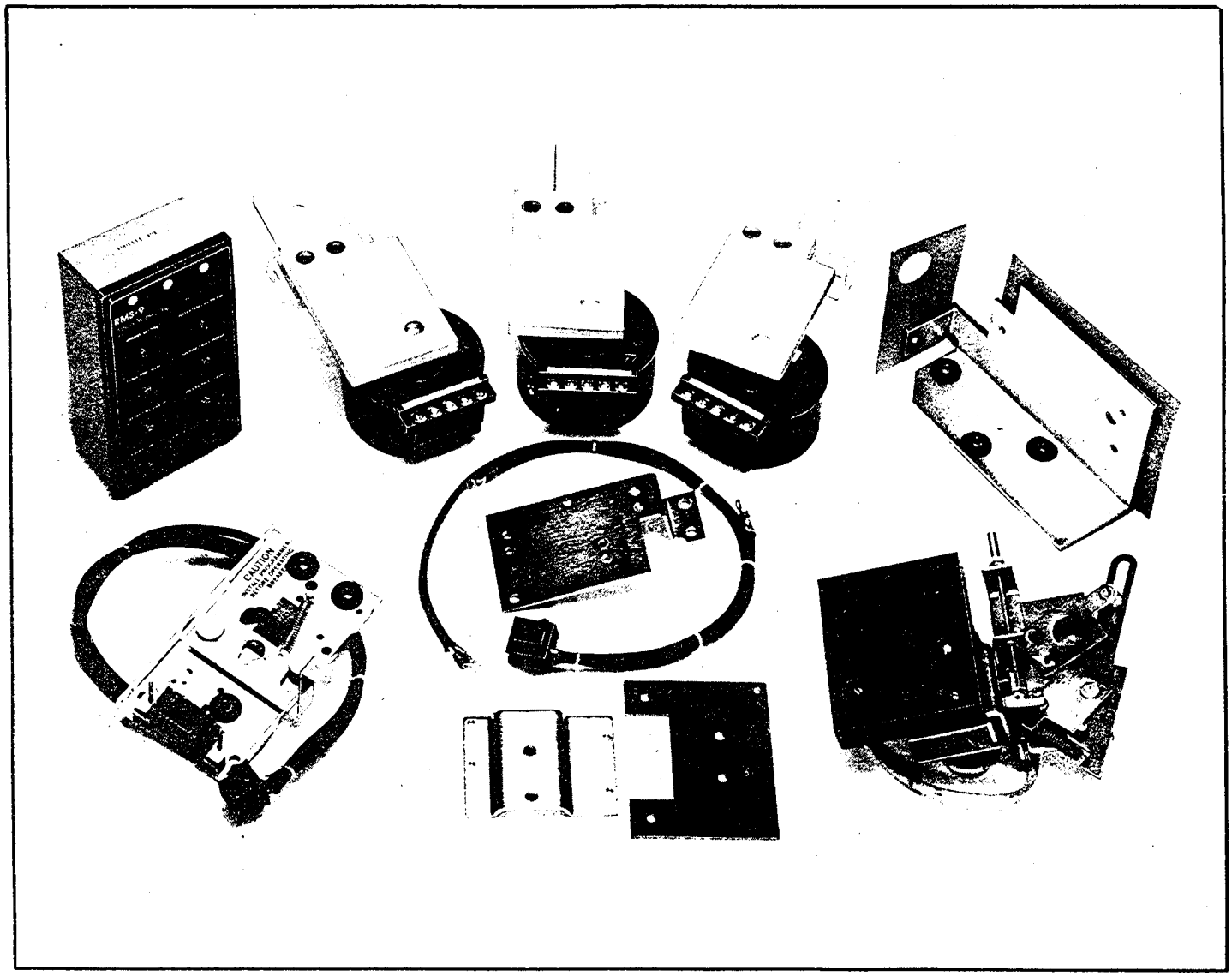
Instructions for
Converting Existing
ECS and SST Trip Systems
to MicroVersaTrip® RMS-9

MicroVersaTrip® RMS-9 Conversion Kit

Types AKR 30/50 and AKRT-50



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SECTION 1 Introduction

These instructions cover the installation of MicroVersaTrip® RMS-9 solid-state trip device conversion kits on AKR 30/50 breakers listed in Table 1-1. Each kit contains the necessary material to convert from existing ECS or SST trip device systems.

Kit installation is straightforward. However, careful workmanship and attention to these instructions should be maintained. Familiarity with the breaker will prove helpful. The general approach is to first strip the breaker of its existing trip devices and then install the MicroVersaTrip® RMS-9 components. Following this, the converted breaker is performance-tested prior to being restored to service.

Prior to starting the conversion, the installer should verify that the correct kit, current sensors and programmer unit have been furnished—see Tables 1-1 through 1-4. Whenever the ground fault trip element is furnished for breakers applied on 4-wire systems, note that, in addition to installing the kit on the breaker, an associated neutral sensor (CT) is required for separate mounting in the equipment. Insure also that retrofitted breakers are applied within their short circuit ratings. For example, as part of a conversion where the breaker's trip elements are to be changed from LI to LS, the short-time rating would govern the application.

As a service-related consideration, the installation of the MicroVersaTrip® RMS-9 kit provides an excellent opportunity to perform normal maintenance on the breaker. Such procedures are described in maintenance manual GEK-64459. Also, any renewal parts required are listed in Renewal Parts publication GEF-4527. If required, copies of these publications are available from the factory.

Table 1-1 MicroVersaTrip® RMS-9 Conversion Kit Model Selection For Fixed Sensors With Interchangeable Rating Plug

Frame Size		Stationary or Draw-out		3- or 4-Wire		Fixed Sensor		Sensor Rating			Programmer Functions
AKR-30/30H = TKR30 AKRU-30								AKR-30/30H AKRU-30	150A = 01 400A = 04 800A = 08		L1 = 01 LIT1 = 02 LIGT2 = 03
AKR-50/50H = TKR50** AKRU-50 AKRT-50/50H	+	S OR D	+	3 OR 4*	+	F	+	AKR-50/50H AKRU-50 AKRT-50/50H	800A = 08 1600A = 16 2000A = 20	+	LSIT1 = 04 LSIGT2 = 05 LSTI = 06 LSGT2-07 LSIGT2X = 08

*Only applicable to programmer functions with ground fault.
**Not suitable for converting Power Sensor-equipped breakers.

EXAMPLE:

- AKR-50, Draw-out construction, 3-wire system, 1600 Amp fixed sensor, LSIGT2 programmer, 1200 Amp rating plug
- MicroVersaTrip® RMS-9 conversion kit model number: TKR50D3F1605
- Interchangeable rating plug, 1200 Amp, model number: TR16S1200

Table 1-2—Current Sensors

Breaker Type	Sensor Ampere Rating	Cat. No.
AKR/AKRU-30, AKR-30H	150 400 800	139C4970G25 139C4970G28 139C4970G30
AKR50/50H, AKRU-50	800 1600	139C4970G30 139C4970G32
AKRT-50/50H	2000	139C4970G33

Table 1-3—Neutral Current Sensors①

Breaker Frame Size	Circuit Breaker Sensor Rating (Amps)	Neutral Sensor Rating or Tap Settings (Amps)	Cat. No.
800	150 400,800	100-300 300-800	TSVG303B TSVG508B
1600	800 1600	300-800 600-1600	TSVG508B TSVG516B
2000	2000	800-2000	TSVG620B

①Provided when 4-wire system with ground fault is specified

Table 1–4—Available Programmer Functions For MicroVersaTrip® RMS-9 Conversion Kits

Function	Model Code	Programmer Function Definition
L1	01	Long-Time, Instantaneous
LIT1	02	Long-Time, Instantaneous, Overload—Short Circuit Trip Indicators
LIGT2	03	Long-Time, Instantaneous, Ground Fault, Overload—Short Circuit—Ground Fault Trip Indicators
LSIT1	04	Long-Time, Short-Time, Instantaneous, Overload—Short Circuit Trip Indicators
LSITGT2	05	Long-Time, Short-Time, Instantaneous, Ground Fault, Overload—Short Circuit—Ground Fault Trip Indicators
LST1	06	Long-Time, Short-Time, Overload—Short Circuit Trip Indicators
LSGT2	07	Long-Time, Short-Time, Ground Fault, Overload—Short Circuit—Ground Fault Trip Indicators
LSIGT2X	08	Long-Time, Short-Time, Switchable Instantaneous Pickup (Off Position), Switchable Ground Fault Pickup (Off Position), Overload—Short Circuit—Ground Fault Trip Indicators

SECTION 2 Phase Sensor Conversion

The MicroVersaTrip® RMS-9 phase sensor is shown in Figure 2-1. Except for coil winding, it is identical to the SST phase sensor.

Referring to Figure 2-2, replacement of the SST or ECS phase sensors with the MicroVersaTrip® RMS-9 sensors is as follows:

1. At the rear of the breaker, remove the two Allen-head screws to separate the stud connector from the contact pivot block.
2. Disconnect the programmer harness from the SST's tap terminal board or directly from the ECS terminals. Remove the cable ties and the tap terminal board from the breaker frame.
3. Loosen the clamping bolt and remove the stud connector. Lift out the existing sensor and its tap terminal board. The sensor may be prevented from slipping off the sensor stud by adjacent accessories. If this exists, the sensor stud must be removed from the breaker base. The stud assembly is secured to the base with four bolts which are accessible from the rear of the breaker.
4. Install the new MicroVersaTrip® RMS-9 sensors, positioning them as shown in Figure 2-2. Secure their tap terminal boards to the breaker frame.
5. Replace the stud connector, making sure the Allen-head screws and clamping bolt are sufficiently tightened.

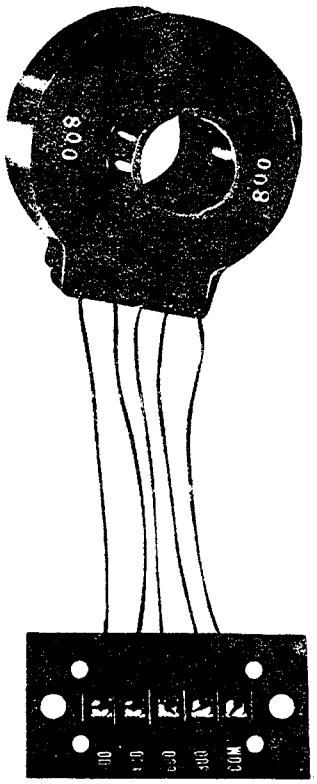
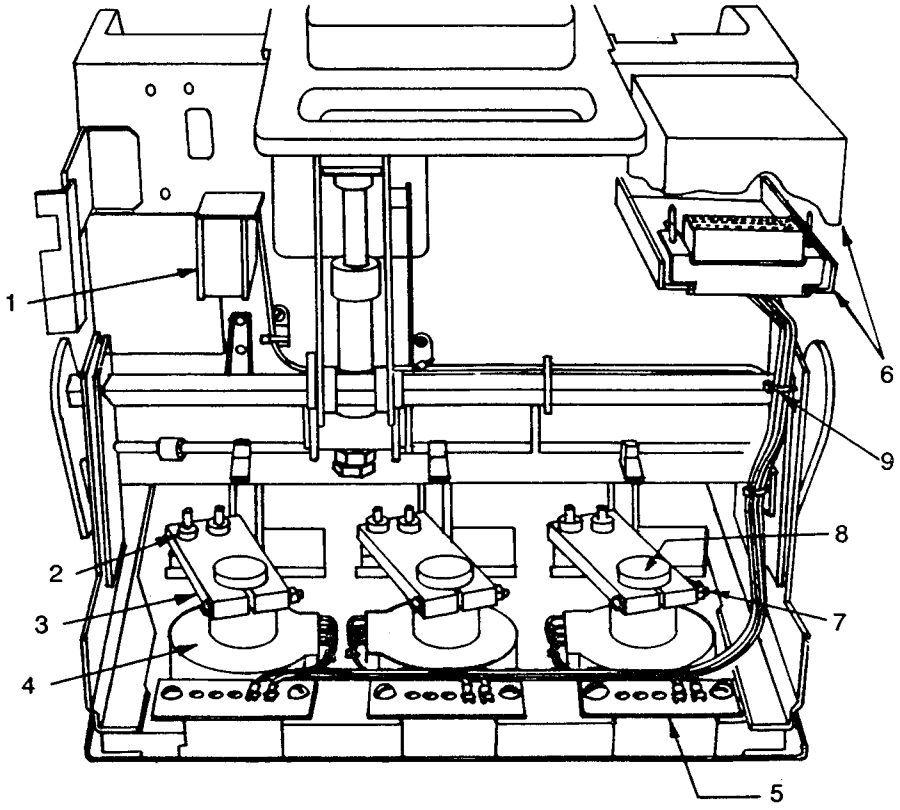


Figure 2-1 MicroVersaTrip® RMS-9 Phase Sensor

1. Flux shift trip device
2. Allen-head screws
3. Stud connector
4. Current sensor
5. Tap terminal board
6. Programmer unit
7. Clamp bolt
8. Sensor stud
9. Phase sensor wire harness



VIEW OF BOTTOM BREAKER

Figure 2-2 MicroVersaTrip® RMS-9 Trip Device System Installation

SECTION 3 Front Frame Conversion

To convert the front frame, replace the flux shifter actuator, programmer mounting bracket, and control harness.

3.1 Flux Shift Trip Device

Replace the SST/ECS flux shifter actuator (Item 1, Figure 2-2) with the MicroVersaTrip® RMS-9 actuator provided. Secure the actuator coil lead harness to the front frame in the same manner as the original coil lead harness. These coil leads must be inserted into the mating programmer connector which is part of the mounting bracket (see section 3.2). The MicroVersaTrip® RMS-9 actuator coil leads are red and white. The SST/ECS actuator leads are red and black.

The trip device requires only one adjustment—the trip rod length. As shown in Figure 3-1, the clearance between the trip rod end and the trip shaft paddle is gaged by a 0.125 inch diameter rod. Adjust gap to 0.125 inch ±0.015 inch. To adjust, open the breaker and restore the breaker mechanism to its reset position. Loosen the jamb nut, rotate the adjuster end until the proper gap is attained, then retighten the jamb nut.

3.2 Programmer Mounting Bracket

The programmer mounting bracket is installed in the same location as the SST/ECS mounting bracket (see Figure 3-2).

1. Before the bracket is installed, the flux shifter actuator coil leads must be inserted into the programmer connector. The necessary connector pins are installed on these leads. Insert the WHITE lead into pin number 28 and the BLACK lead into pin 32. Insert these pins until they snap into place. Verify that they are fully inserted by comparing them with the other pins.
2. Disconnect the programmer control harness and remove the SST/ECS unit.
3. Remove the SST/ECS mounting bracket and replace it with the new mounting bracket. Use the same mounting holes.
4. Secure the phase sensor wire harness to the front frame as shown in Figure 2-2.

An AMP extraction tool (Cat. No. 455822-2) is provided to remove the socket leads from the AMP programmer connector.

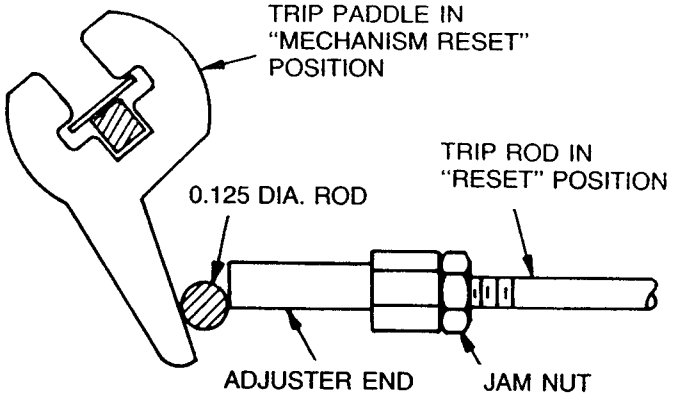
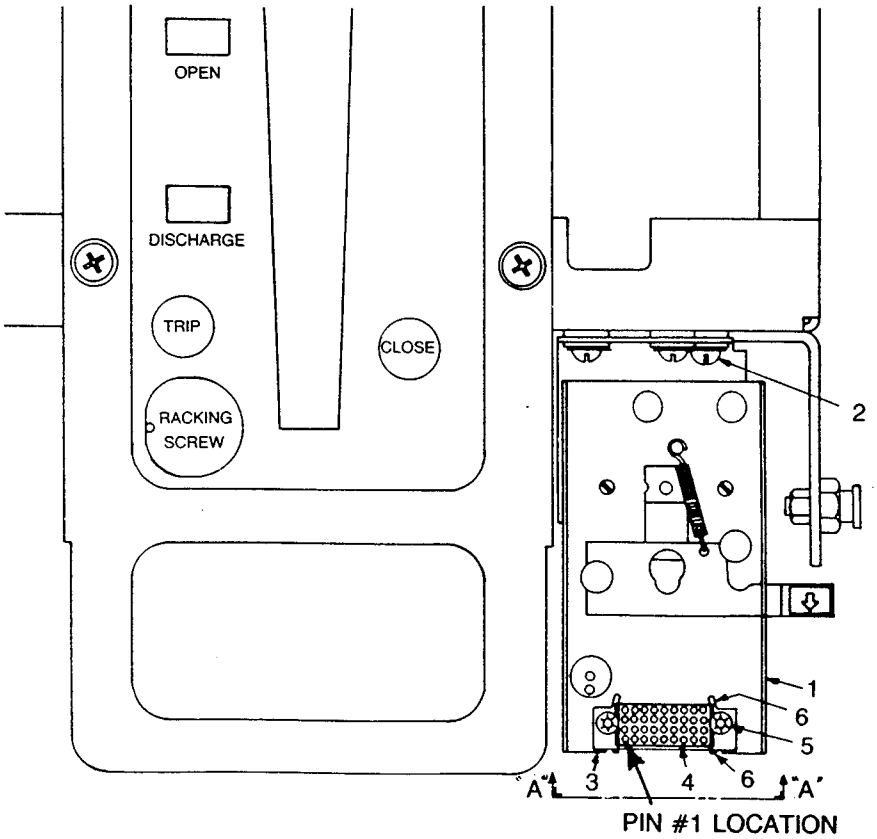


Figure 3-1 Trip Rod Adjustment



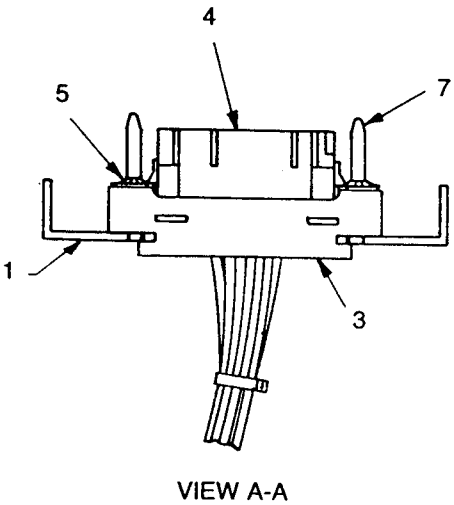


Figure 3-2

SECTION 4 4-WIRE GROUND FAULT

The MicroVersaTrip® RMS-9 ground fault option requires an additional neutral sensor when used on a 4-wire system with its neutral grounded at the transformer. The phase sensors are mounted on the breaker, but the neutral sensor is inserted in the neutral which is part of the equipment. The neutral sensor is connected to the breaker through the 4th wire neutral disconnect.

4.1 Draw-out Breaker Conversion

The 4th wire disconnect is mounted to the lower rear back frame on the centerline of the left pole as shown in Figure 4-1.

1. If the disconnect is existing, just replace the control harness. Maintain the following color code:
   WHITE—Common
   BLACK—Tap
2. If the disconnect is being added, mount the disconnect assembly and run the control harness as shown in Figure 4-1.

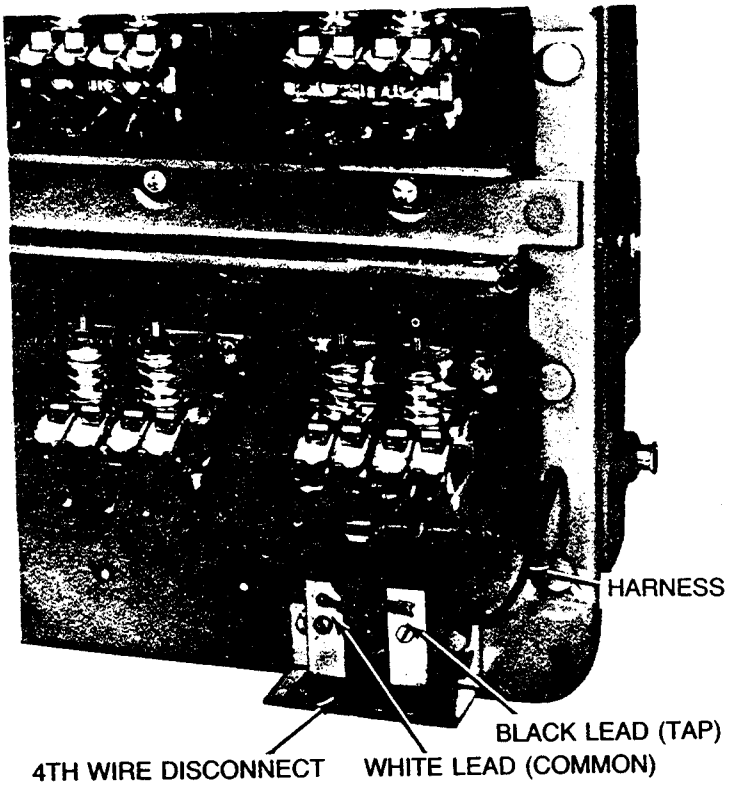


Figure 4-1 4th Wire Disconnect Breaker Mounted

4.2 Stationary Breaker Conversion

The 4th wire disconnect is a terminal board located behind the programmer. It is assembled to a bracket attached to the side of the front frame where the racking mechanism support plates would be mounted (see Figure 4-2).

1. If the terminal board exists, just replace the control harness. Maintain the following color code:
   WHITE—Common
   BLACK—Tap
2. If the terminal board assembly is being added, mount it as shown in Figure 4-2.

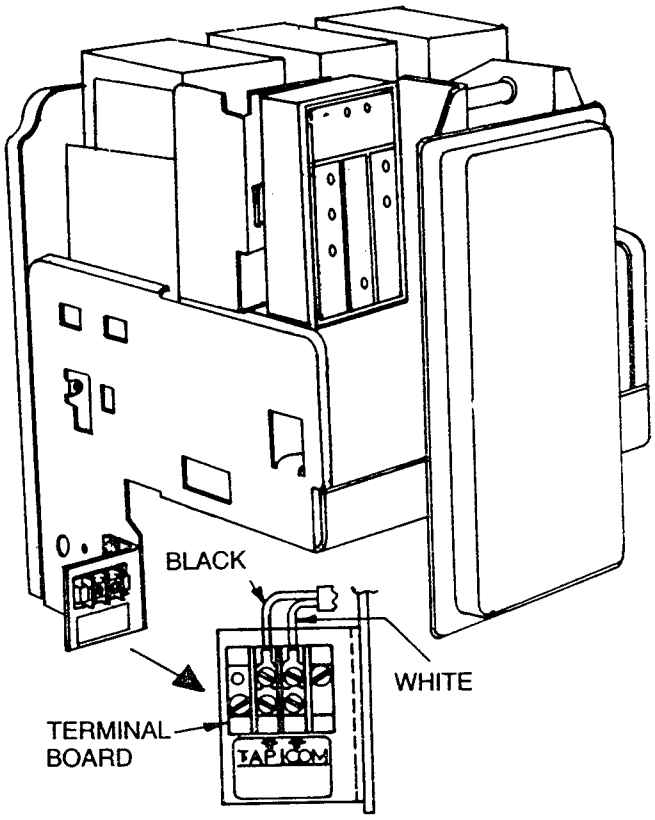


Figure 4-2

SECTION 4 4-Wire Ground Fault

4.3 Equipment Conversion

The equipment compartment contains the mating portion of the 4th wire disconnect and the neutral sensor. The neutral sensor is discussed in Section 4.4.

The AKD-5/6 and substructure-type equipment compartments use the same disconnect assembly. The support bracket for the disconnect assembly is different for each equipment type. This conversion kit provides the brackets. Refer to Table 4.1 and Figures 4-3 and 4-4 for mounting bracket installation details.

TABLE 4-1

Legend for Figures 4-3 AND 4-4

ITEM NO.	DESCRIPTION
1	Equipment Portion 4th Wire Disconnect
2	Mounting Brackets
3	10-32 Mounting Screws
4	10# Lock Washer
5	10# Flat Washer
6	¼-20 Mounting Screws

4.4 Neutral Sensors

The neutral sensor is an electrical duplicate of the phase sensor when wired to the tap which equals the phase sensor rating.

Mount the neutral sensor in the outgoing neutral lead, normally in the equipment's bus or cable compartment. **Be sure to observe the sensor's LINE and LOAD directional markings.** See Figure 4-5 for the sensor's bar drilling plan. Check to insure that the neutral and phase sensors match, i.e., have the same ampere range (see Tables 1-2 and 1-3). Refer to Figure 4-6 for additional neutral sensor installation information.

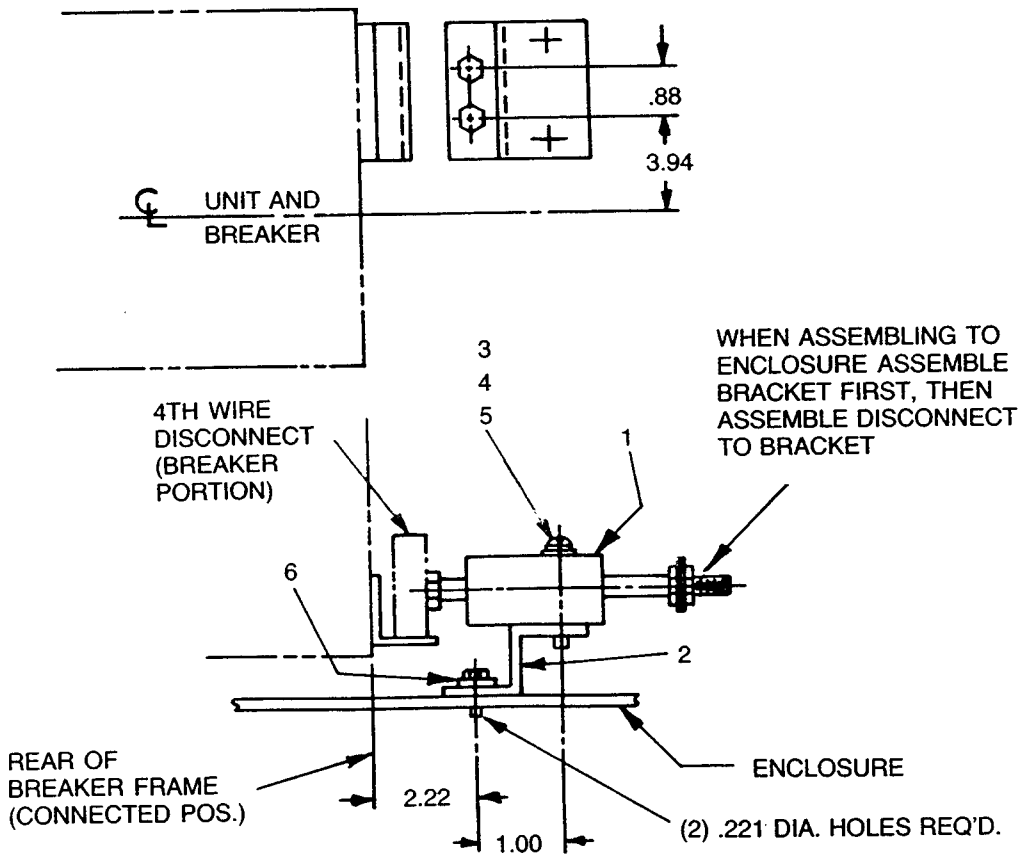


Figure 4-3 4th Wire Disconnect Installation—Type AKD-5/6

SECTION 4 4-Wire Ground Fault

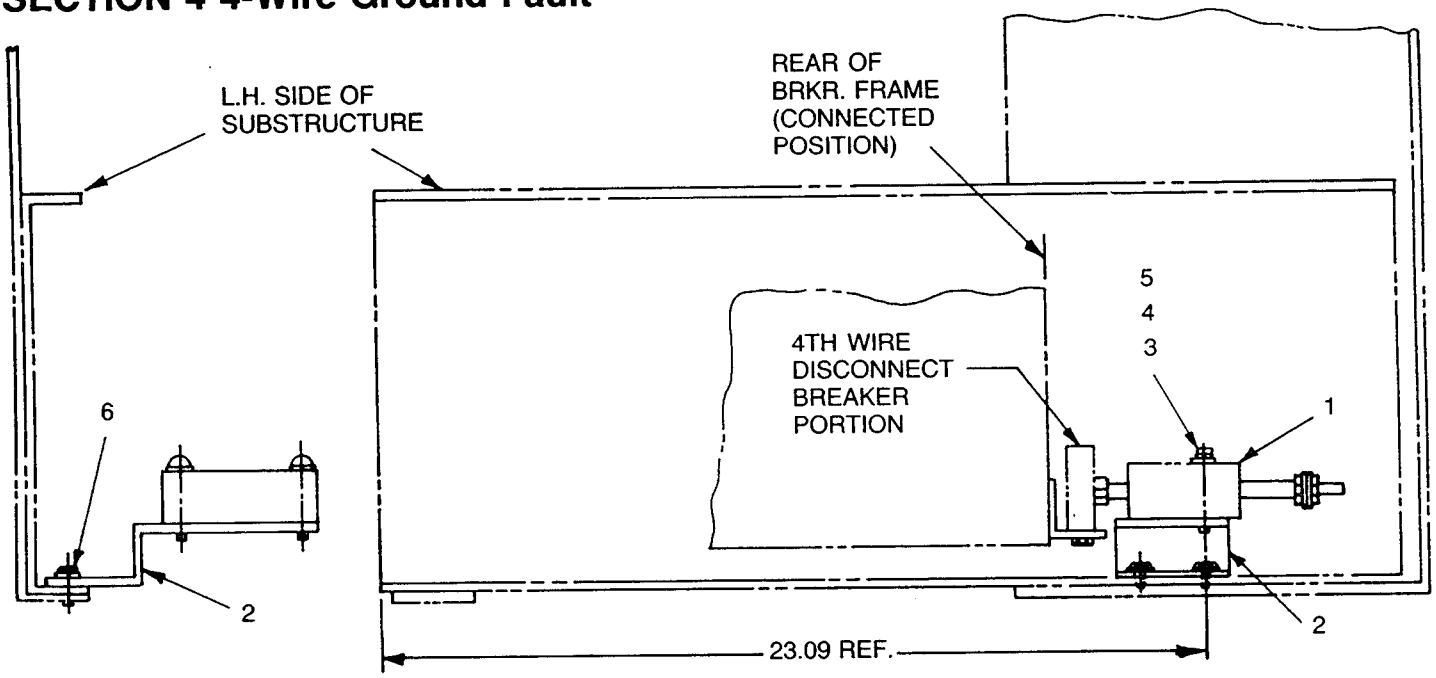
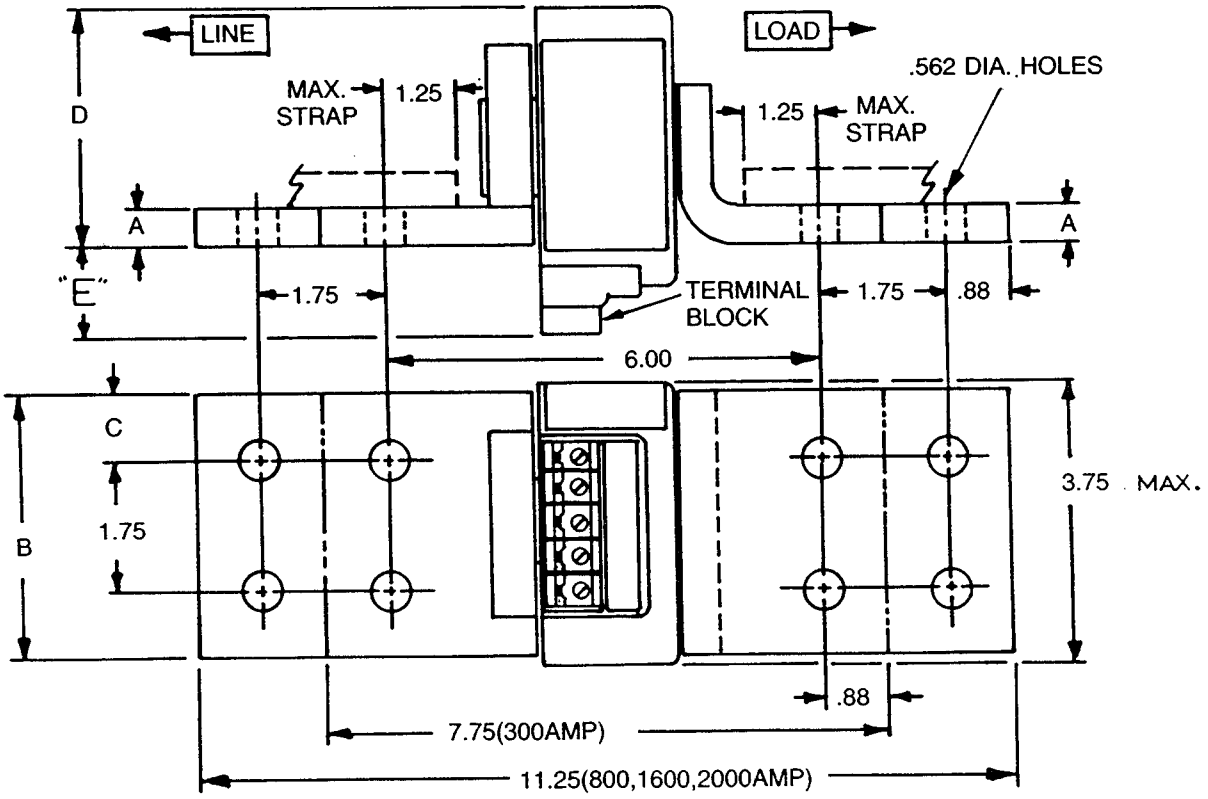


Figure 4-4 4th Wire Disconnect Installation—Substructure



SENSOR CAT. NO.	AMPERE RANGE	A	B	C	D	E
TSVG303BK	100-300	.250	3.25	.75	3.20	1.30
TSVG508BK	300-800	.250	3.25	.75	3.20	1.30
TSVG516BK	800-1600	.500	3.62	.94	3.20	1.30
TSVG620BK	800-2000	.625	3.25	.75	3.33	1.18

Figure 4-5 Neutral Sensor Outline

SECTION 4 4-Wire Ground Fault

4.5 INSTALLATION NOTES

- Observe LINE and LOAD markings when making bus or cable connections.
- Bond sensor on LINE side only.
- Maintain polarity of sensor secondary leads when connecting to breaker, i.e., TAP to TAP, COM to COM.

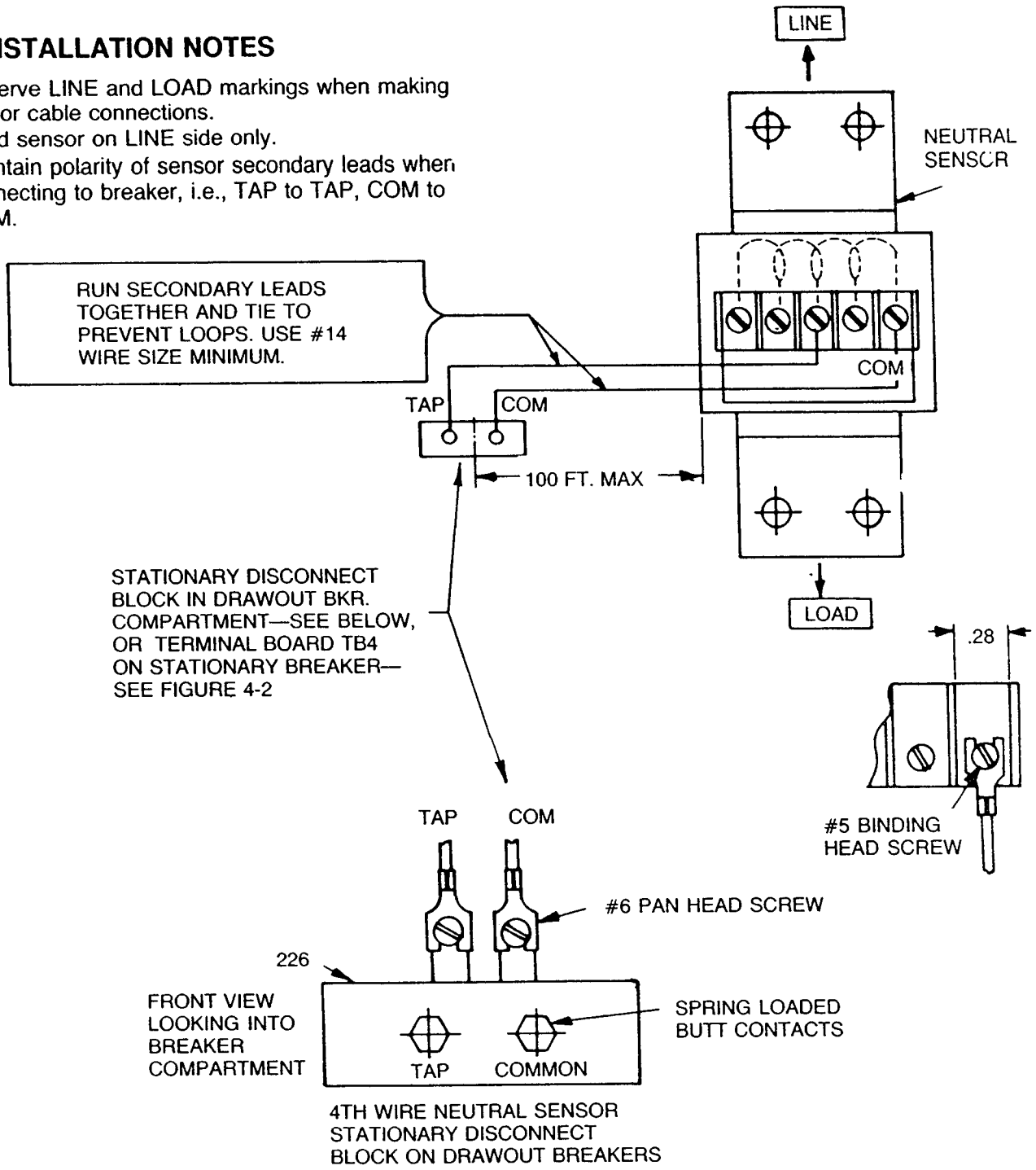
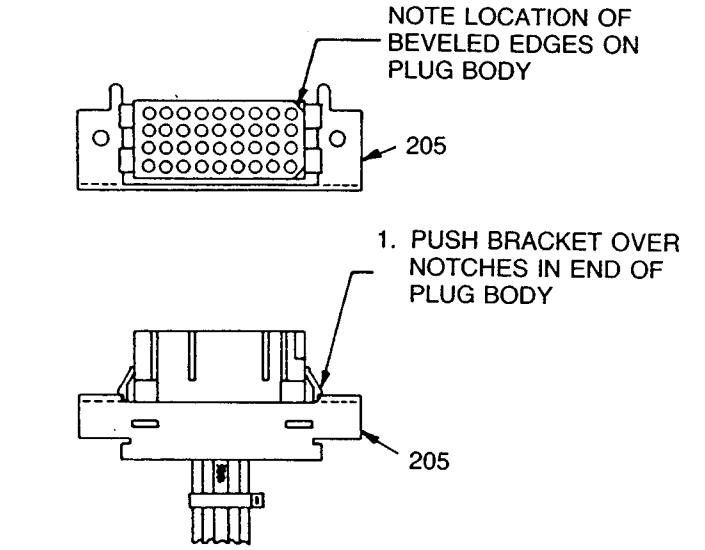


Figure 4-6 Connecting the 4th-wire neutral sensor.

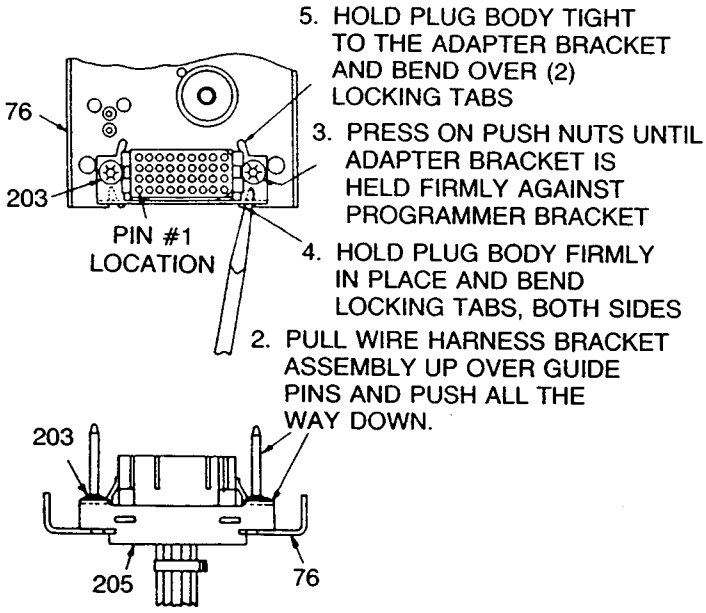
SECTION 5 Programmer Installation

Prior to installing the MicroVersaTrip® RMS-9 programmer, an adapter bracket (205) must be first assembled to the 36-pin programmer connector—see Figure 5-1.

1. Assemble adapter bracket (205) to 36-pin programmer connector (with bevels to right side) by pushing bracket over notches in ends of plug body (step ①). Follow steps ② through ⑤ of Figure 5-1 to complete assembly of programmer harness to programmer bracket.
2. Install the programmer as follows:
   - **a.** Insert the guide pins into the holes, and push on the programmer. This will engage the connector and release the locking level which will then move upwards.
   - **b.** Verify that the locking lever did engage the programmer pin.
3. Remove the programmer as follows:
   - **a.** Move the locking lever to a horizontal position, releasing the programmer pin.
   - **b.** Remove the programmer.



PROGRAMMER HARNESS PLUG SUB-ASSEMBLY



PROGRAMMER HARNESS PLUG TO PROGRAMMER BRACKET

Figure 5-1 Harness Connector

SECTION 6 Testing and Troubleshooting

Once the breaker has been converted, and before it is energized, it must be tested as described in Section 6.1. If any problems develop with the trip device system, refer to Section 6.2 and 6.3 for trouble-shooting details.

6.1 Testing

Before returning a converted breaker to service, perform the following steps:

a. Verify that the programmer is securely installed. The phase sensors **MUST NOT** be energized if they are open-circuited.

b. Megger breaker primary circuit using a 1000 volt megger.

c. Check the trip device system by either of two methods:

1. Conduct high-current, single phase tests on the breaker using a high-current, low-voltage test set.

NOTE: For these single-phase tests, special connections must be employed for MicroVersaTrip RMS-9 breakers equipped with ground fault. Any single-phase input to the programmer circuit will generate an unwanted "ground fault" output signal which will trip the breaker. This trip signal can be nullified by testing two poles of the breaker in series.

2. Test the components of the MicroVersaTrip RMS-9 system using portable test set Cat. No. TVRMS. The applicable test procedures are detailed in instruction book GEK-64464.

SECTION 6 Testing and Troubleshooting

6.2 Troubleshooting

When malfunctioning is suspected, the first step in troubleshooting is to examine the circuit breaker and its power system for abnormal conditions such as:

a. Breaker tripping in proper response to overcurrents or incipient ground faults.

b. Breaker remaining in a trip-free state due to mechanical interference along its trip shaft.

c. Inadvertent shunt trip activations.

WARNING: DO NOT CHANGE TAPS ON THE CURRENT SENSORS OR ADJUST THE PROGRAMMER UNIT SET KNOBS WHILE THE BREAKER IS CARRYING CURRENT.

Once it has been established that the circuit breaker can be opened and closed normally from the test position, attention can be directed to the trip device proper. Testing is performed as described in Section 6.1.

6.2.1 Resistance Values

For use in troubleshooting the MicroVersaTrip® RMS-9 phase sensors, the resistance of the windings is given in Table 6-1.

Table 6-1—Fixed Sensor Resistance Values

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

The coil resistance of the MicroVersaTrip flux shifter device is approximately 7 ohms.

6.3 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. As indicated by the cabling diagram of Figure 6-2, each phase sensor is connected to summing circuitry in the programmer. Under no-fault conditions on 3-wire load circuits, the currents in this circuitry 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 programmer unit can cause a false trip signal.

If nuisance tripping is encountered on any breaker whose MicroVersaTrip® RMS-9 components have previously demonstrated satisfactory performance via the TVRMS test set, the sensors and their connections should be closely scrutinized. After disconnecting the breaker from all power sources:

1. Check that all phase sensors are the same type (ampere range).
2. Insure that the tap settings on all 3-phase sensors are identical.
3. Verify that the harness connections to the sensors meet the polarity constraints indicated by the cabling diagram.
4. On ground fault breakers serving 4-wire loads, check that the neutral sensor is properly connected (see cabling diagram Figure 6-3). In particular,

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. Verify that on breakers where the lower studs connect to the supply source, the neutral sensor has its LOAD end connected to the source. See Figure 6.4.

d. Insure that the neutral conductor is carrying only that neutral current associated with the breaker's load current (neutral not shared with other loads).

5. If the preceding steps fail to identify the problem, measure the sensor resistances. Since the phase and neutral sensors are electrically identical, their tap-to-tap resistances should closely agree. See Table 6-1.

6.4 MicroVersaTrip Cabling Diagrams

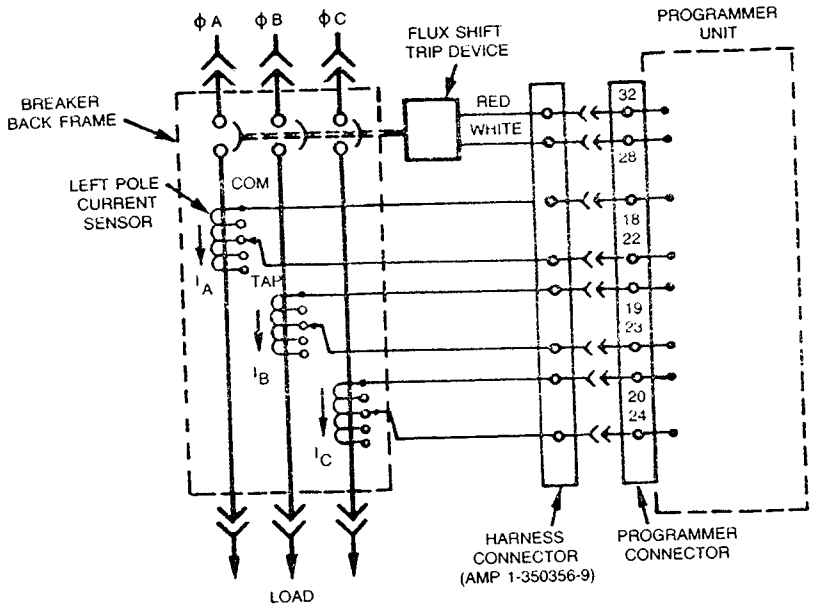


Figure 6-1 Cabling Diagram—MicroVersaTrip® RMS-9 Without Ground Fault

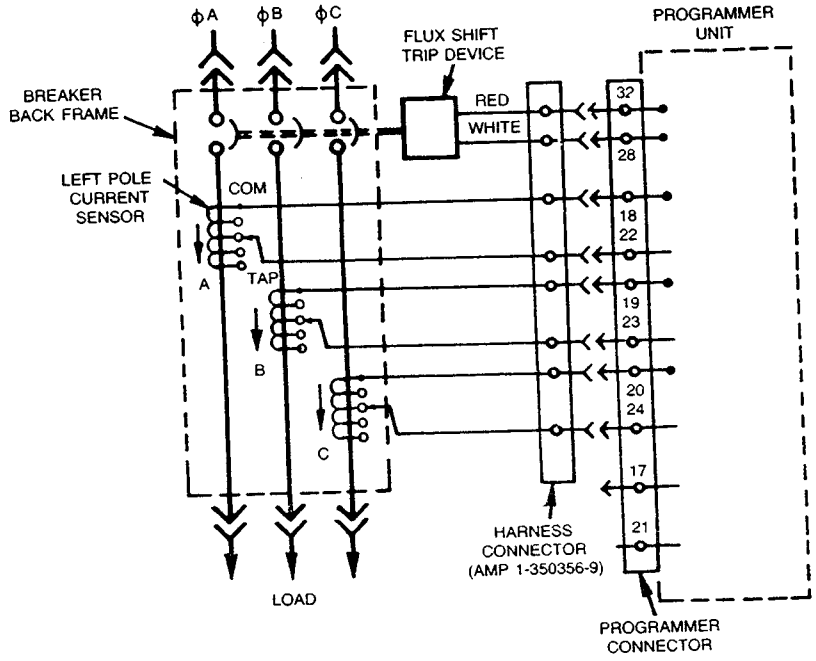


Figure 6-2 Cabling Diagram—MicroVersaTrip® RMS-9 With Ground Fault On 3-Wire Load

6.4 MicroVersaTrip Cabling Diagrams

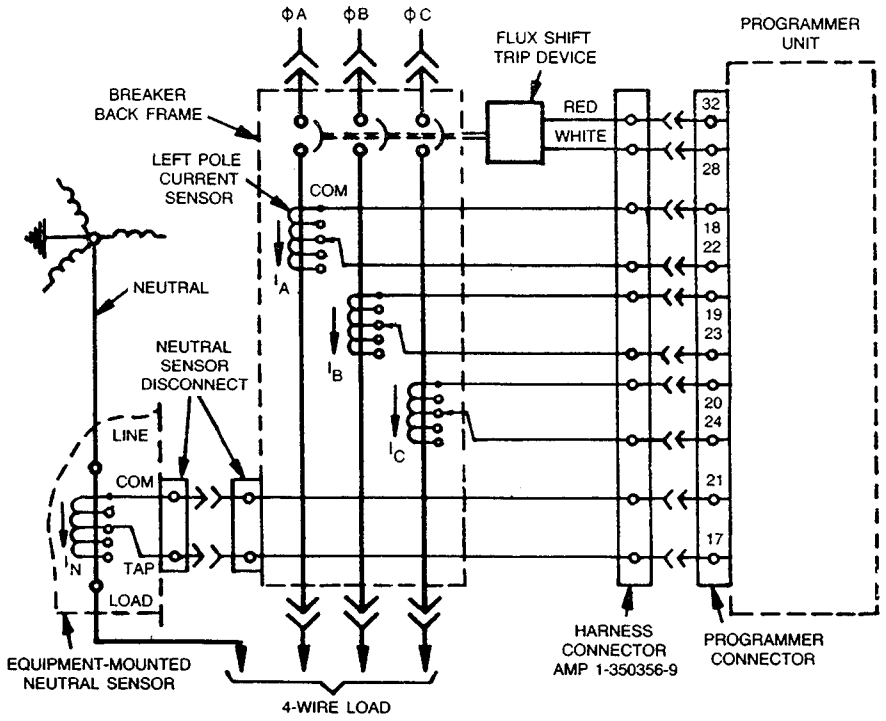


Figure 6-3 Cabling Diagram—MicroVersaTrip With Ground Fault On 4-Wire Load

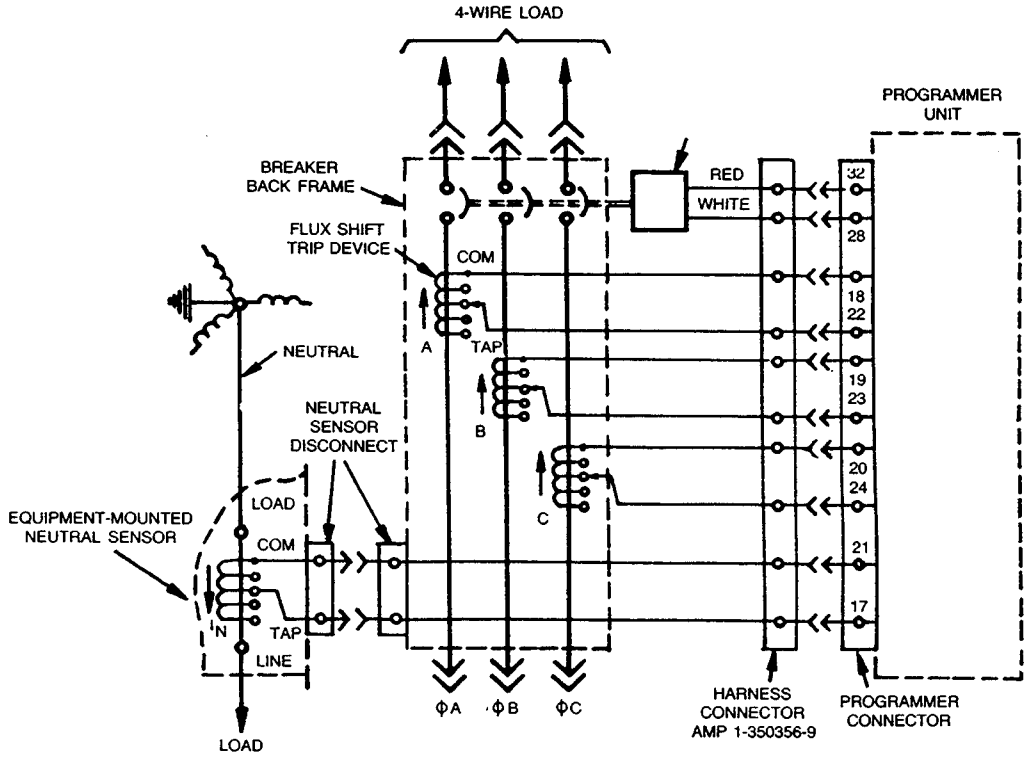


Figure 6-4 Cabling Diagram—MicroVersaTrip With Ground Fault on 4-Wire Load —Breaker Reverse Fed

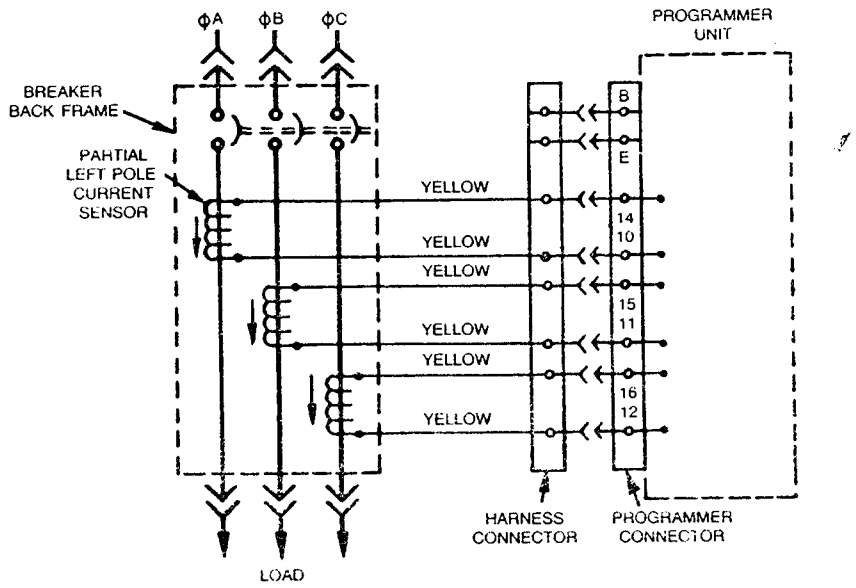


Figure 6-5 Partial Cabling Diagram: 'H'-Option Winding Connections

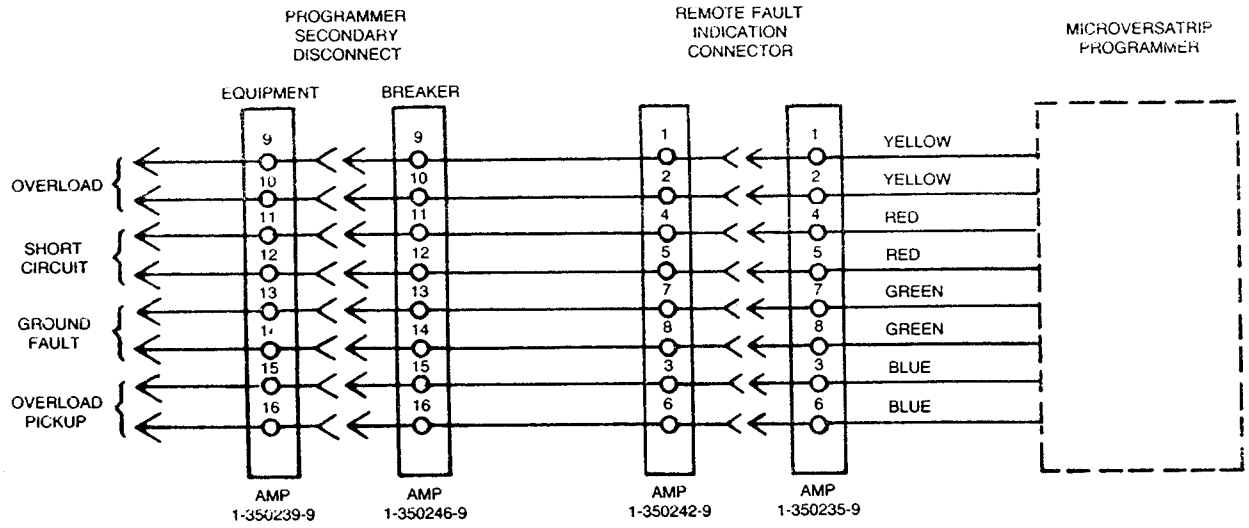


Figure 6-6 Cabling Diagram—Remote Fault Indication

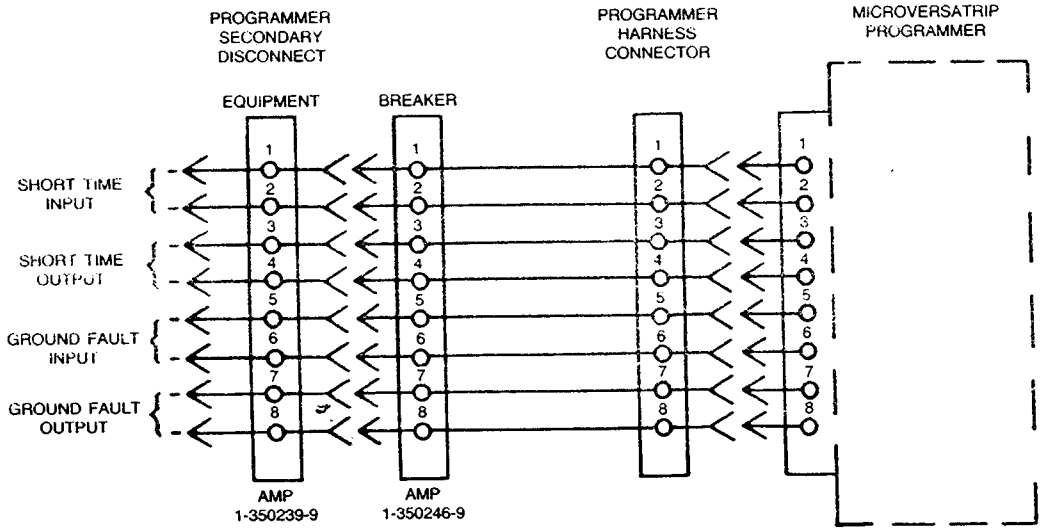


Figure 6-7 Cabling Diagram—Zone Selective Interlock