ProTrip™ Conversion Kits

For Westinghouse® Type DB-25, DBL-25, DB-50,
DBL-50 Low-Voltage Power Circuit Breakers

INTRODUCTION

GE Conversion Kits are designed for upgrading existing Westinghouse® low-voltage power circuit breakers, rather than replacing the entire breaker. The Conversion Kits include ProTrip™ Trip Units, the latest advance in GE trip systems.

ProTrip 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 ProTrip™ Conversion Kits on Westinghouse Type DB-25, DBL-25, DB-50, and DBL-50 low-voltage power circuit breakers. Each Conversion Kit contains all the components needed to convert from an existing Westinghouse electromechanical trip system.

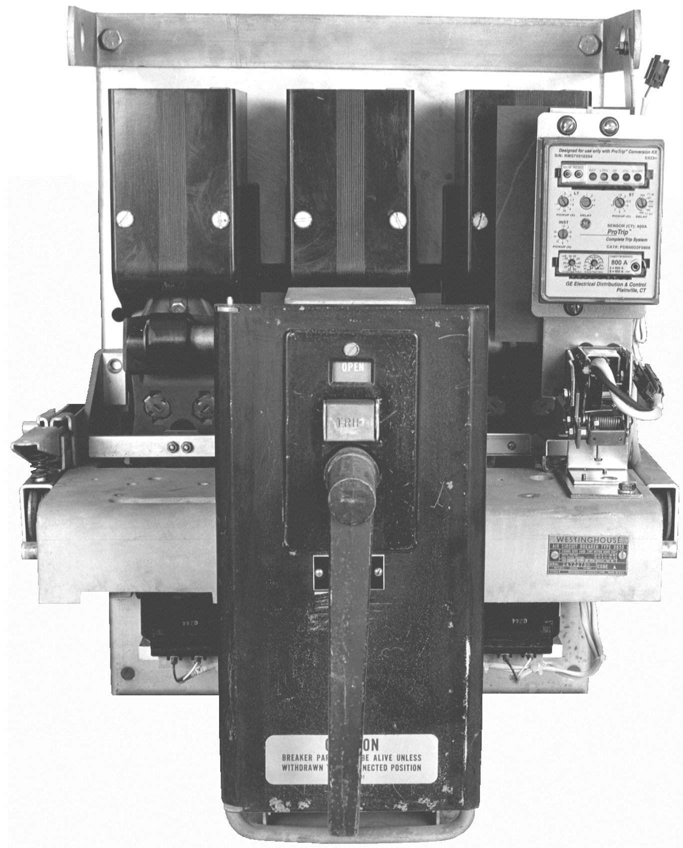

TABLE OF CONTENTS

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. Then general approach is to first remove the existing trip devices from the breaker, then install the ProTrip 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 installations 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 ProTrip kit 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.

Note that all ProTrip trip units supplied with conversion kits are equipped with long-time, short-time, instantaneous, and defeatable ground fault (LSIGX) trip functions. The installer should be aware of how these functions will affect his application before installing the conversion kit.

As a service-related consideration, the installation of a ProTrip kit provides an excellent opportunity to perform normal maintenance on the breaker, particularly when the front and back frames are separated. Such procedures are described in the installation and maintenance manuals supplied with the 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 an OPEN breaker and be sure the stored-energy springs are discharged, thus removing 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. BACK FRAME BREAKER CONVERSION

The back frame conversion of a Westinghouse® DB-25, DBL-25, DB-50, or DBL-50 breaker consists of the following steps:

1. Remove the breaker to a clean, well-lighted work bench and place it upright, so that both the front and back are easily accessible, as shown in Figure 1.
2. Remove the existing electromechanical trip devices.
3. Assemble the phase sensors (CTs) to their bus structures.
4. Install the CT assemblies on the breaker.

Removing the Electromechanical Trip Devices

1. On a draw-out breaker, remove the load-side draw-out contact fingers. Use a pair of pliers to squeeze the fingers and release them from the load terminals, as shown in Figure 2.
2. On both a DB-25 and DB-50 breaker, remove and discard the two 1/2-13 bolts above each load terminal, as shown in Figures 3 and 4.

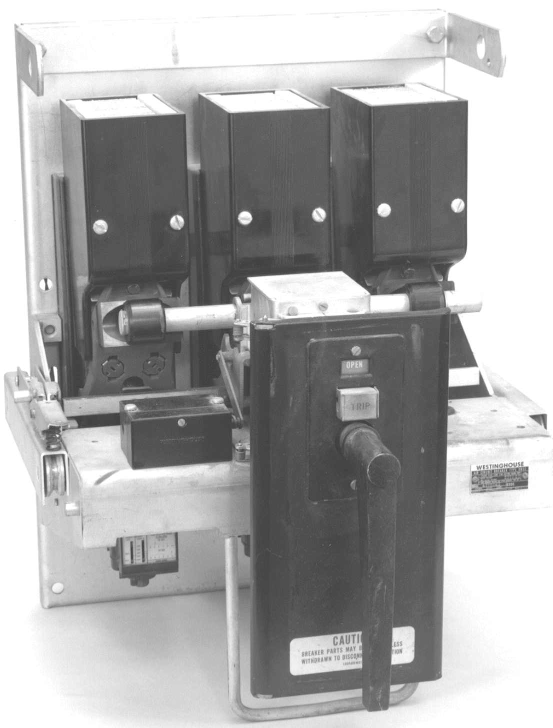

Figure 1. Westinghouse DB-50 breaker removed from its enclosure and ready for conversion.

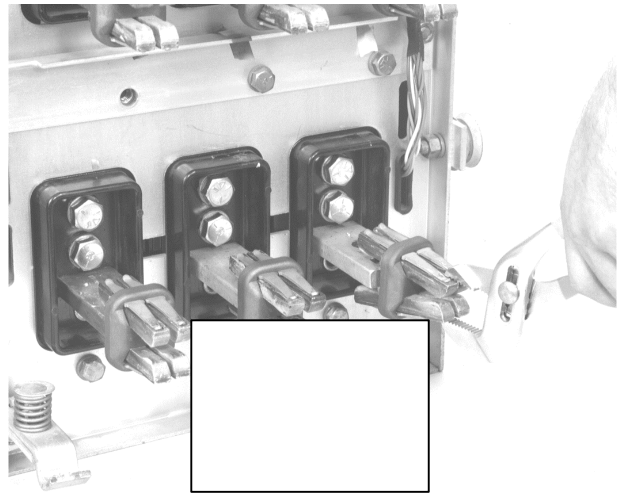

Figure 2. Removal of the load-side draw-out fingers from a DB-25 breaker.

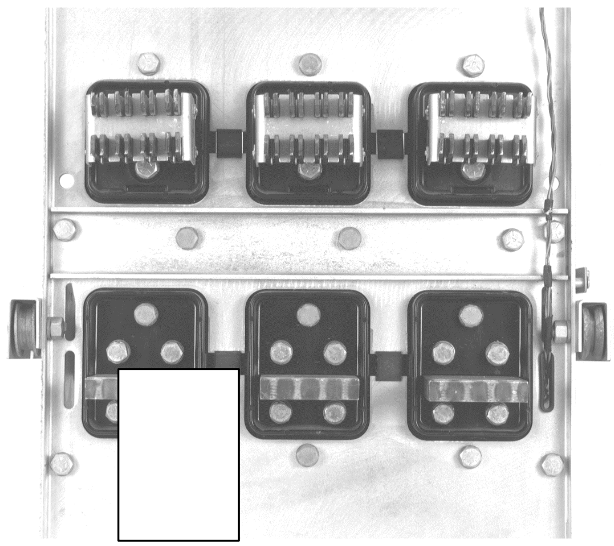

Figure 3. Trip unit mounting bolts to be removed from a DB-50.

3. On a DB-50 breaker, remove and discard the two 1/2-13 bolts under each load terminal, as shown in Figure 3.

On a DB-25 breaker, remove and discard the single 3/8-16 bolt under each load terminal, as shown in Figure 4.

4. Remove the electromechanical trip devices, shown in Figure 5, from the frame and discard them. The back frame is now ready for conversion, as shown in Figure 6.

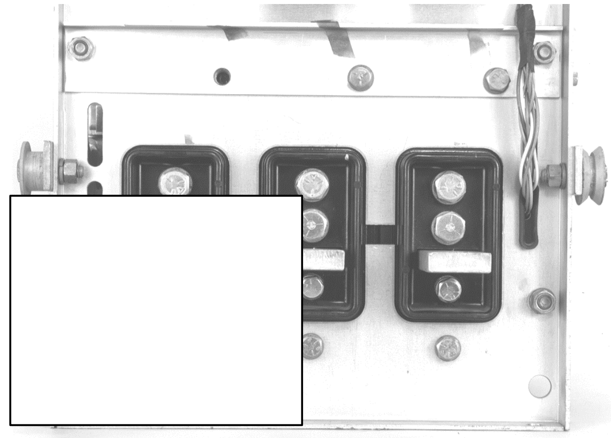

Figure 4. Trip unit mounting bolts to be removed from a DB-25.

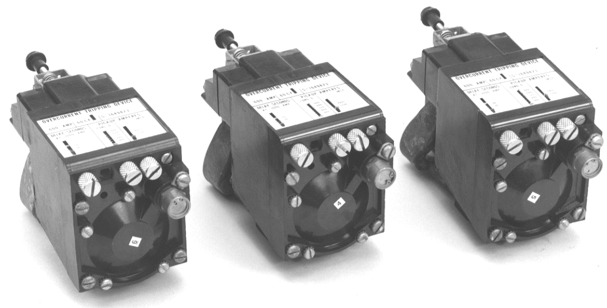

Figure 5. Electromechanical trip devices removed from the breaker.

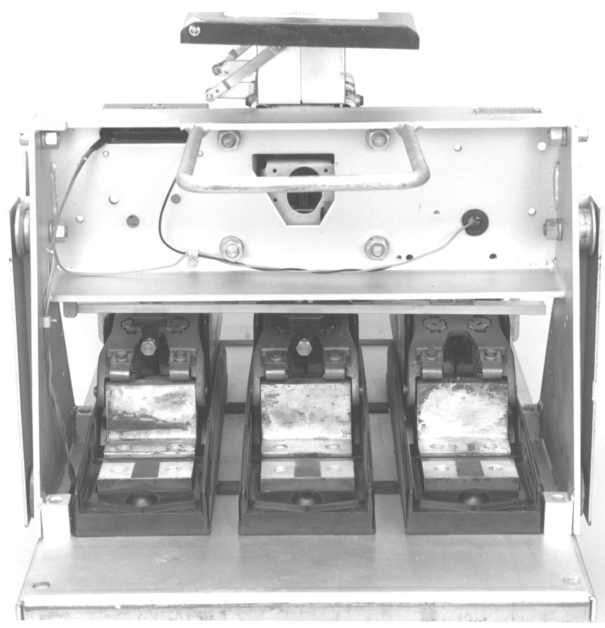

Figure 6. DB-50 back frame with the electromechanical trip devices removed and ready for conversion.

Installing the Phase Sensors (CTs)

The CTs must be assembled with their associated copper bus parts before they can be installed onto the breaker frame in the spaces previously occupied by the electromechanical trip devices.

1. Slide the CT over the post on the lower copper bus strap, as shown in Figure 7. Place the insulating barrier on the top of the CT.
2. On a DB-50 breaker, place the top bus strap over the insulating barrier and insert a 1/2-13 x 1 1/4" bolt, with a flat washer and lock washer, as shown in Figure 9. Leave the bolt finger tight for now.

   On a DB-25 breaker, place the top bus strap over the insulating barrier and insert a 3/8-16 x 1 1/4" bolt, with a flat washer and lock washer, as shown in Figure 9. Leave the bolt finger tight for now.

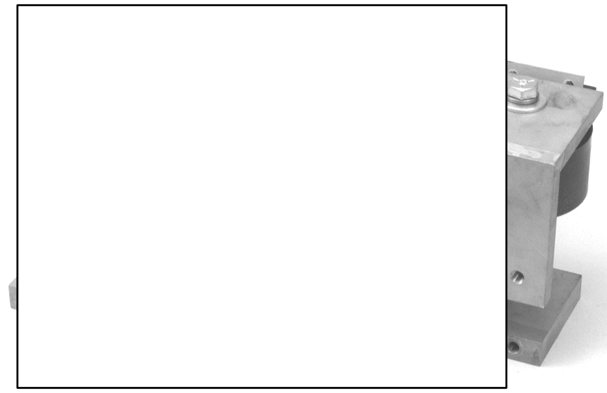

Figure 7. Assembling a CT to the bus.

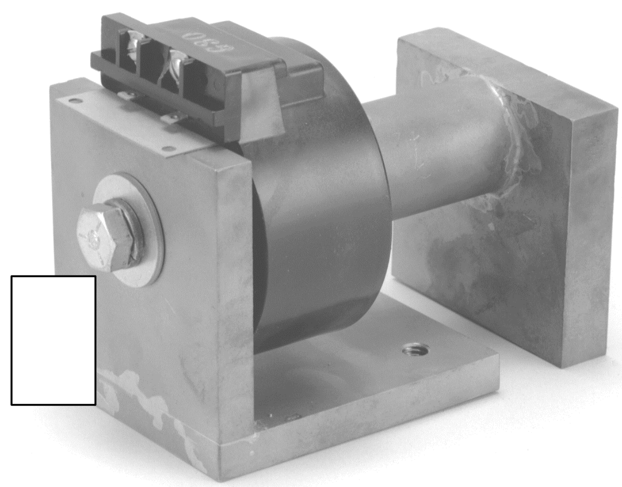

Figure 8. CT assembly for a DB-50 breaker.

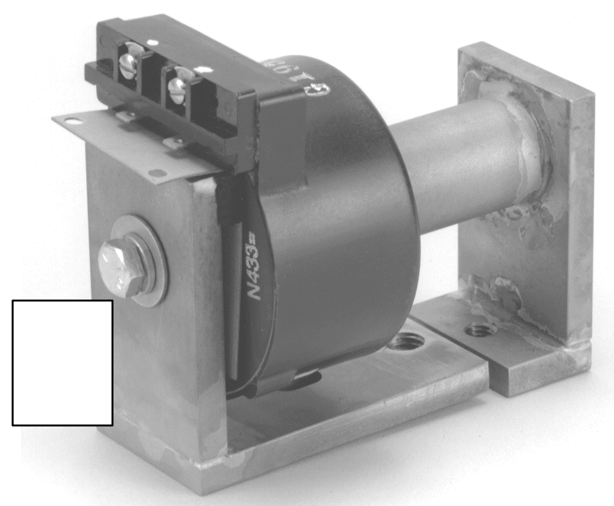

Figure 9. CT assembly for a DB-25 breaker.

3. On DB-25 breakers only, insert the bus alignment dowel into the hole below each load terminal, as shown in Figure 10.
4. Place each CT assembly into the breaker, as shown in Figure 11, carefully aligning the tapped holes in the bus with the existing holes in the back frame.
5. On a DB-50 breaker, insert the four 3/8-16 x 2 1/2" bolts, with lock washers and flat washers, through the back of the breaker into the tapped holes in the CT assemblies, as shown in Figure 12. Leave the bolts finger tight for now.

   On a DB-25 breaker, insert a single 1/2-13 x 2 1/4" bolt, with a lock washer and flat washer, through the hole immediately above the load terminal on the back of the breaker into the tapped hole in the CT assembly, as shown in Figure 13. Insert the 3/8-16 x 2" bolt, with a lock washer and flat washer, through the second hole above the load terminal.

   A breaker with all three CT assemblies installed in shown in Figure 14.

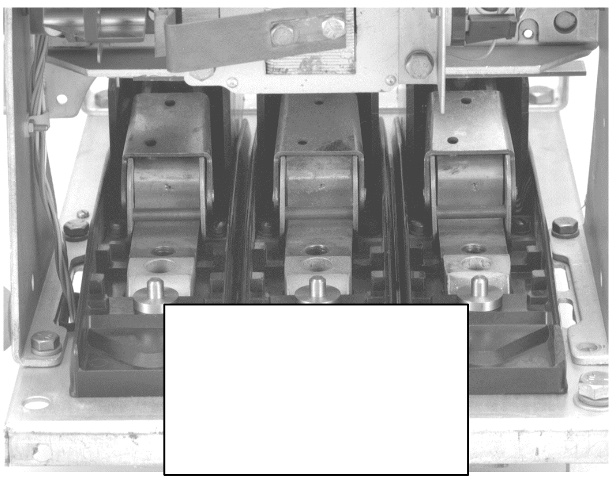

Figure 10. CT alignment dowels installed on a DB-25 breaker.

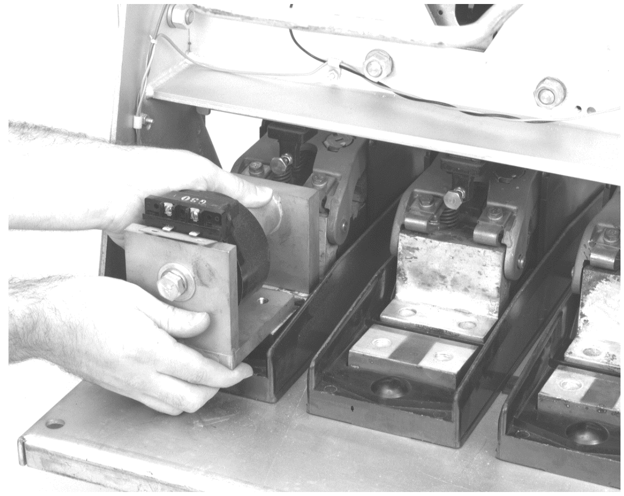

Figure 11. Placing a CT into position on a DB-50 breaker.

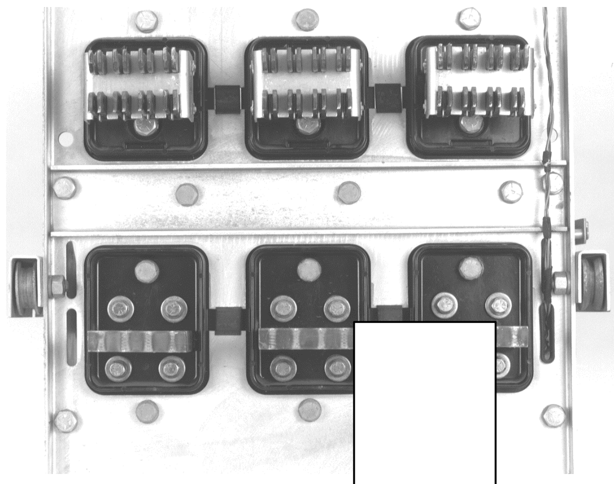

Figure 12. CT bolts inserted into a DB-50 breaker back frame.

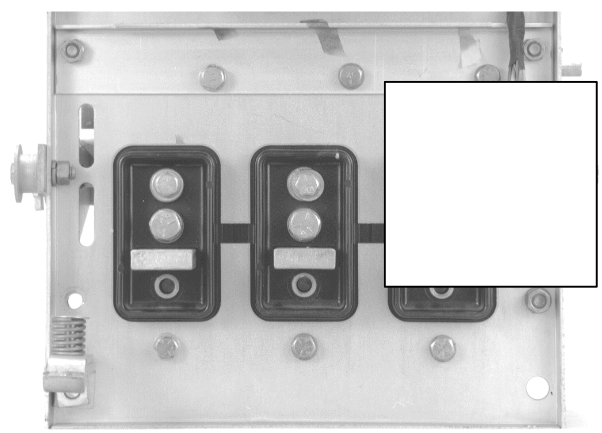

Figure 13. CT bolts inserted into a DB-25 breaker back frame.

6. Tighten the CT assembly mounting bolts, as shown in Figure 15. For a DB-25 breaker, tighten the 1/2-13 bolts to 300 in-lb and the 3/8-16 bolts to 200 in-lb. Tighten all the CT mounting bolts on a DB-50 breaker to 200 in-lb.
7. On a DB-25 breaker, tighten the bolts on the CT assemblies to 200 in-lb, as shown in Figure 16. Tighten the CT assembly bolts on a DB-50 to 300 in-lb.

WARNING: Steps 6 and 7 provide 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.

8. On a draw-out breaker, reinstall the load-side draw-out fingers removed earlier.

The conversion of the back frame is now complete.

Figure 14. CT assemblies installed into the breaker.

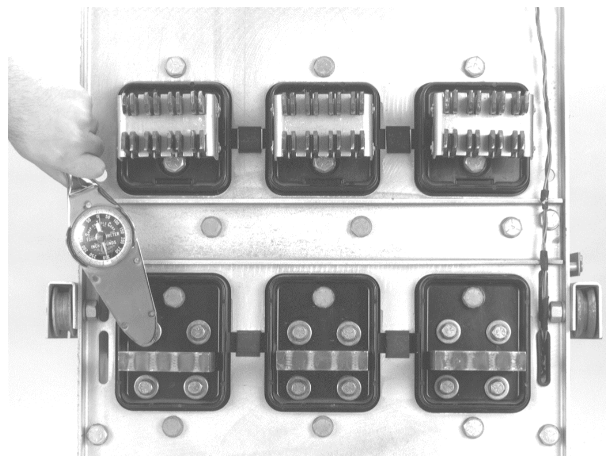

Figure 15. Tightening the CT assembly mounting bolts. on the rear of the breaker.

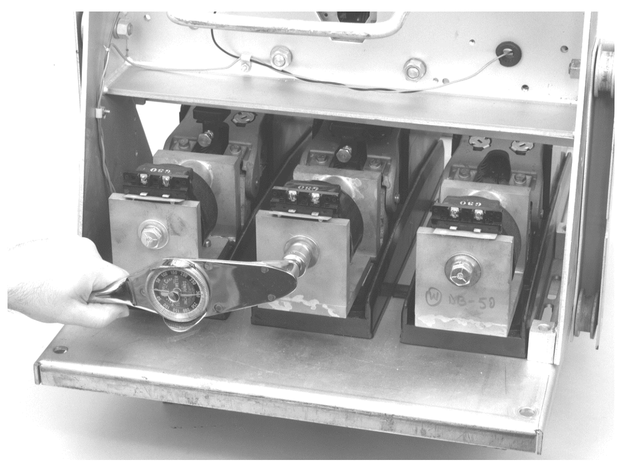

Figure 16. Tightening the CT assembly bolts.

SECTION 4. FRONT FRAME BREAKER CONVERSION

The front frame conversion of a Westinghouse DB-25 or DB-50 breaker consists of the following steps, which are each described in detail:

1. Installing the trip paddle.
2. Installing the trip unit bracket assembly.
3. Adjusting the flux shifter.
4. Installing the wiring harness.

Installing the Trip Paddle

The trip paddle is installed on the right end of the common trip bar, as shown in Figure 17.

1. Align the trip paddle with the hole located $2\frac{1}{2}$–$3\frac{1}{2}$ inches from the end of the trip bar. On a DB-50 breaker, use the second hole from the end.
2. Insert an 8-32 x $\frac{1}{2}$" screw thought the trip paddle and trip bar and fasten with the nut with integral lock washer provided.
3. On a DB-25 breaker, remove the existing snap ring from the right end of the cross bar. Install the reset sleeve on the cross bar and secure it with the snap ring provided, as shown in Figure 18.

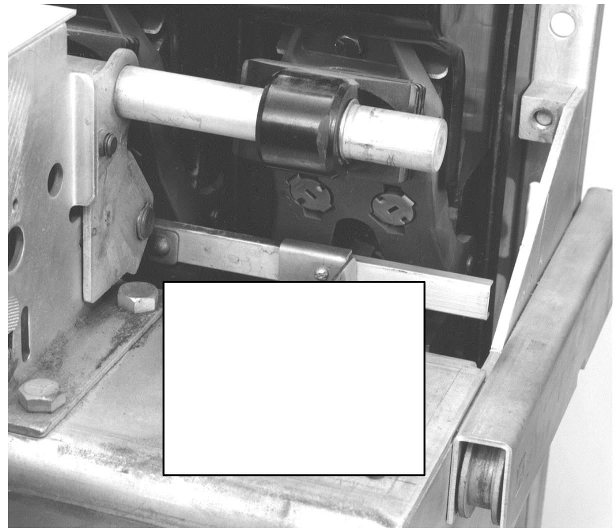

Figure 17. Installing the trip paddle onto the trip bar.

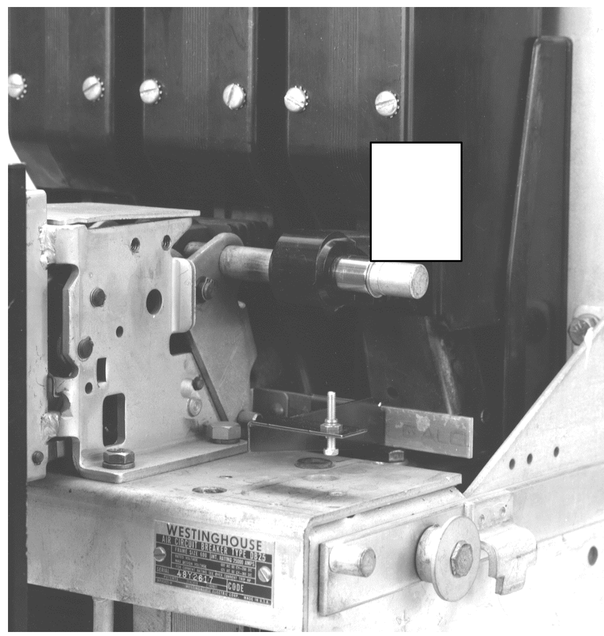

Figure 18. Installing the reset sleeve onto the cross bar of a DB-25 breaker.

Installing the Trip Unit Mounting Bracket

The trip unit mounting bracket, shown in Figure 19, mounts the trip unit and flux shifter to the breaker frame.

1. Mount the trip unit bracket assembly to the right side of the breaker frame, as shown in Figure 23:

   1a. For a DB-50 breaker, mount the bracket assembly to the existing tapped hole in the breaker frame with the two 5/16-18 x 1/2" bolts and lock washers provided.

   Ensure that the 10-32 pivot screw in the mounting bracket is inserted through the slot in the trip paddle.

   1b. For a DB-25 breaker, be sure that the reset arm on the left side of the flux shifter assembly is hooked over the cross bar, as shown in Figure 20.

   Mount the bracket assembly to the existing tapped hole in the breaker frame with the two 1/4-20 x 3/4" bolts and lock washers provided.

   Attach the spring clamp to the existing hole in the breaker frame, as shown in Figure 21, with the supplied 1/4-20 x 3/4" bolt, flat washer, and lock washer. Connect the spring from the flux shifter assembly to the clamp.

2. Attach the support bracket provided to strengthen the top of the trip unit bracket with the 1/4-20 x 3/4" bolt provided, as shown in Figure 22. Use the bracket as a template to locate the position in the breaker frame to drill a hole to accommodate a 1/4" bolt.

3. Attach the support bracket to the breaker frame with the 1/4-20 x 3/4" bolt provided, as shown in Figure 23. The trip unit bracket should be parallel to the breaker back frame.

NOTE: If an undervoltage device is present on the breaker, it will have to be relocated.

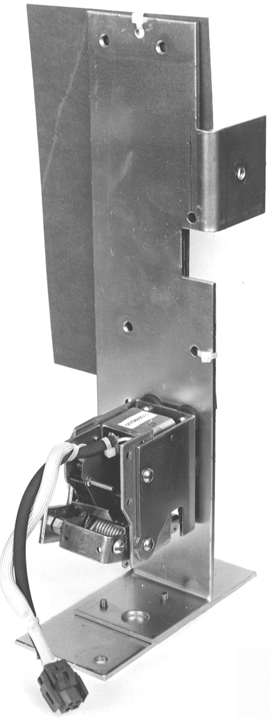

Figure 19. Trip unit and flux shifter mounting bracket assembly.

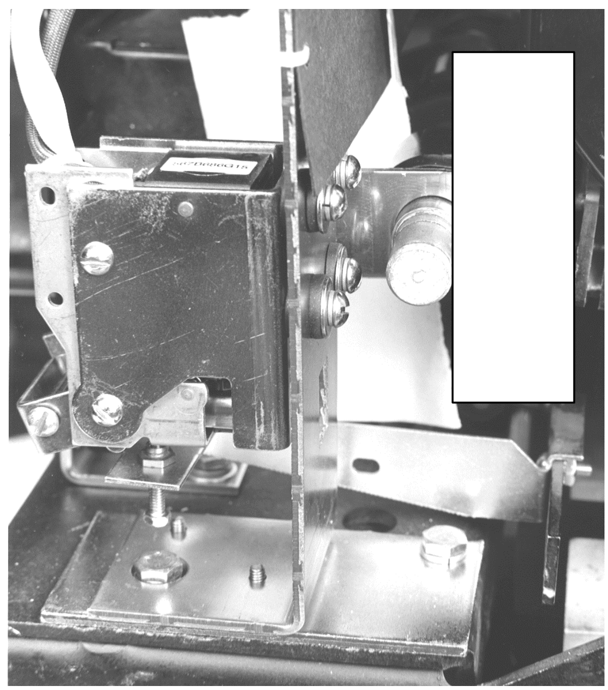

Figure 20. DB-25 flux shifter bracket installed on the cross bar.

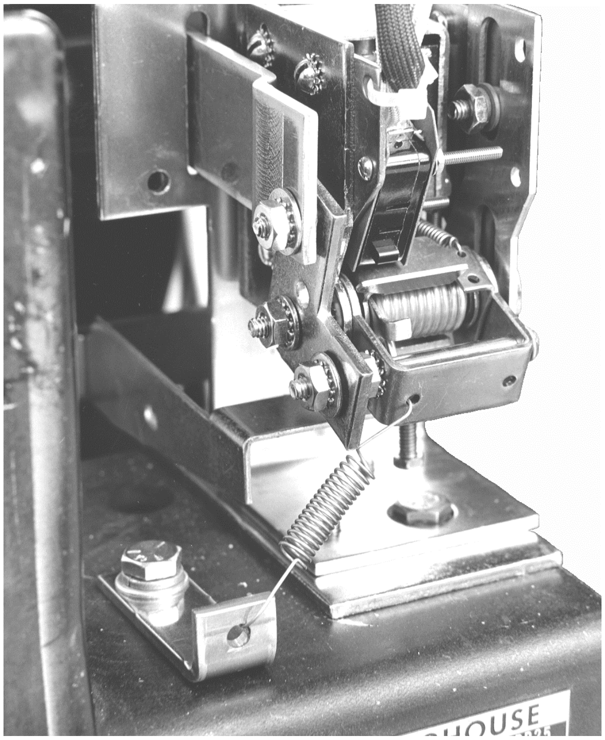

Figure 21. DB-25 spring clamp installed on the breaker frame.

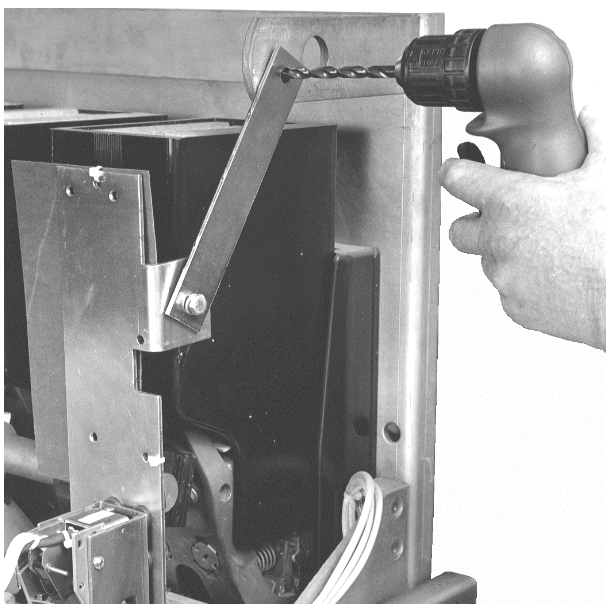

Fig 22. Drilling the flux shifter support bracket mounting hole.

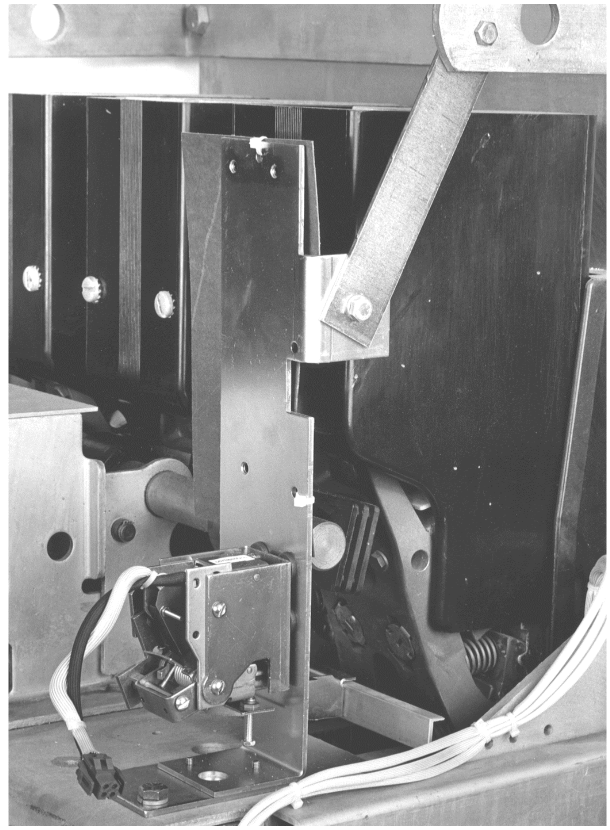

Figure 23. Installed flux shifter and trip unit mounting bracket (DB-50).

Adjusting the Flux Shifter

With the breaker in the CLOSED position, the gap between the adjustment screw and the trip paddle should be 1/16 inch, as shown in Figure 24. For safety, OPEN the breaker before adjusting the screw with a 1/4-inch wrench. CLOSE the breaker to check the adjustment.

WARNING: Be extremely careful when working on a CLOSED breaker. *Do not* reach 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.

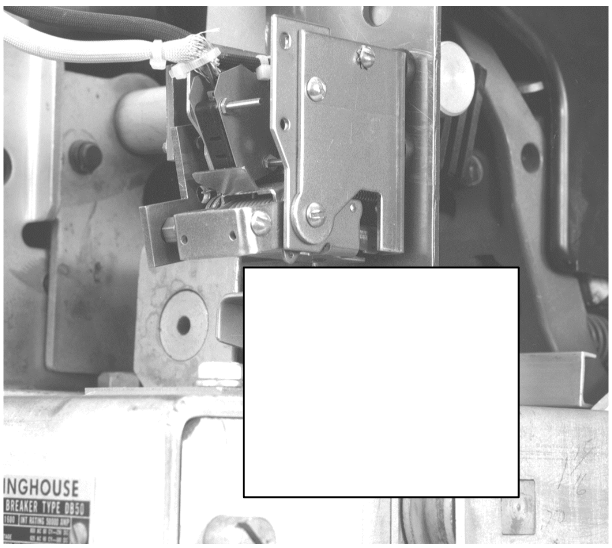

Figure 24. Adjusting the flux shifter.

Connecting the Trip Unit Wiring Harness

1. Join the four-pin connector on the trip unit harness to the four-pin connector on the flux shifter.
2. Run the CT leads through the inside of the breaker frame, as shown in Figure 25. Connect the harness leads to the screw terminals on each CT. The black wire (tap) connects to the left terminal and the white wire (common) to the right terminal.
3. Use the wire ties provided to secure the harness back against the frame. Tie the harness to each CT assembly, as shown in Figure 25. Ensure that the wiring will not interfere with any moving parts.

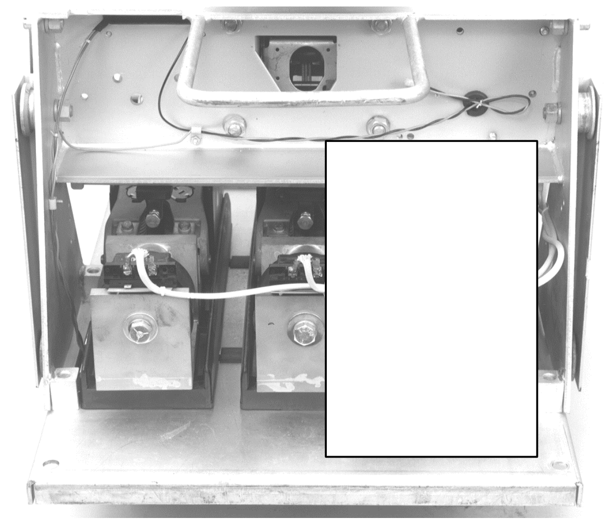

Figure 25. Wiring harness installed on the CTs.

Installing the Trip Unit

1. Place a lock washer and flat washer over each of the three 1/4-20 x 1 3/8" screws provided and insert through the mounting holes on the trip unit mounting plate. From the rear of the plate, place a flat washer, spacer, and O-ring over the screws, as shown in Figure 26.
2. Remove the large screw from the rear of the trip unit. Place the trip unit in position on the mounting plate, with the 50-pin connector aligned with the opening in the plate. Secure with the large screw, as shown in Figure 26.
3. Insert the 50-pin female connector on the wiring harness into the trip unit connector through the rear of the mounting plate. Secure to the mounting plate with the two small screws provided, as shown in Figure 27.
4. Place the trip unit and mounting plate in position on the support bracket mounted to the breaker. Secure with the screws in the mounting plate into the tapped holes in the bracket, as shown in Figure 28.

Configuring the Trip Unit

See DEH-40034 for detailed instructions for setting up ProTrip trip units.

Figure 27. Harness connector attached to the trip unit.

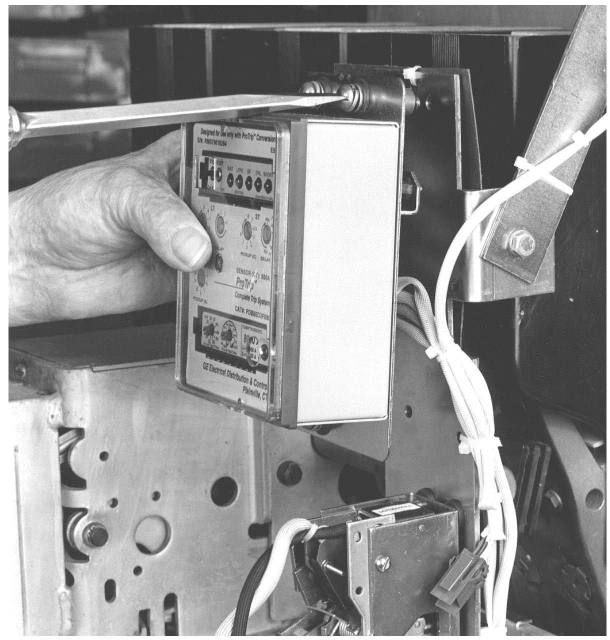

Figure 28. Mounting the trip unit on the breaker.

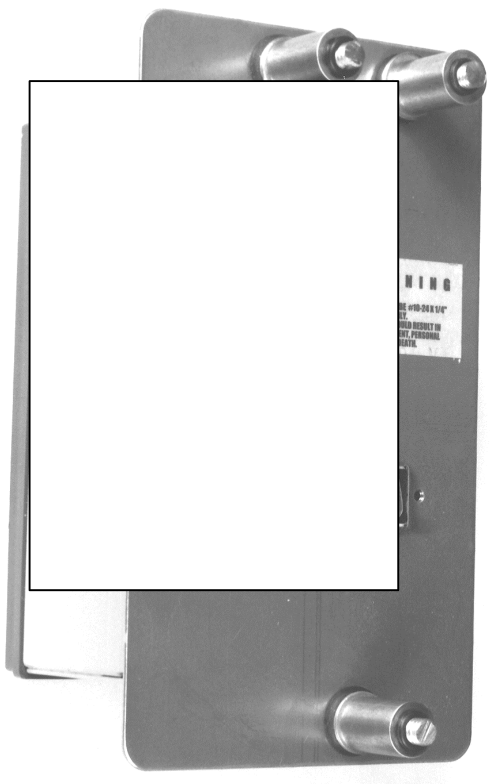

Figure 26. Trip unit attached to its mounting plate.

SECTION 5. FOUR-WIRE GROUND FAULT OPTION

The ground fault option for four-wire installations requires the installation of an additional current sensor 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. Figures 29 and 30 show the outlines of the neutral sensors for a DB-25 and DB-50 breaker, respectively.
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 connect 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.

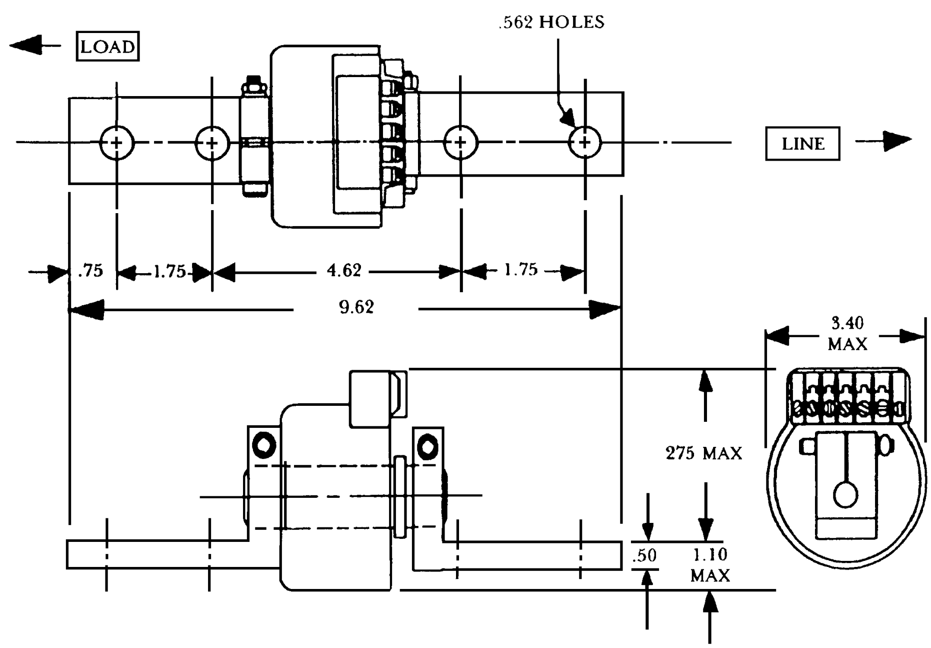

Figure 29. Neutral sensor outline for a DB-25 breaker.

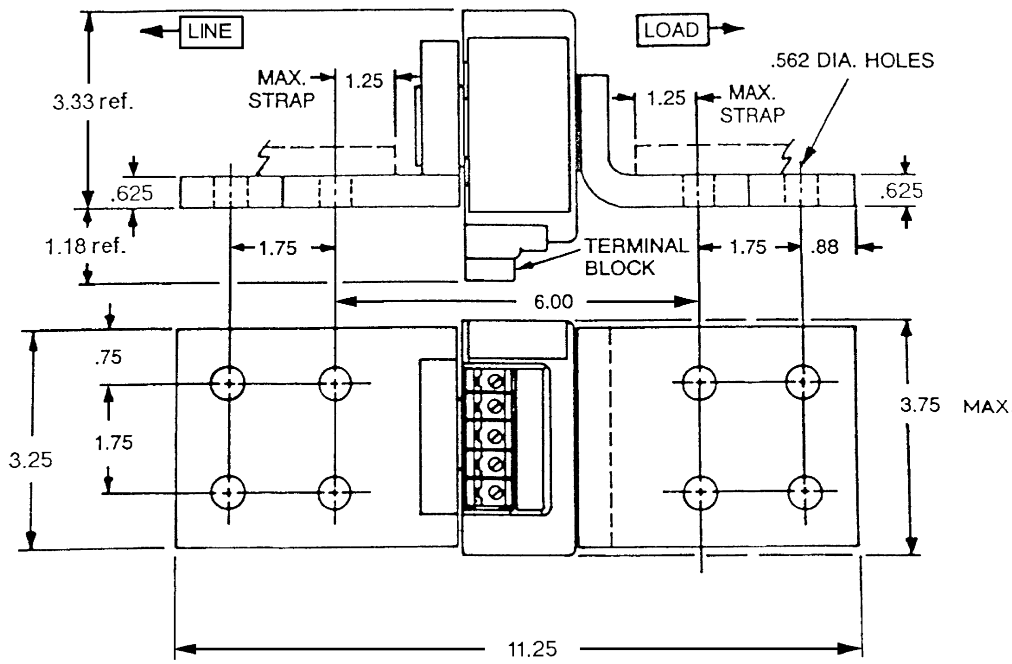

Figure 30. Neutral sensor outline for a DB-50 breaker.

SECTION 6. 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

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

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.

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, 50-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 Megger.

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 by 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 ProTrip 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 31.

4. On ground fault breakers serving four-wire loads, check that the neutral sensor is properly connected, as indicated in Figure 31. 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
DB-25	225	14–18
DBL-25	600	40–50
DB-50	800	58–79
DBL-50	1500	130–154

Table 1. CT resistance values.

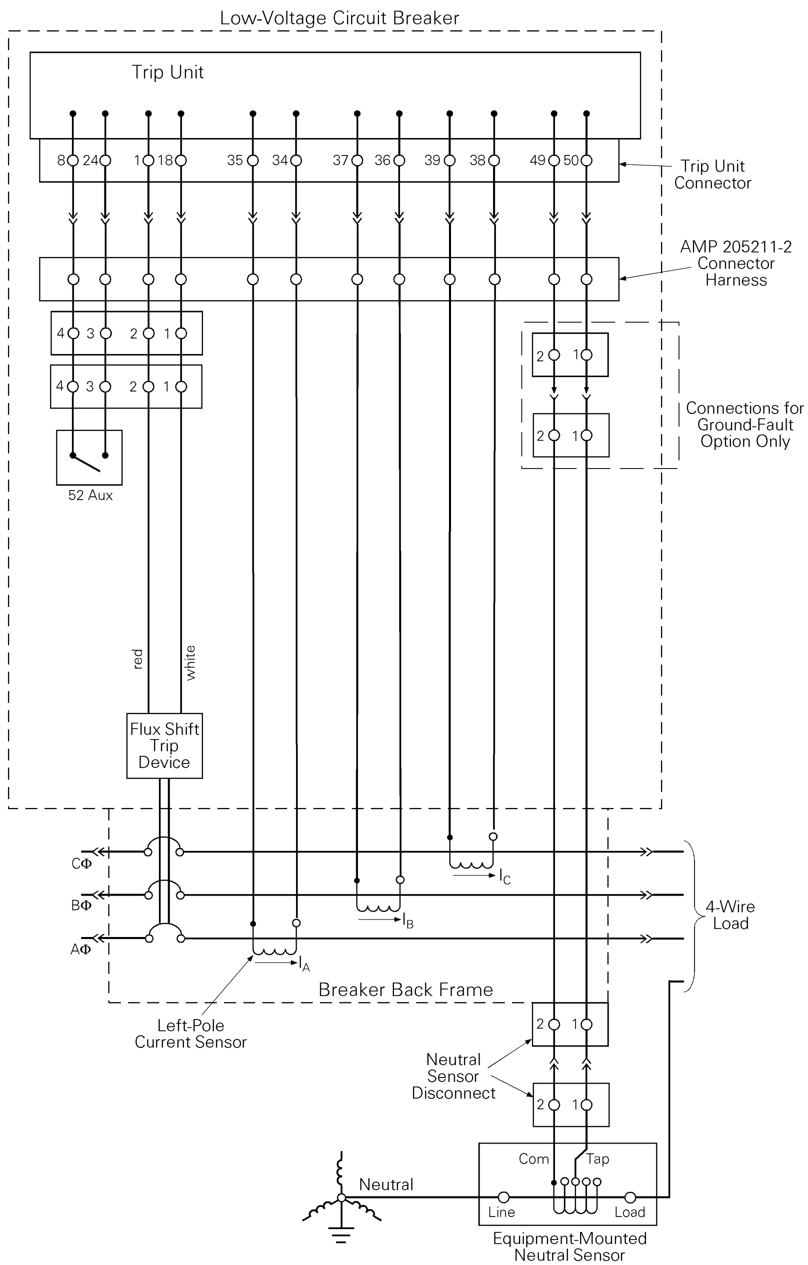

Figure 31. Cabling diagram for ProTrip™ trip units with ground fault on four-wire loads.

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 GE Company.

g

GE Industrial Systems

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

DEH40031 R02 0899