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ProTrip™ Conversion Kits

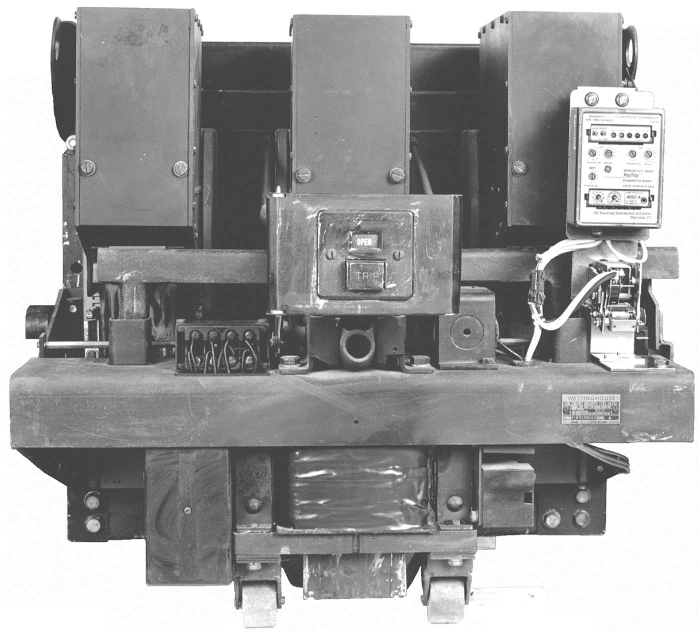
For Westinghouse® Type DB-75, DBL-75, DB-100,
DBL-100 Low-Voltage Power Circuit Breakers

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-75, DBL-75, DB-100, and DBL-100 low-voltage power circuit breakers. Each Conversion Kit contains all the components needed to convert from an existing Westinghouse electromechanical trip system.



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SECTION 1. GENERAL INFORMATION

GE Conversion Kit installation is straightforward, but does require careful workmanship and attention to these instructions. Familiarity with the breaker 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-75 or DB-100 breaker consists of the following steps:

1. Remove the breaker to a clean, well-lighted work bench and place it on its left side, so that both the bottom and back are easily accessible.
2. Remove the existing electromechanical trip devices.
3. Install the new phase sensors (CTs).

Removing the Electromechanical Trip Devices

1. Remove and discard the four bolts holding each trip device to a pole of the breaker, as shown in Figure 1.
2. Remove and discard the three electromechanical trip devices, shown in Figure 2.

> ***CAUTION:*** Do not remove the trip paddles from the common trip bar. They are used to balance the trip action and could cause nuisance tripping if removed.

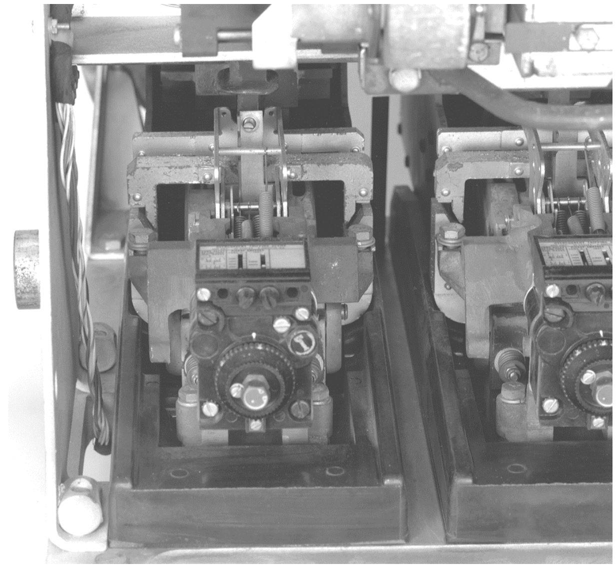


Figure 1. Removing a trip device.

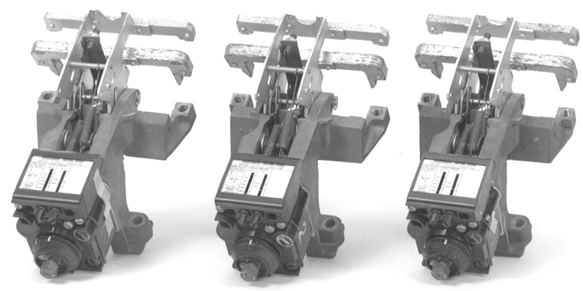


Figure 2. Electromechanical trip devices removed from the breaker.

Installing the Phase Sensors (CTs)

1. On draw-out type breakers, remove and save the load-side draw-out finger assemblies, as shown in Figure 3.
2. Remove and discard the two bolts above and the two bolts below each load terminal, as shown in Figure 3.
3. Place each of the CTs provided over a load terminal with the wire terminal at the top, as shown in Figure 4.
4. Secure the CTs with the four 1/2-13 x 2 3/4" Allen-head bolts and lock washers provided, as shown in Figure 4.

NOTE: In some stationary breaker applications it may be necessary to install the breaker before bolting the CTs into place. In such cases, slide a CT over each bus before bolting the breaker into the equipment.

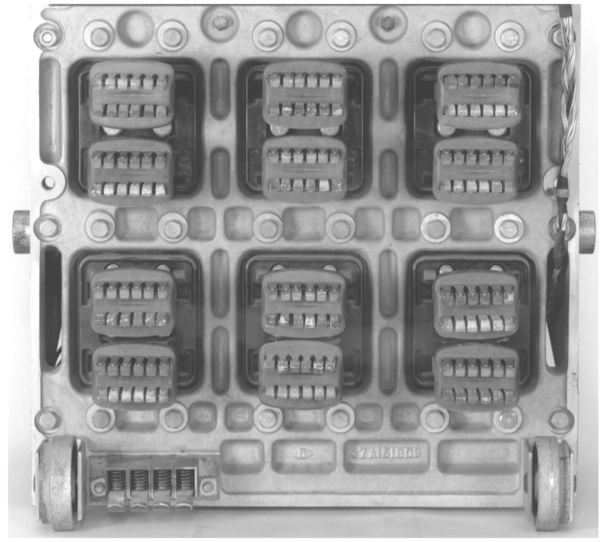


Figure 3. Preparing the load terminals.

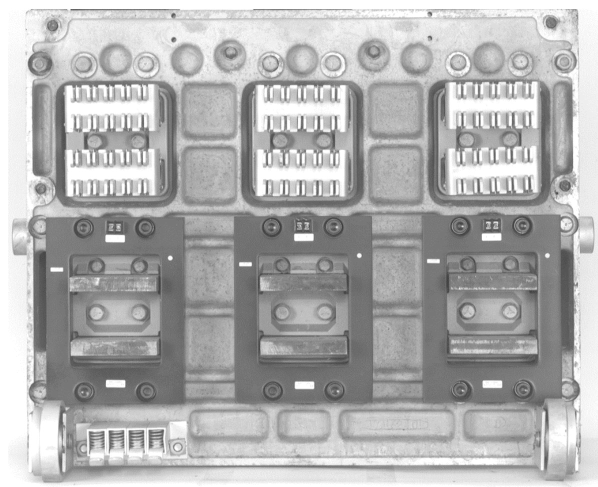


Figure 4. CTs installed on the breaker.

SECTION 4. FRONT FRAME BREAKER CONVERSION

Installing the Trip Paddle

1. Remove the 1/4-20 bolt that fastens the draw-out interlock lever to the common trip bar, as shown in Figure 5.
2. Install the new trip paddle provided over the existing interlock lever and secure it with the existing hardware, as shown in Figure 5.

Installing the Trip Unit Mounting Bracket

The trip unit mounting bracket, shown in Figure 6, mounts the flux shifter and trip unit to the breaker frame.

1. Mount the trip unit mounting bracket to the right side of the breaker frame, as shown in Figure 8. Insert the 5/16-18 x 1 1/4" bolt with two flat washers up through the frame and the hole in the bottom of the bracket. Secure with a lock washer and nut.
2. Install the support bracket provided to strengthen the top of the trip unit bracket, as shown in Figure 7. Attach the support bracket to the trip unit mounting bracket with the 1/4-20 x 3/4" bolt provided. 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. Slide the support bracket to the inside of the right breaker frame member, as shown in Figure 8, and secure it with the 1/4-20 x 3/4" bolt, lock washer, and nut provided.

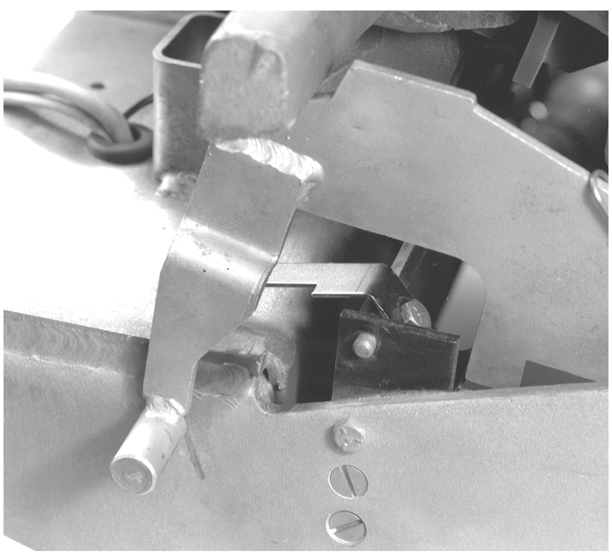


Figure 5. Trip paddle installed on the trip bar.

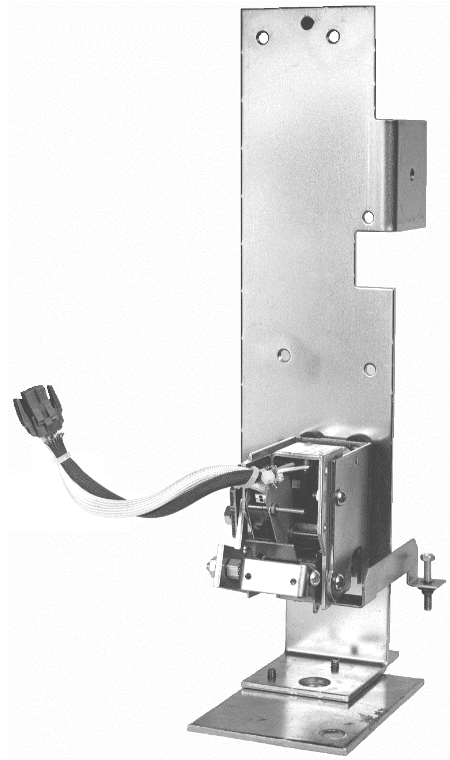


Figure 6. Trip unit mounting bracket.

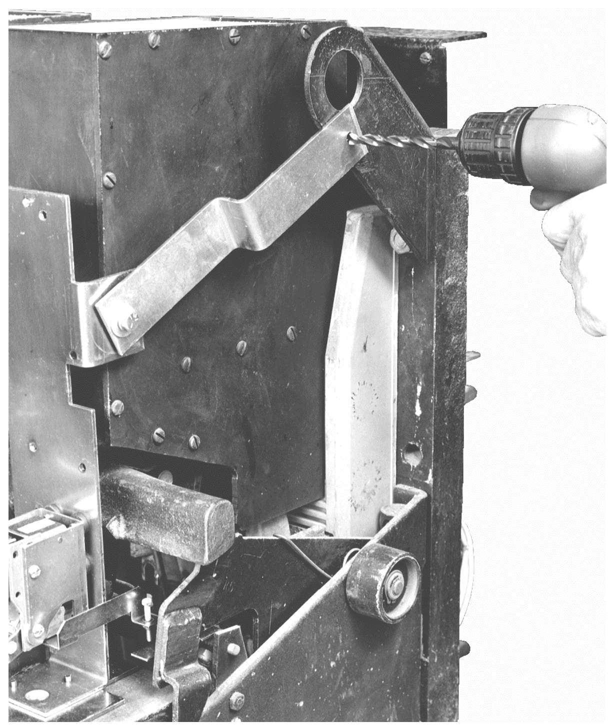


Figure 7. Installing the support bracket..

Adjusting the Flux Shifter

With the breaker in the CLOSED position, the gap between the adjustment screw and the trip paddle should be 1/32 inch, as shown in Figure 9. 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.

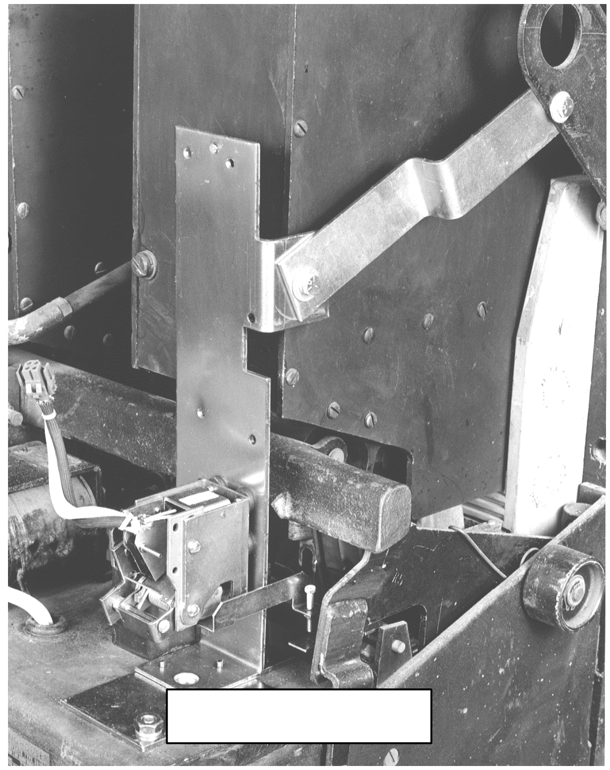


Figure 8. Trip unit mounting bracket installed on the breaker frame.

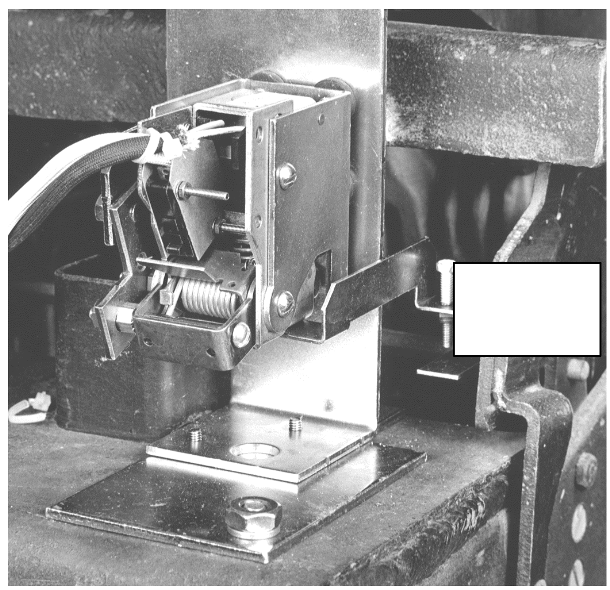


Figure 9. Adjusting the flux shifter.

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. Bring the CT leads of the wiring harness around to the back and bottom of the breaker, as shown in Figure 10. Connect the harness leads to the screw terminals on each CT. The black wire (tap) connects to the "B" terminal and the white wire (common) to the "W" terminal.

> ***NOTE:*** Some stationary breaker applications may require mounting the CTs over the line terminals. If this is the case, the polarity of the wiring harness leads to the CTs must be reversed.

3. Use the wire ties provided to secure the harness back against the frame. Ensure that the wiring will not interfere with any moving parts.

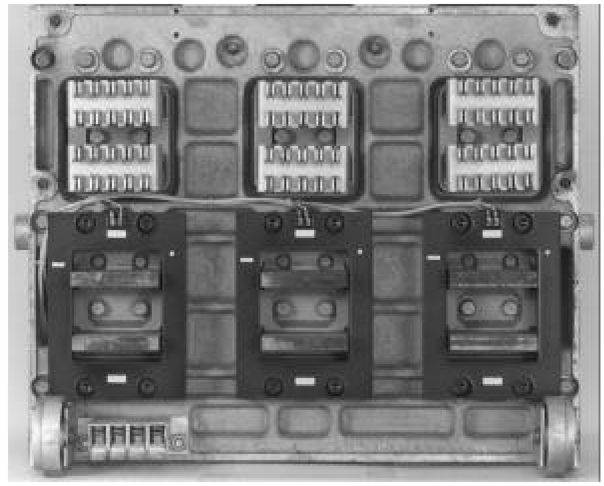


Figure 10. Wiring harness installation on the CTs.

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 11.
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 11.
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 12.
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 13.

Configuring the Trip Unit

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

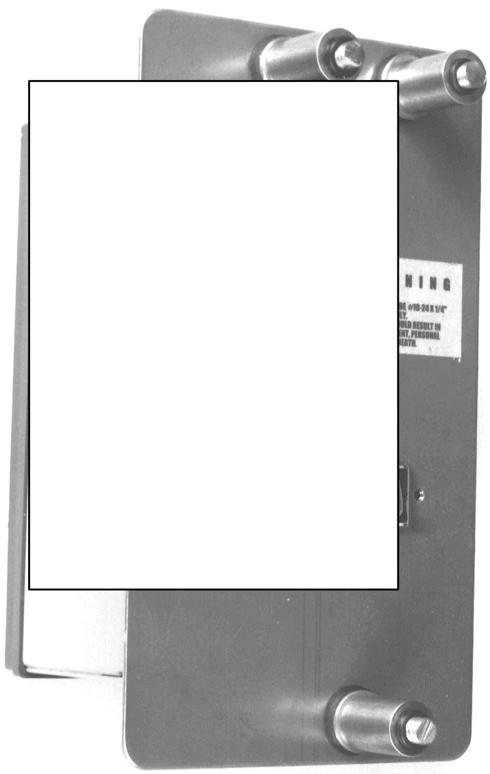


Figure 11. Trip unit attached to its mounting plate.

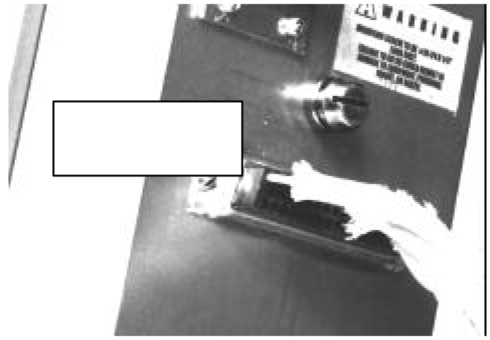


Figure 12. Harness connector attached to the trip unit.

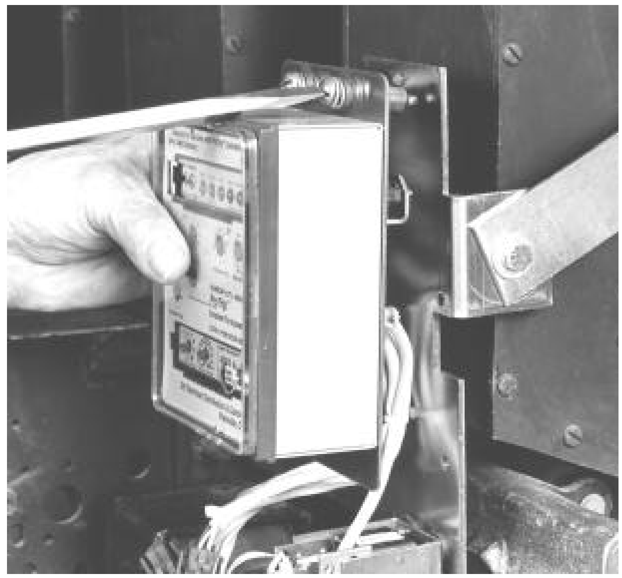
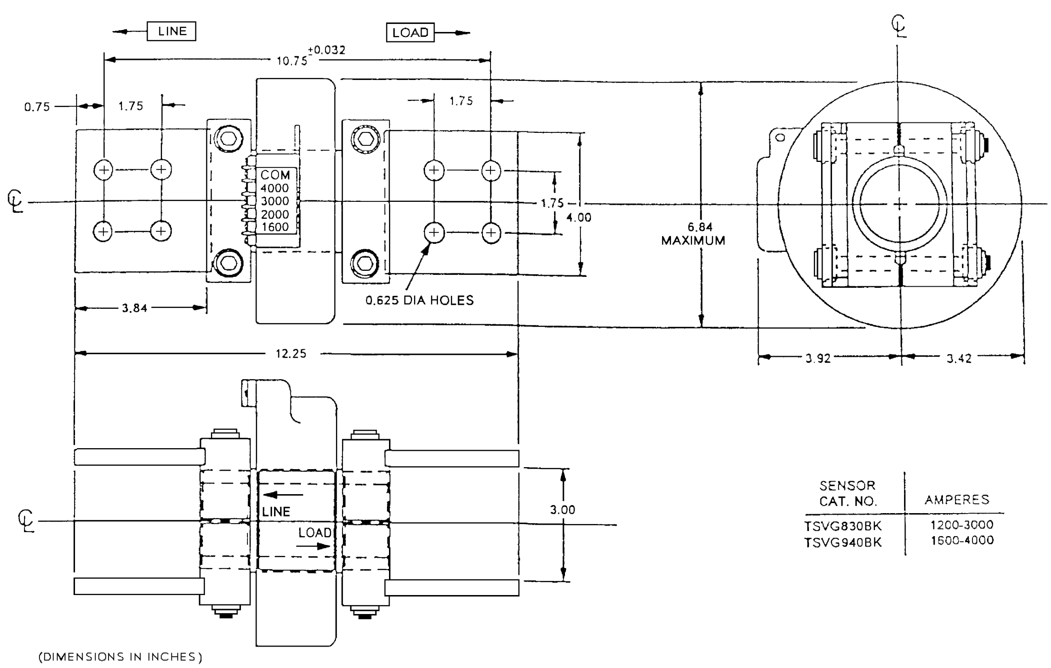


Figure 13. Mounting the trip unit on the breaker.

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. Figure 14 shows the outline of the neutral sensor for a DB-75 or DB-100 breaker.
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.



SENSOR CAT. NO.	AMPERES
TSVG830BK	1200-3000
TSVG940BK	1600-4000

Figure 14. Neutral sensor outline for a DB-75 or DB-100 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 15.

4. On ground fault breakers serving four-wire loads, check that the neutral sensor is properly connected, as indicated in Figure 15. 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-75 DBL-75	3000	56–68
DB-100 DBL-100	4000	72–88

Table 1. CT resistance values.

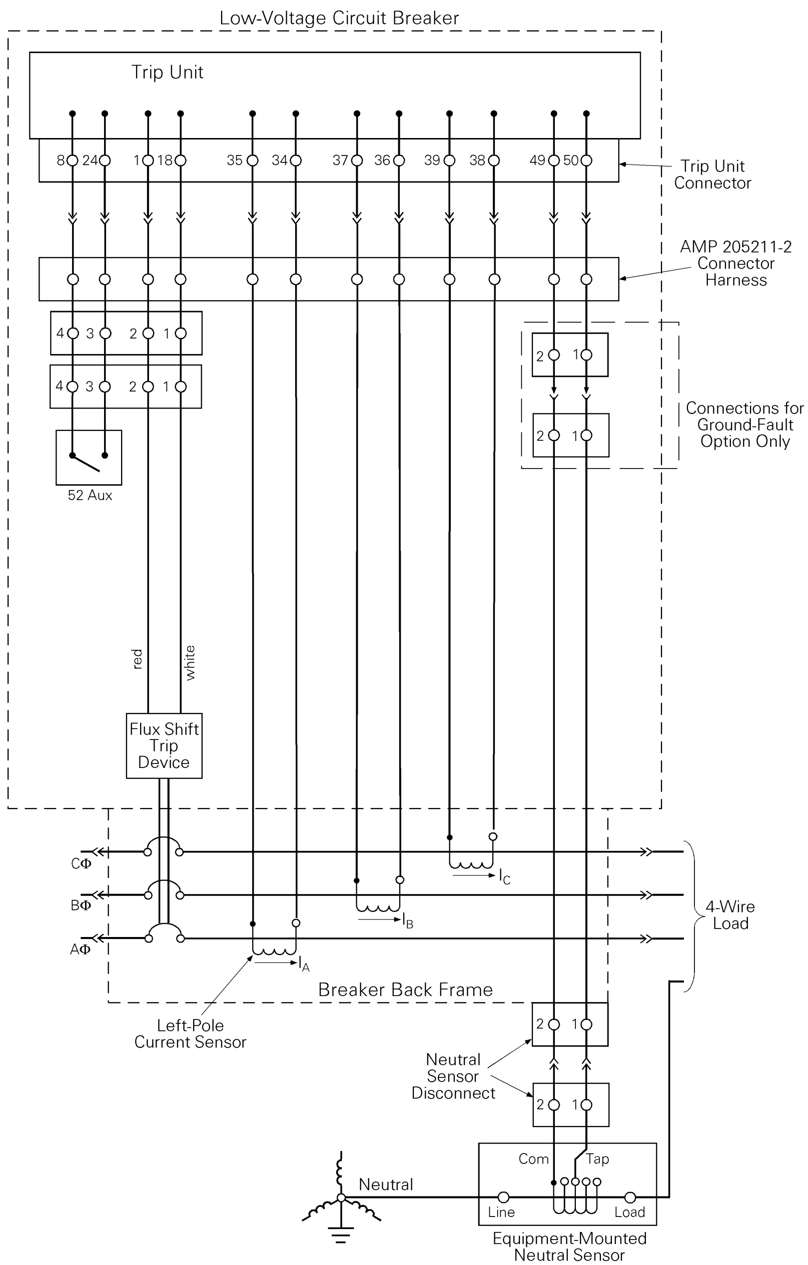


Figure 15. Cabling diagram for ProTrip™ trip units with ground fault on four-wire loads.

NOTES

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

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