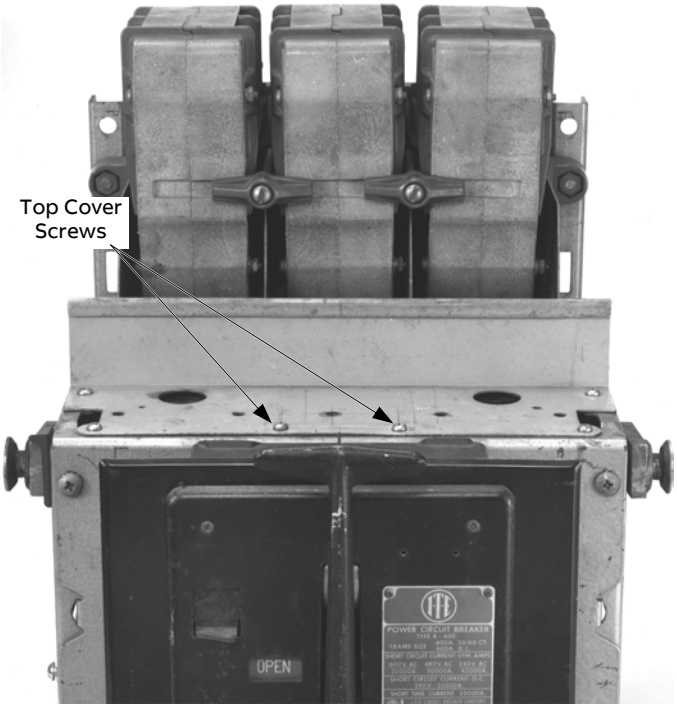


Figure 37. Removing the top cover screws.

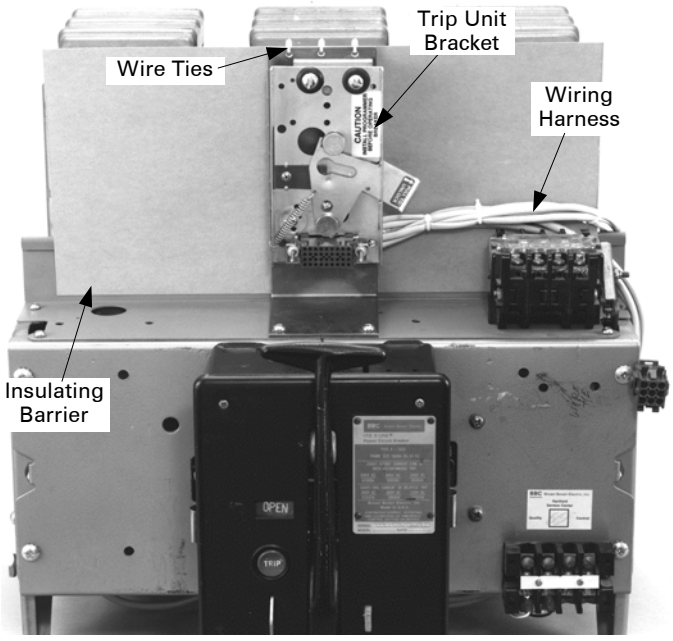


Figure 38. Trip unit mounting bracket installed on the breaker.

Connecting the Trip Unit Wiring Harness

1. Carefully rotate the breaker onto its back so that the bottom of the breaker is accessible.
2. Run the wires comprising the trip unit wiring harness along the front of the insulating barrier, then down to the bottom of the breaker, as shown in Figure 39.
3. Join the four-pin connector on the trip unit harness to the four-pin connector on the flux shifter, as shown in Figure 39.
4. Connect the harness leads to the screw terminals on each CT, as shown in Figure 39. The black wire (tap) connects to the left terminal and the white wire (common) to the right terminal.
5. Use the wire ties provided to tie the harness back against the frame. The harness should be tied to the holes in the fiber barriers at each CT. Ensure that the wiring will not interfere with any moving parts.

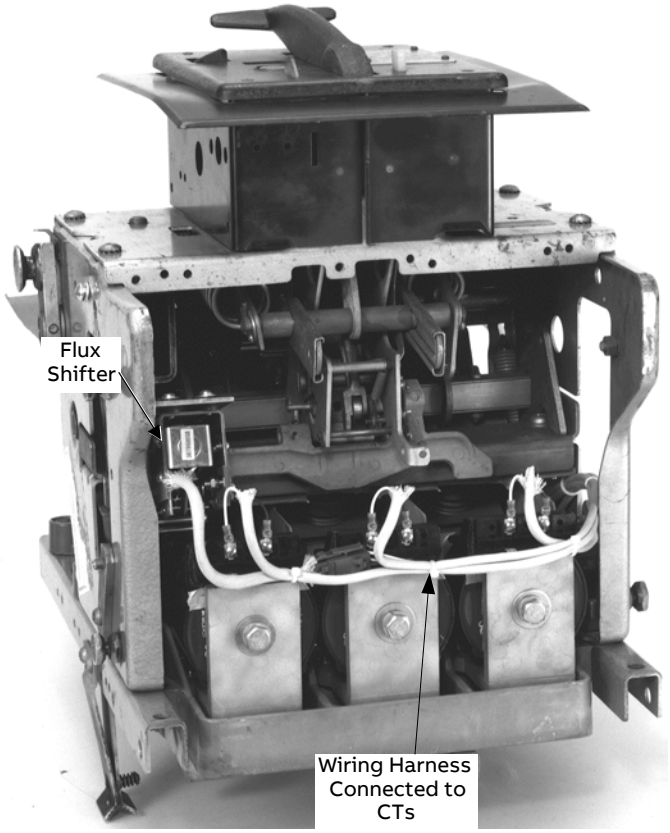


Figure 39. Connecting the wiring harness to the CTs.

Installing the Communications Harness

The communications harness is used if the trip unit is to communicate with a power management control system. The communications connector, included in the trip unit wiring harness, is mounted with the supplied angle bracket. This bracket has two small holes on one arm for attaching with screws to a convenient spot on the breaker frame and a large rectangular hole in the other arm for mounting the connector.

The communications connector should be installed on the breaker on the same side as the breaker compartment's door hinge, to protect it from damage when the compartment door is opened or closed. Attach the supplied caution labels, shown in Figure 40, to both the breaker and the compartment door as a warning to disconnect the communications harness before removing the breaker from the compartment.

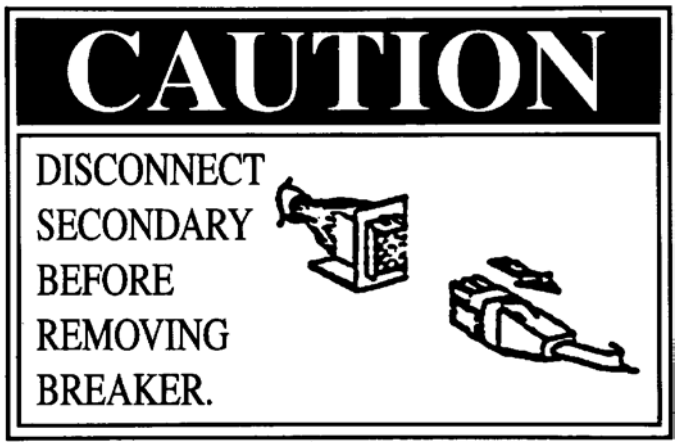


Figure 40. Caution label to be applied to the breaker and compartment door.

SECTION 5. INSTALLING THE TRIP UNIT

Use the following procedure to install the trip unit.

1. Pull out the locking lever on the trip unit mounting plate until it snaps into the open position, as shown in Figure 36.
2. Carefully line up the pins in the rear connector with the connector on the mounting plate, as shown in Figure 41. The alignment pin on the rear of the trip unit must fit in the hole in locking lever.
3. Push the trip unit against the mounting plate until it locks into position. The locking lever will automatically snap back to secure the trip unit. Figure 42 shows an installed trip unit.
4. The breaker escutcheon may be attached and the breaker testing started.

To remove the trip unit, slide out the locking lever to release the alignment pin, then carefully pull the trip unit straight off the mounting plate.

See GEH-6273 for detailed instructions on setting up MicroVersaTrip Plus and MicroVersaTrip PM trip units.

Figure 42. Completed breaker assembly.

Figure 41. Attaching the trip unit to the mounting bracket.

SECTION 6. FOUR-WIRE GROUND FAULT OPTION

The ground fault option for four-wire installations requires the installation of an additional current sen-sor on the neutral bus in the equipment. The sensor is connected to the trip unit through the connector provided in the wiring harness.

1. Mount the neutral sensor on the outgoing neutral lead, normally in the bus or cable compartment in the equipment. Figure 43 shows the outline of the neutral sensor for K-225, K-600, and K-800 applications. Figure 44 shows the neutral sensor for K-1600 and K-2000 applications.
2. Connect the neutral sensor wire harness to the correct taps on the sensor. To maintain the same polarity as the phase sensors, connect the white wire to the common terminal, black to the tap.
3. Route the wires through the equipment and con-nect to the two-pin connector on the trip unit wiring harness. The wires should be tied to the breaker frame in an easily accessible location. It may be located with the communication harness.

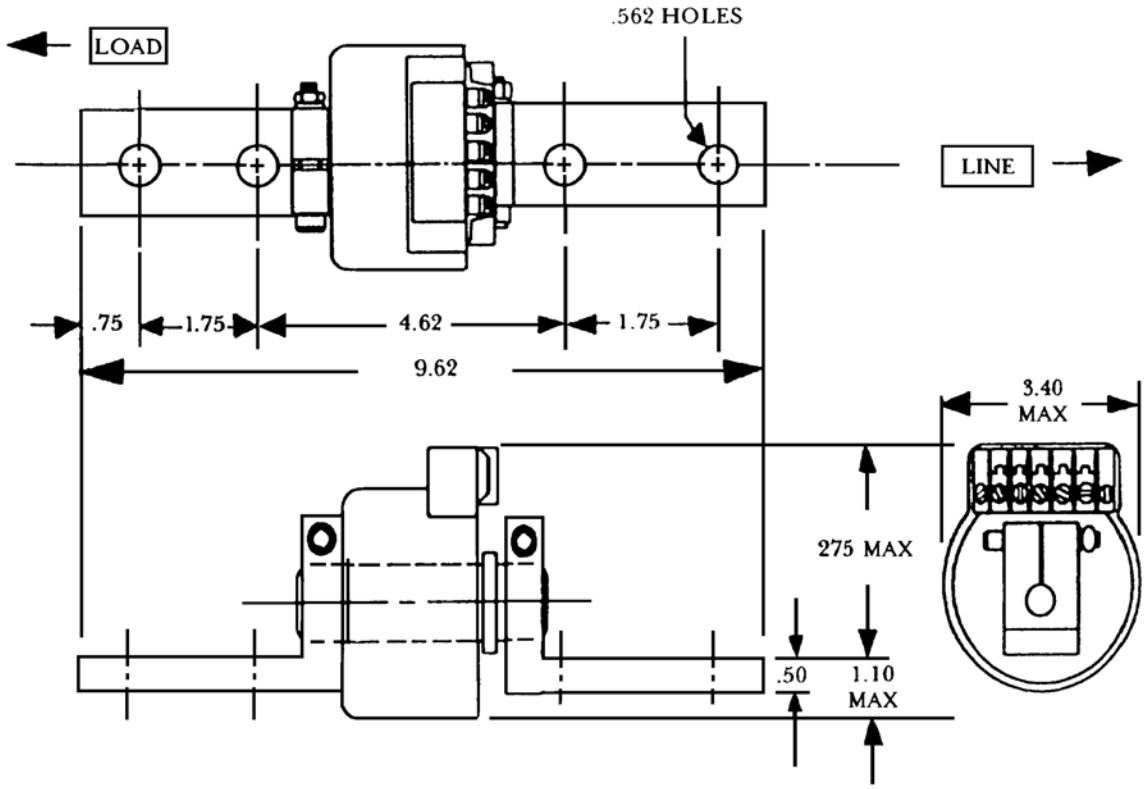


Figure 43. Neutral sensor outline for K-225, K-600, and K-800 breakers.

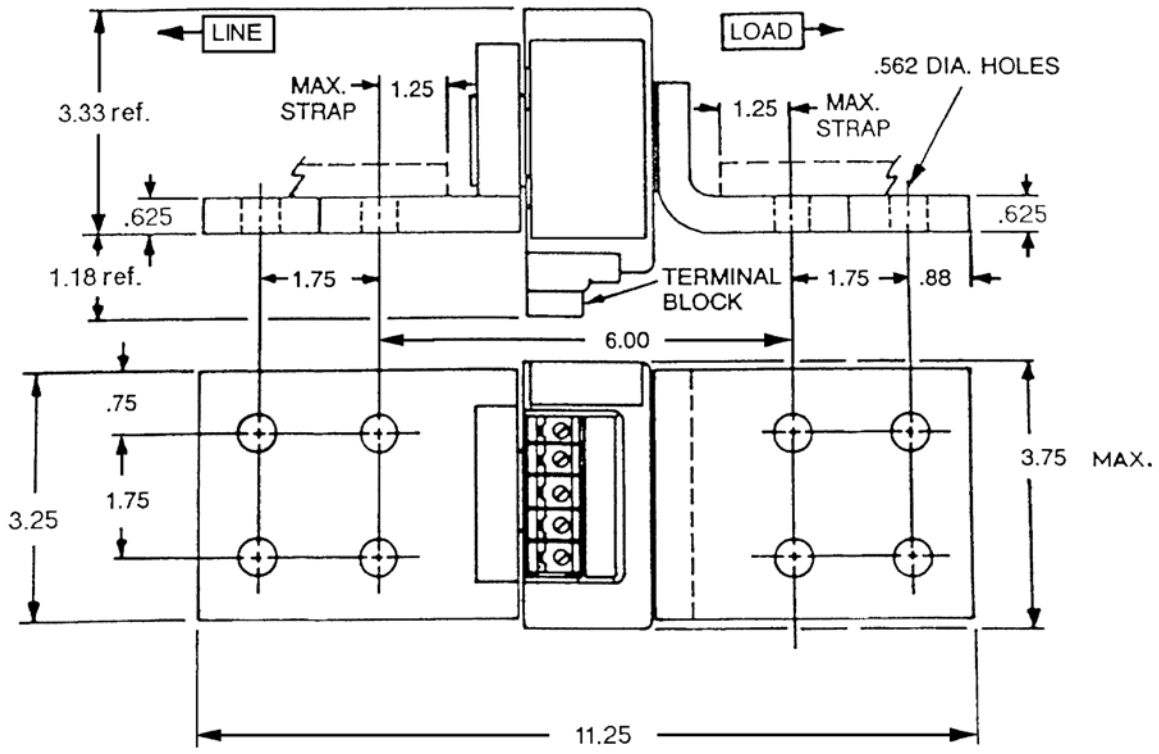


Figure 44. Neutral sensor outline for K-1600 and K-2000 breakers.

SECTION 7. TESTING AND TROUBLE-SHOOTING

WARNING: Do not change taps on the current sensors or adjust the trip unit settings while the breaker is carrying current. Failure to adhere to these instructions will void all warranties.

Testing

1. Verify that the trip unit is securely installed by performing a continuity test on the CT wiring and the trip unit.
   - **a.** Disconnect the black CT wires at each phase sensor.
   - **b.** Check for continuity with a continuity tester or VOM from the white lead of the phase A CT to the white lead of the phase B CT.
   - **c.** Repeat this continuity test for the white leads of the phase A and phase C CTs.
   - **d.** Measure the resistance across each phase sensor and compare the values measured to the values listed in Table 1.
   - **e.** Reconnect the black CT leads to all of the phase sensors. Ensure that this is done before continuing with performance testing of the breaker.

CAUTION: In addition to the continuity test described in Step 1 and before performance testing of the converted breaker, each phase of the breaker should be primary injected with a current level of about 10%, but no more than 20%, of the CT rating. During the application of test current, activate the trip unit screen by depressing the battery button on the trip unit face and check that the test current is displayed on the screen for each phase tested. If the trip unit fails to display the test current, stop the test immediately and verify the installation of the trip unit and wire harness before proceeding with any additional testing.

WARNING: If the converted breaker is energized or tested by primary injection with a sufficiently high test current with a loose or open circuit between the CTs and the trip unit, damage will occur to the trip unit, wire harness, 36-pin trip unit connector, and CTs. Failure to adhere to these instructions will void all warranties.

2. Check the insulation on the primary circuit with a 1,000-volt Meggar.
3. Measure the resistance across the line and load terminals for each phase using a micro-ohmmeter or millivolt tester. If the resistance differs considerably from phase to phase, the electrical connections may not be properly tightened or it could also indicate improper contact wipe.
4. To verify that the breaker has been properly retrofitted, perform a primary injection test on each phase. This test will check the CTs, bus, wiring harness, flux shifter, and trip unit as a complete system.
   - **a.** A high-current, low-voltage power supply should be connected across each line and load terminal to simulate an overcurrent fault.
   - **b.** Set the long-time trip at 0.5 to minimize the breaker stress.
   - **c.** When ground fault is installed, the test can be performed by wiring two adjacent poles in series or by using the GE Digital Test Kit, cat. no. TVRMS2. This will prevent the breaker from tripping because of an unbalanced current flow.

CAUTION: Do not attempt to use GE Test Kit cat. no. TVTS1 or TVRMS on this trip unit.

Trouble-Shooting

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

- The breaker is not tripping in response to overcurrent conditions or incipient ground faults.
- The breaker is remaining in a trip-free state because of mechanical interference along its trip shaft.
- The shunt trip (if present) is activating improperly.

Nuisance Tripping on Ground Fault-Equipped Breakers

When nuisance tripping occurs on breakers equipped with ground fault trip, a probable cause is the existence of a false ground signal. Each phase sensor is connected to summing circuitry in the trip unit. Under no-fault conditions on three-wire load circuits, the currents add to zero and no ground signal is developed. This current sum is zero only if all three sensors have the same electrical characteristics. If one sensor differs from the others (such as a different rating or wrong tap setting), the circuitry can produce an output sufficient to trip the breaker. Similarly, a 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 MicroVersaTrip PM trip unit has previously demonstrated satisfactory performance. After disconnecting the breaker from all power sources, perform the following procedure:

1. Check that all phase sensors are the same type (current range).
2. Verify that the tap settings on all three phase sensors are identical.
3. Verify that the wiring harness connections to the sensors have the proper polarity (white lead to common, black lead to tap), as shown in the cabling diagram in Figure 45.
4. On ground fault breakers serving four-wire loads, check that the neutral sensor is properly connected, as indicated in Figure 45. In particular, check the following:
   a. Verify that the neutral sensor has the same rating and tap setting as the phase sensors.
   b. Verify 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 trip unit wiring harness connector.
   c. If the breaker's lower studs connect to the power source, then the neutral sensor must have its load end connected to the source.
   d. Verify that the neutral conductor is carrying only the neutral current associated with the breaker's load current (the neutral is not shared with other loads).
5. If the preceding steps fail to identify the problem, then measure the sensor resistances. The appropriate values are listed in Table 1. Since the phase and neutral sensors are electrically identical, their resistances should agree closely.

Breaker	CT Rating, A	Resistance, ohms
K-225	150 225	9–12 14–18
K-600	225 600	14–18 40–50
K-800	150 400 800	9–12 27–32 58–79
K-1600	800 1600	58–79 130–154
K-2000	2000	210–246

Table 1. CT resistance values.

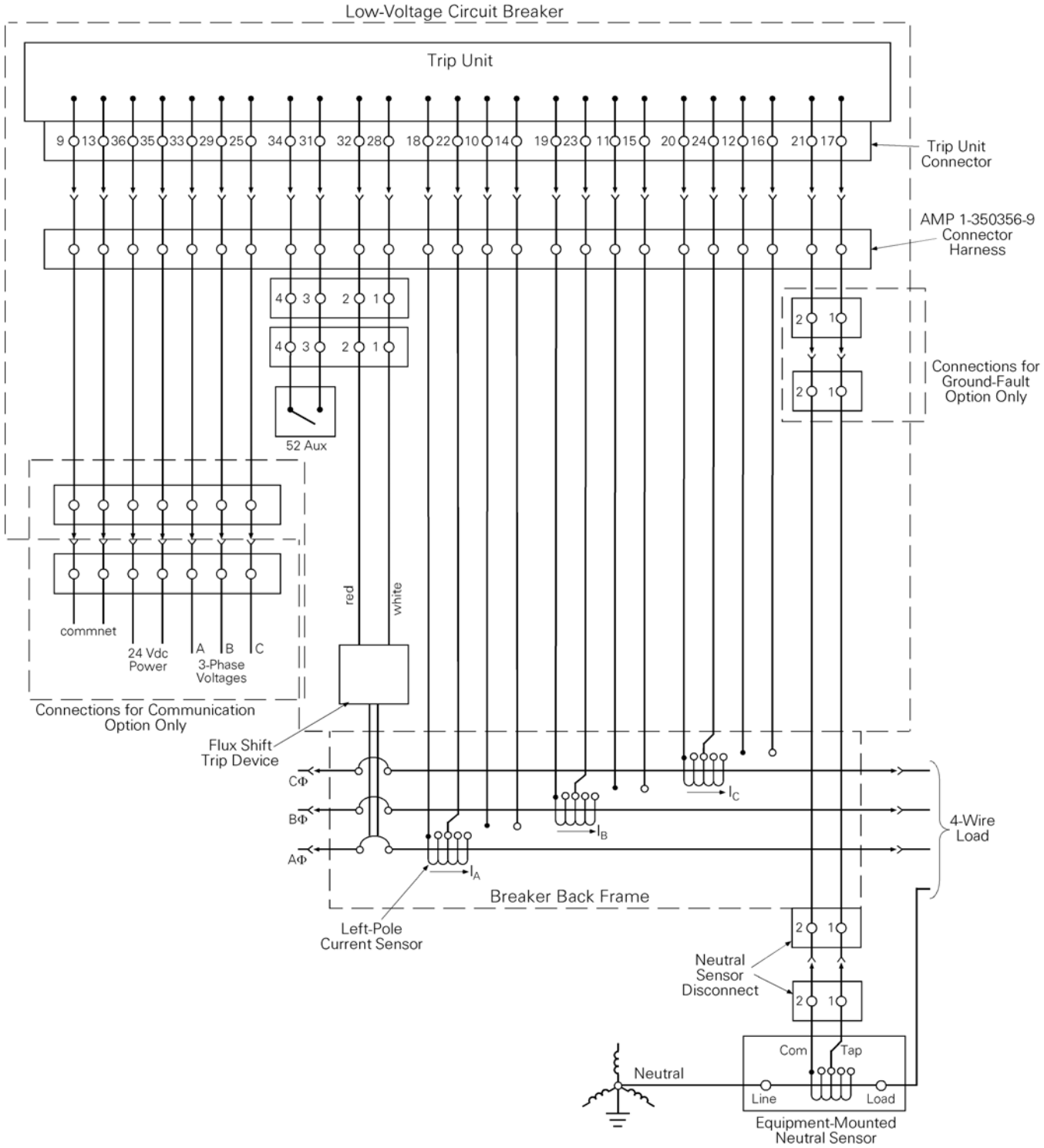


Figure 45. Cabling diagram for MicroVersaTrip Plus™ and MicroVersaTrip PM™ trip units with ground fault on four-wire loads.

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

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