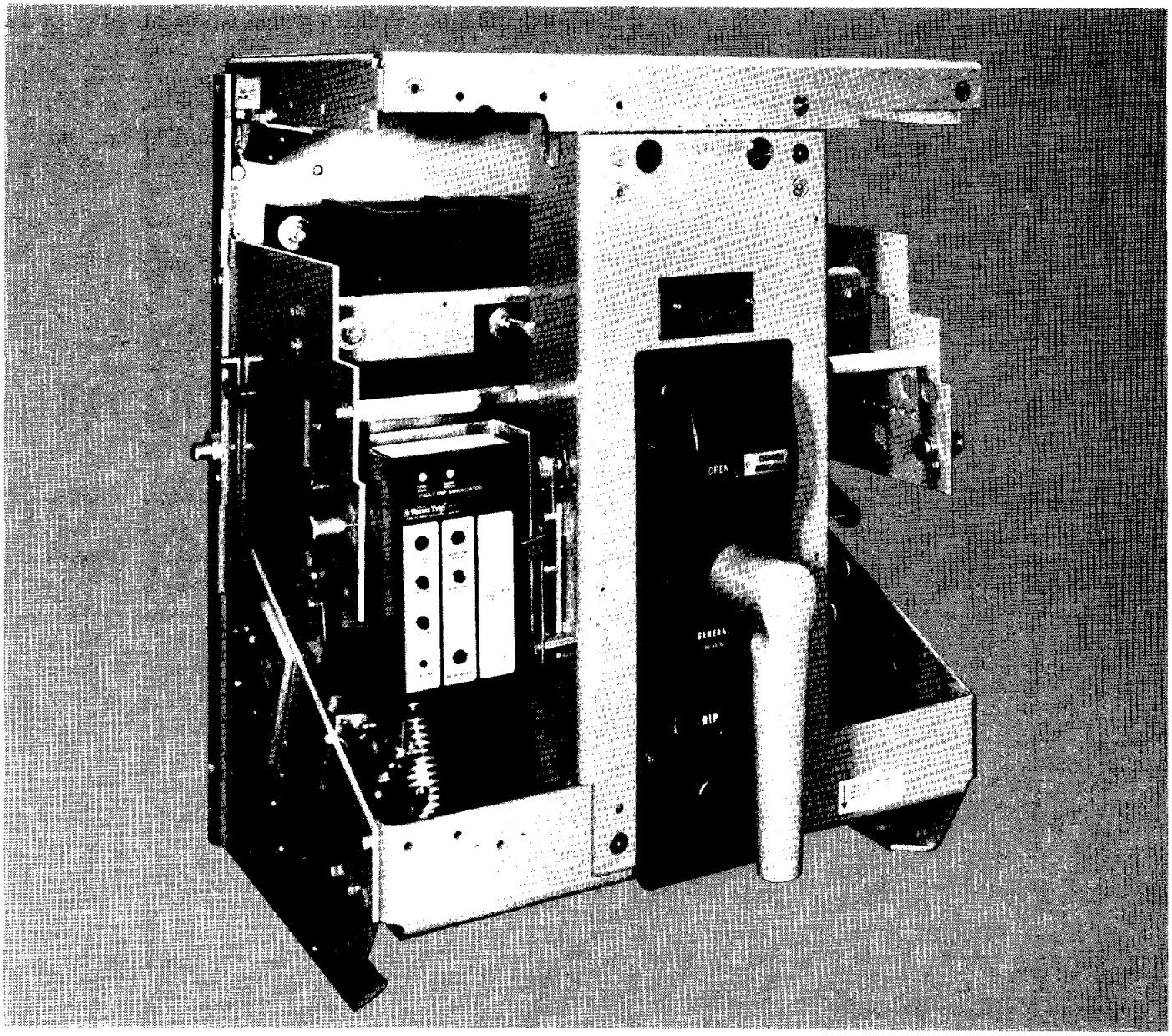
GEK-64468

Installation
Manual

MicroVersaTrip™ Conversion Kits

Breaker Types AK/AKU/AKT-50, AKS/AKSU/AKST-50, AK/AKR-75, AK/AKR-100



GENERAL ELECTRIC

MicroVersaTrip™ Conversion Kits

Table of Contents

CONTENTS

SECTION 1—Introduction

1.1—General Information

These instructions cover installation of the MicroVersaTrip™ solid-state, trip-device, conversion kits on the AK/AKR-75/100 and AK/AKS-50 breakers listed in Table 1-1. Each kit contains the necessary material to convert from existing EC, Power Sensor, ECS or SST trip device systems.

Kit installation is straightforward but does require careful workmanship and attention to these instructions. Familiarity with the breaker itself is highly desirable. The general approach is to first strip the breaker of its existing trip devices, then install the MicroVersaTrip™ components. Following this procedure, the converted breaker is performance tested, prior to restoring the breaker to service.

For the majority of breaker models listed in Table 1-1, kit installations do not require any customized assembly work. However, some conversions may involve unusual mounting circumstances or accessory combinations which necessitate minor modification/relocation of a component(s). In most instances this supplementary work can be done on site.

Preparatory to beginning the conversion, the installer should verify that the correct kit, current sensors and programmer unit have been furnished—see Tables 1-2 through Table 1-5. 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, assuming that as part of a conversion the breaker's trip elements are to be changed from LI to LS, then the short time rating would govern the application.

As a service related consideration, the installation of the MicroVersaTrip™ kits provides an excellent opportunity to perform normal maintenance on the breaker proper, particularly while the front and back frames are separated. Such procedures are described in the Maintenance Manuals listed in Table 1-6. Also, any renewal parts required are listed in the Renewal Parts Bulletins given in Table 1-6. If required, copies of these publications are available from the factory.

> **NOTE:** Although designed specifically for the breaker models in Table 1-1; these kits in many instances can be employed for conversion of the earlier AK-1-50/75/100 types. Undertaking such conversions should be a local decision and may involve additional modification depending upon the breaker's vintage and its accessory complement.

Table 1-1—Basic MicroVersaTrip™ Conversion Kits

Breaker Type	Cat. No. 343L821G			
	Drawout		Stationary	
	With 4th Wire Ground Fault	Without 4th Wire Ground Fault	With 4th Wire Ground Fault	Without 4th Wire Ground Fault
AK-50 AKT-50 AKU-50	4	5	6	5
AKS-50 AKST-50 AKSU-50	11	12	13	12
AK-75	7	8	N/A	N/A
AK-100	9	10	N/A	N/A
AKR-75	23	24	25	24
AKR-100	17	18	19	18
AKR-W-100	20	21	22	21

N/A—Not Available

Table 1-2—Neutral Sensors

Breaker Frame Size	Sensor Ampere Range	Cat. No.
1600	300-800	TSVG508BK
	600-1600	TSVG516BK
2000	800-2000	TSVG620BK
3000	1200-3000	TSVG830BK
3200	1200-3200	TSVG832BK
4000	1600-4000	TSVG940BK

Table 1-3—Current Sensors

Breaker Type	Sensor Ampere Range	Cat. No.
AK/AKS-50 AKU/AKSU-50	300-800	193A1439G14
	600-1600	193A1439G15
AKT/AKST-50	800-2000	193A1439G16
AK-75	1200-3000	Included With Basic Kit
AKR-75	1200-3200	
AK/AKR-100	1600-4000	

Table 1-4—Basic Programmer Catalog No.

Breaker Frame Size	Cat. No.
1600	TA9VT20
2000	
3000	TA9VT32
3200	
4000	TA9VT40

Table 1-5—MicroVersaTrip™ Programmer Functions

Note: Add suffix letters to basic programmer Cat. No. in sequence shown		Programmer Suffix Letters						
			Optional Functions					
		STD②	S	-or M	L	G	-or GR	A1
Long Time	• Adjustable current setting	X	X	X				
	• Adj long-time pickup	X	X	X				
	• Adj long-time delay	X	X	X				
	• Long-time timing light	X	X	X				
Short-Time	• Adj short-time pickup		X	X				
	• Adj short-time delay		X	X				
	• Short-time I^2t switch③				X			
Instantaneous	• Adj instantaneous pickup	X	X					
Ground Fault	• Adj ground fault pickup④ —1-ph, 2-w; 3-ph, 3-w; 3-ph, 4-w —Ground return					X	X	
	• Adj ground fault delay					X	X	
Other Functions	• Trip indication targets —Overload & short circuit —local only —O/L S/C and ground fault —local only					X	X	X

② No suffix is required for standard.

③ Requires short-time function.

④ Order neutral current transformer for conversion kit by catalog number when present. See Table 1-2.

Table 1-6—Related Publications

Breaker Type	Maintenance Manual	Renewal Parts Bulletin
AK/AKU/AKT-50	GEK-7303 GEI-86135	GEF-4150
AK-75		GEF-4395
AK-100		GEF-4396
AKS/AKSU/AKST-50	GEK-64460	GEF-4150
AKR-75		GEF-4552
AKR-100		GEF-4552

SECTION 2—Front Frame Conversion

2.1—General Information

The Front Frame Conversion consists of the following:

1. Relocating the W Relay on quick-close, electrically operated, Type AK-50/75/100 breakers equipped with EC trip devices.
2. Remounting the X Relay on the same breakers described above.
3. Installing the Flux Shifter device.
4. Installing the Programmer Mounting bracket.
5. Installing the Programmer Wire harness.

2.2—Breaker Disassembly

WARNING: BEFORE STARTING ANY WORK, DISCONNECT THE BREAKER FROM ALL POWER SOURCES (PRIMARY AND SECONDARY) AND PLACE IN A CLEAN WORK AREA.

Verify the breaker is OPEN. Referring to the appropriate Maintenance Manual, See Table 1-6, separate the breaker's front and back frames.

2.3—Remounting W and X Relays

Type AK-2/2A Breakers (EC trip devices) electrically-operated with quick-close may require the relocation of their anti-pump, W-Relay to insure proper space for the MicroVersaTrip™ programmer unit. On these breakers, the W Relay normally mounts on the left side of the center channel, sharing a common mounting bracket with the X Relay as shown in Fig. 2-1.

Remove the W-relay and using the new mounting bracket provided, See Fig. 2-2, relocate the mounting bracket to the upper-left side of the front frame, as shown in Fig. 2-1.

Remove the X Relay and its mounting bracket. Using the new bracket provided, see Fig. 2-2, remount the X Relay in its existing location, as shown in Fig. 2-1.

Type AKR and AKS Breakers do not require remounting of their W and X Relays.

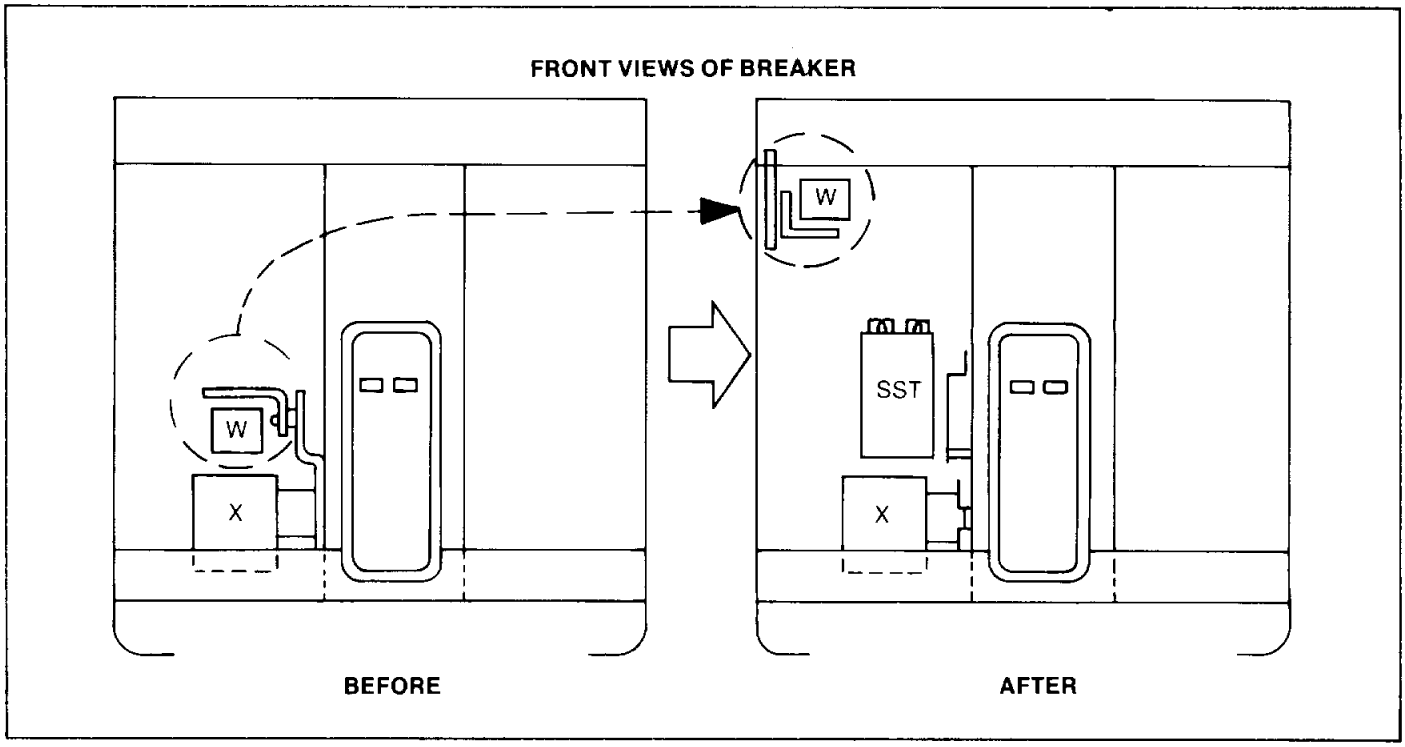


Fig. 2-1. Relocating W-relay and remounting X-relay

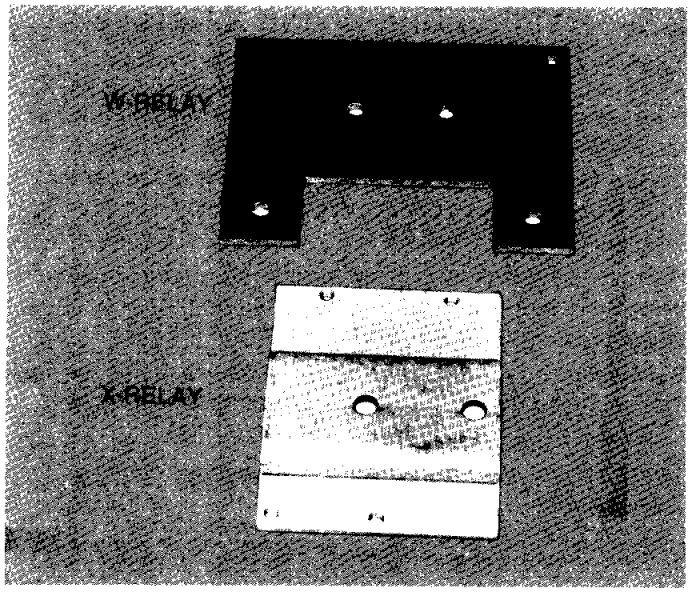
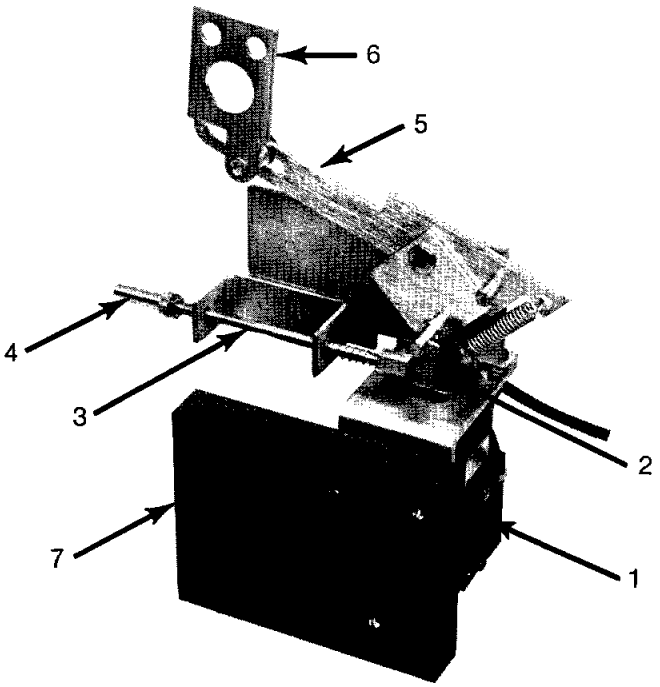


Fig. 2-2. New W and X relay mounting brackets



1. Actuator
2. Actuator arm
3. Trip rod
4. Trip rod adjuster end
5. Reset linkage
6. Actuator bracket
7. Mounting base

Fig. 2-3. MicroVersaTrip™ flux shifter

2.4—Flux Shifter Installation

The Flux Shifter device is shown in Fig. 2-3. For breakers equipped with an ECS or SST Trip Device system:

1. Remove the ECS or SST Programmer.

2. Remove the existing flux shifter device and the programmer control harness.

3. Install the new flux shifter device, positioning the insulator and programmer connector bracket as shown in Fig. 2-4.

For AK Breakers equipped with EC or power sensor systems, the flux shifter mounting holes must be added to the left side of the front frame. The drill pattern for the required, three (3) 0.209 diameter holes is given in Fig. 2-5.

Install the flux shifter as described in Section 2.4 Step 3 and as shown in Fig. 2.4

> **NOTE:** If the breaker is an AKU-50 fused type, take care to position the Flux Shift Trip device sufficiently upward to avoid interference with the coil of the Open Fuse Lockout (OFLO) device.

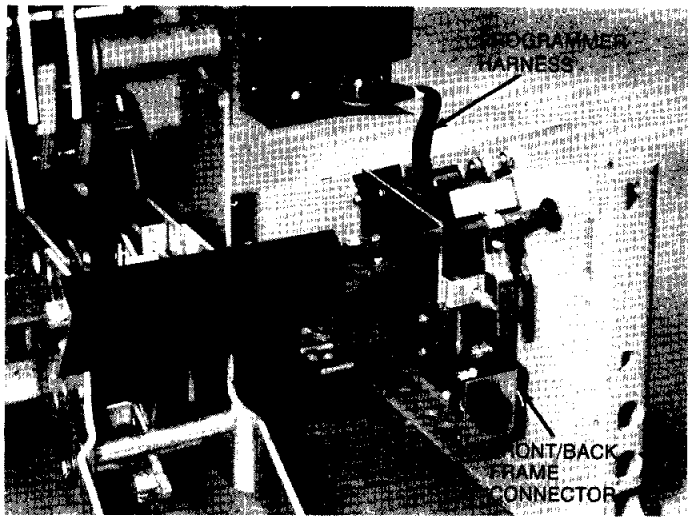


Fig. 2-4. Flux shifter installed

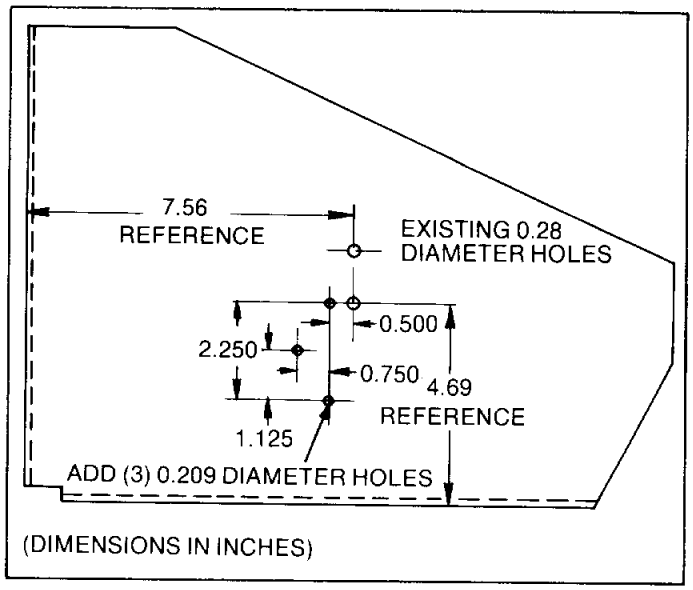


Fig. 2-5. Flux shifter mounting hole pattern

2.4.1—Trip Paddle Installation

For breakers equipped with an ECS or SST system, the existing Flux shifter trip paddle will be used with the new flux shifter.

For all other breakers, the flux shifter trip paddle must be assembled to the trip shaft as shown in Fig. 2-6.

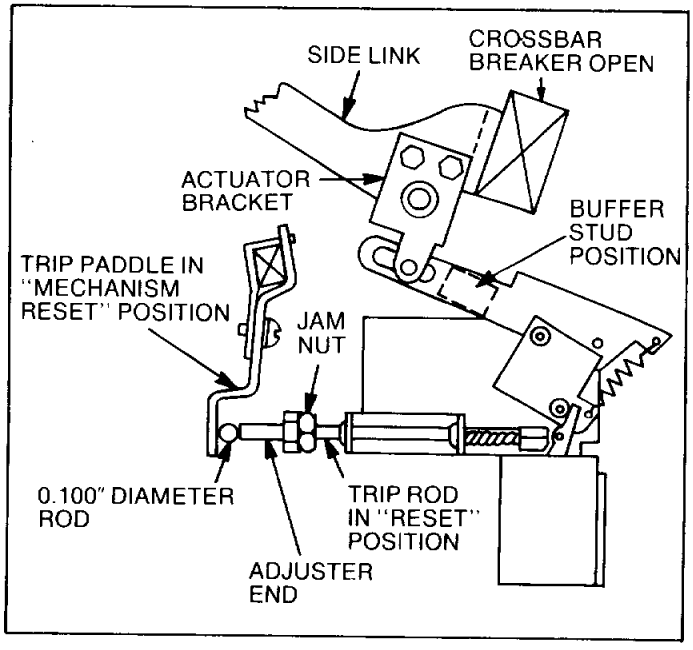


Fig. 2-6. Flux shifter adjustments

2.4.2—Adjustments

Once the flux shifter and its trip paddle are installed and the breaker frames are reassembled, the following adjustments must be made.

1. With the mechanism in the RESET position set the gap between the trip paddle and the end of the flux shifter

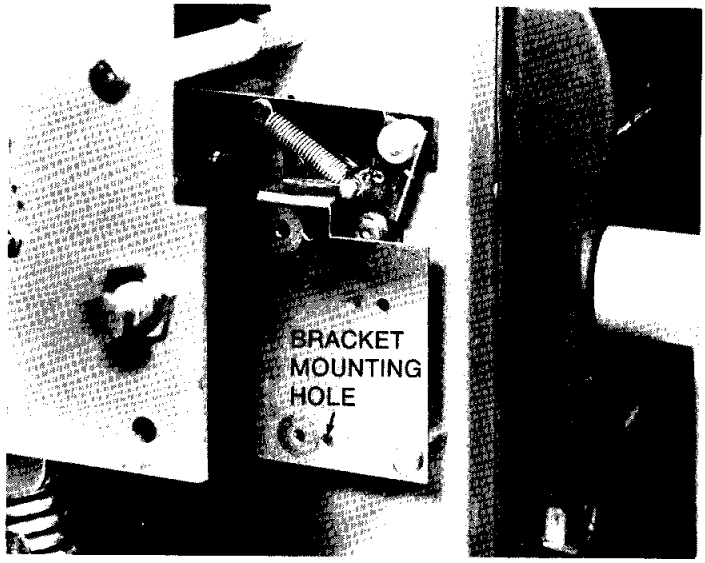
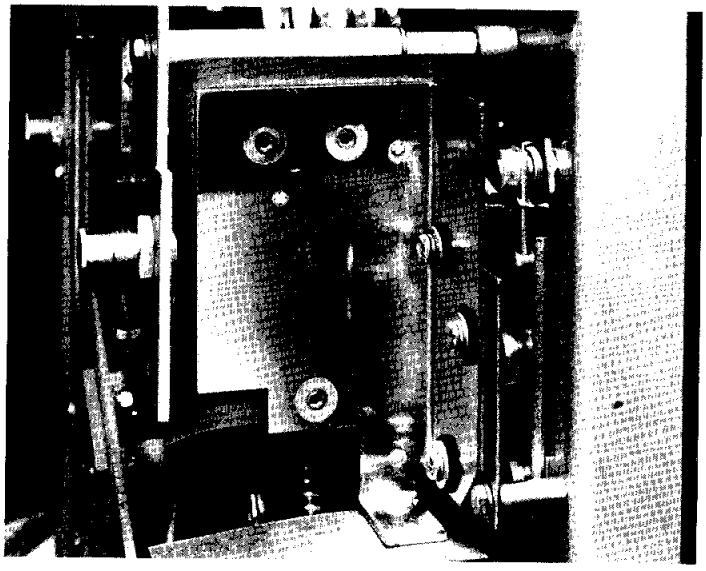


Plate Assembled to Channel



Mounting Bracket Installed To Plate

Fig. 2-7. Programmer mounting bracket and plate

trip rod to 0.100 inches. Use a 0.100 inch diameter rod as shown in Fig. 2-6. Set the adjuster end of the trip rod and lock it in place with the jam nut.

2. As the crossbar travels between the "breaker closed" and "breaker open" positions, the tang of the actuator bracket must clear the buffer stud. If insufficient clearance exists, loosen it's two mounting screws and rotate the bracket clockwise to take up mounting hole slack. Retighten screws.

2.5—Programmer Mounting Installation

The MicroVersaTrip™ Programmer mounts to the left side of the front channel. A mounting bracket is shock mounted to a plate that is assembled to the front channel as shown in Fig. 2-7. Use Loctite or an equivalent retaining material on the mounting screws for the plate assembled to the front channel.

For breakers equipped with an ECS or SST system, replace the existing plate and mounting bracket with the new ones provided. Assemble the mounting bracket to the plate using the holes closest to the front of the breaker. See Fig. 2-7.

For EC or Power Sensor equipped breakers, the holes for the new plate may have to be added to the front channel. The drill pattern for these holes is given in Fig. 2-8. Once the plate is installed, assemble the mounting bracket to the plate using the holes closest to the front of the breaker, See Fig. 2-7.

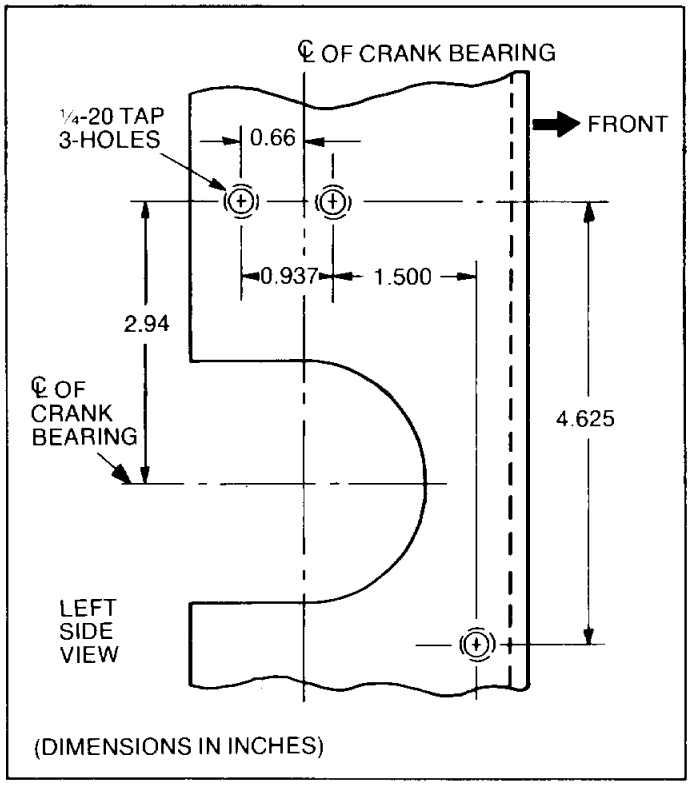


Fig. 2-8. Mounting plate hole pattern

2.6—Programmer Harness Installation

The programmer harness consists of the mating 36 pin programmer connector and the 16 pin front frame half of the front/back frame connector. Insert 36 pin programmer connectors' beveled edges on the right-hand side (front view). Bend Z securing tabs with screwdriver to secure.

The 16-pin connector is inserted into the programmer connector bracket which is part of the flux shifter assembly. See Fig. 2-4. Insert this connector so that the Number 1 pin is towards the breaker's top, right-hand side.

Route the harness under the flux shifter base. Attach the harness to this base using the wire keeper provided.

Install the programmer harness as shown in Fig. 2-4. Include the flux shifter leads with this harness.

Before installing the programmer bracket to the mounting bracket, the flux shifter leads must be inserted into the programmer connector. These leads are color-coded RED and WHITE. The required connector pins are factory installed on the leads. Insert the RED lead into Pin Number 32 and the WHITE lead into Pin Number 28. Insert the pins until they snap into place. Verify that the pins are fully inserted by comparing them with the other pins.

Assemble the programmer bracket to the mounting bracket as shown in Fig. 2-9.

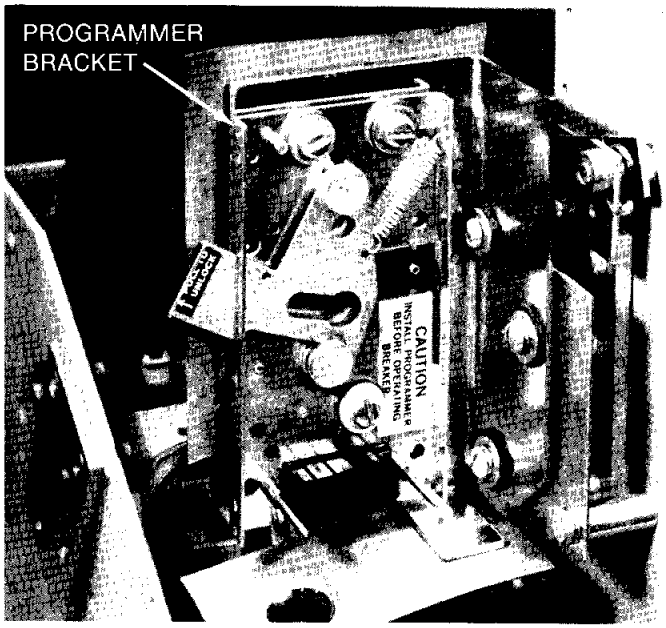


Fig. 2-9. Programmer plate installation

SECTION 3—Back Frame Conversion

3.1—General Information

The back frame conversion consists of the following:

1. Modifying the crossbar assembly for the flux shifter installation.
2. Installing the phase sensors.
3. Installing the back frame harness.

3.2—Crossbar Modification

The flux shifter's reset linkage is driven by the actuator bracket. See Fig. 2-3. The actuator bracket must be assembled to the left side link of the left pole, as shown in Fig. 3-1.

If the actuator bracket mounting holes are not in the left side link, the holes must be added. Drill and tap two (2) five-sixteenths (5/16) of an inch x 18-inch holes using the hole pattern given in Fig. 3-2.

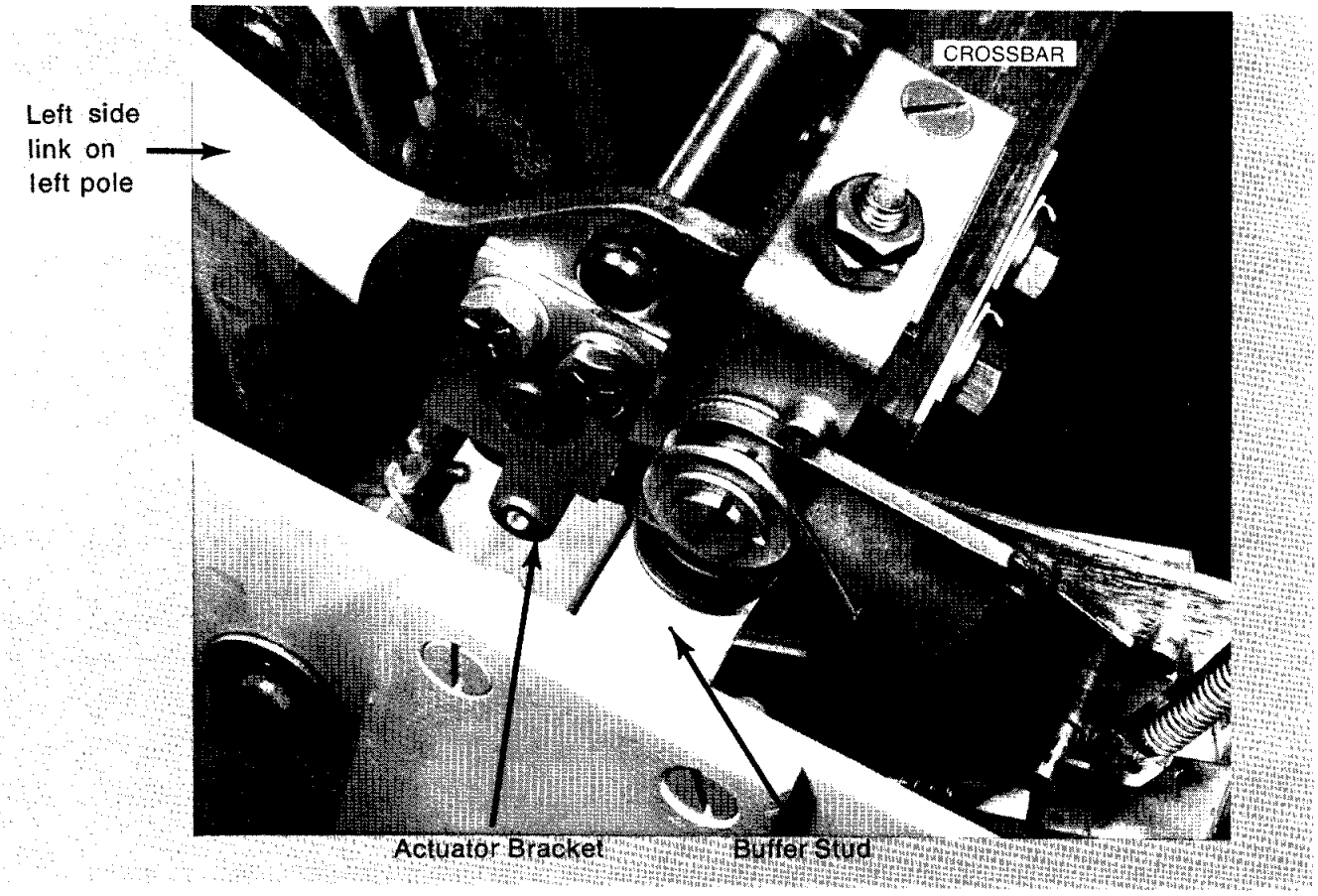


Fig. 3-1. Flux shifter actuator bracket installation

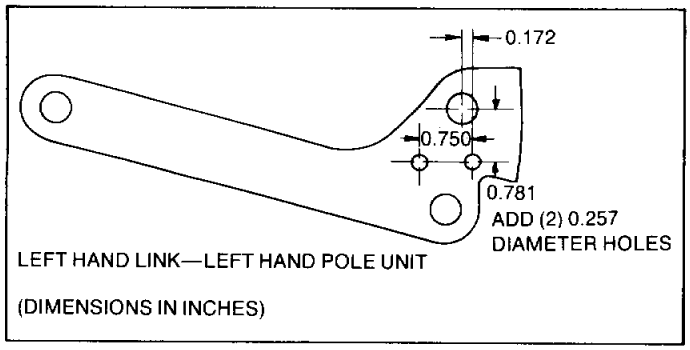


Fig. 3-2. Actuator bracket – mounting hole pattern

SECTION 3 (CONT'D)—Back Frame Conversion

3.3—Phase Sensors—AK/AKS-50

For EC and Power Sensor equipped breakers:

1. Remove the existing trip devices and harnesses.

2. Install the lower adaptor connector, as shown in Fig. 3-3.

3. Install MicroVersaTrip™ phase sensor. Secure sensor to lower adaptor with RTV or equivalent adhesive. Install upper adaptor connector. See Fig. 3-4.

For SST equipped breakers.

1. Replace the existing SST phase sensor with the new MicroVersaTrip™ sensor.

2. Install as shown in Fig. 3-4.

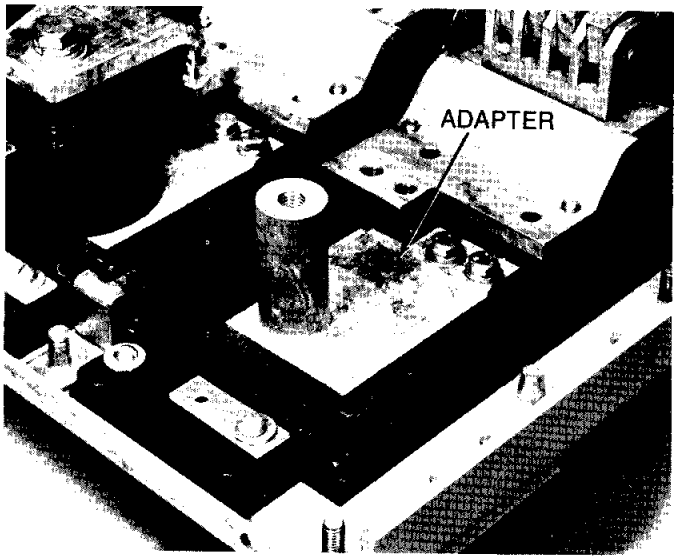


Fig. 3-3. Lower adapter connector

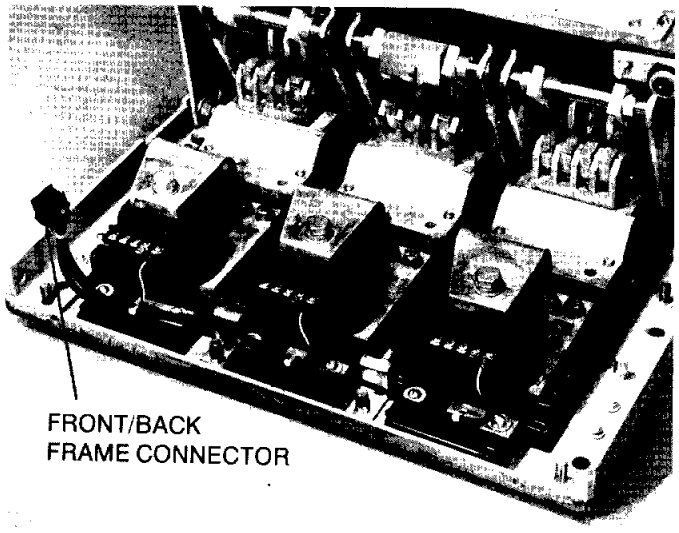


Fig. 3-4. MicroVersaTrip™ phase sensors and harness installed — AK/AKS-50

3.4—Phase Sensors—AKR-75/100

For SST and ECS equipped breakers:

1. Remove the back frame harness from the sensor terminal boards.

2. Remove the primary finger disconnect assemblies from AKD-6 or Substructure breakers (Z long bolts).

3. Remove the locking ring and slide off the phase sensor.

4. Remove the sensor terminal.

5. Install the MicroVersaTrip™ phase sensors as shown in Fig. 3-5. Engage the sensor's anti-turn lugs with the notches in the locking ring.

6. Install the new sensor terminal board. See Fig. 3-5.

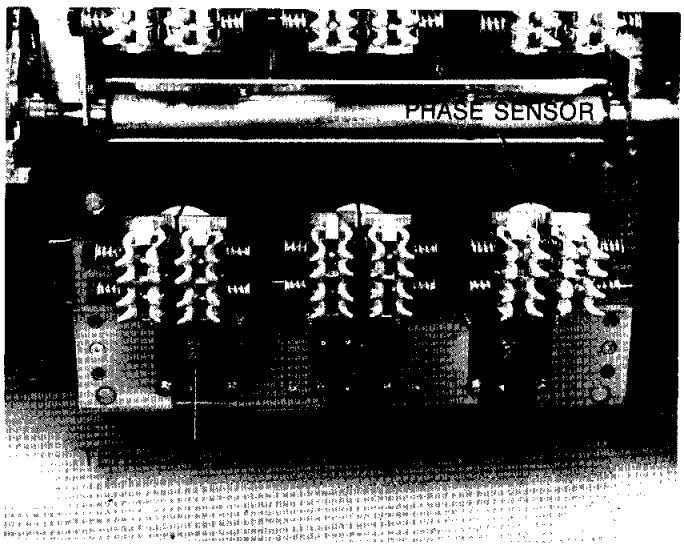


Fig. 3-5. MicroVersaTrip™ phase sensors installed

3.5—Phase Sensors—AK-75/100

For EC and Power Sensor equipped breakers:

1. Remove the existing trip devices and harnesses.

2. The MicroVersaTrip™ sensors mount on the upper-breaker studs. The sensors are held on the stud with the locking rings, as shown in Fig. 3-6. Leave enough of the stud exposed for the primary fingers to engage. Engage the sensor's anti-turn lugs with the notch in the locking ring. Before tightening the locking rings, position each sensor so that its leads will exist between the pole bases, as shown in Fig. 3-8.

3. Mount the three sensor terminal boards to the rear of the back frame as shown in Fig. 3-8 using the hardware provided.

4. Form each sensor's leads downward between the pole bases and thru the hole in its terminal board as shown in Fig. 3-8. Wire tie and solder to the terminals as indicated. Be sure to position wire colors as shown.

For SST equipped breakers:

The MicroVersaTrip™ sensor is physically identical to the SST sensor. Follow the basic procedure given above and replace the SST with the MicroVersaTrip™ sensor.

Fig. 3-6. Phase sensors installed — AK-75/100

3.6—Backframe Harness Installation

Install the Backframe Harness as shown in Fig. 3-4 or Fig. 3-7. Wire ties used to form and secure the harness are provided.

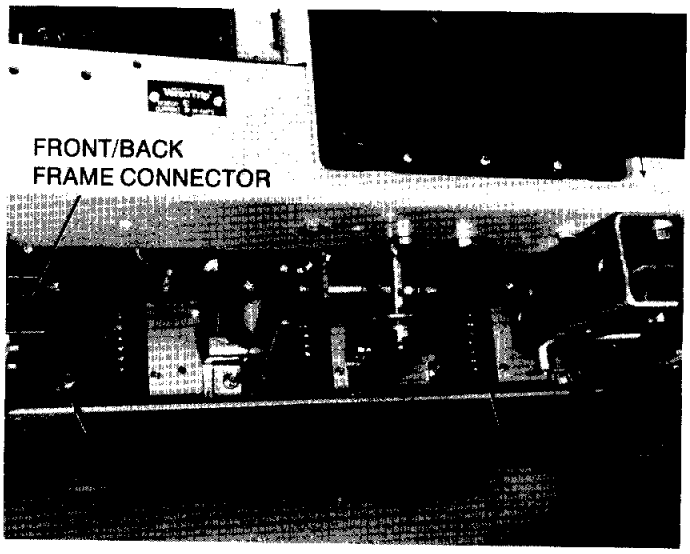


Fig. 3-7. Back frame harness installation — AK/AKR-75/100

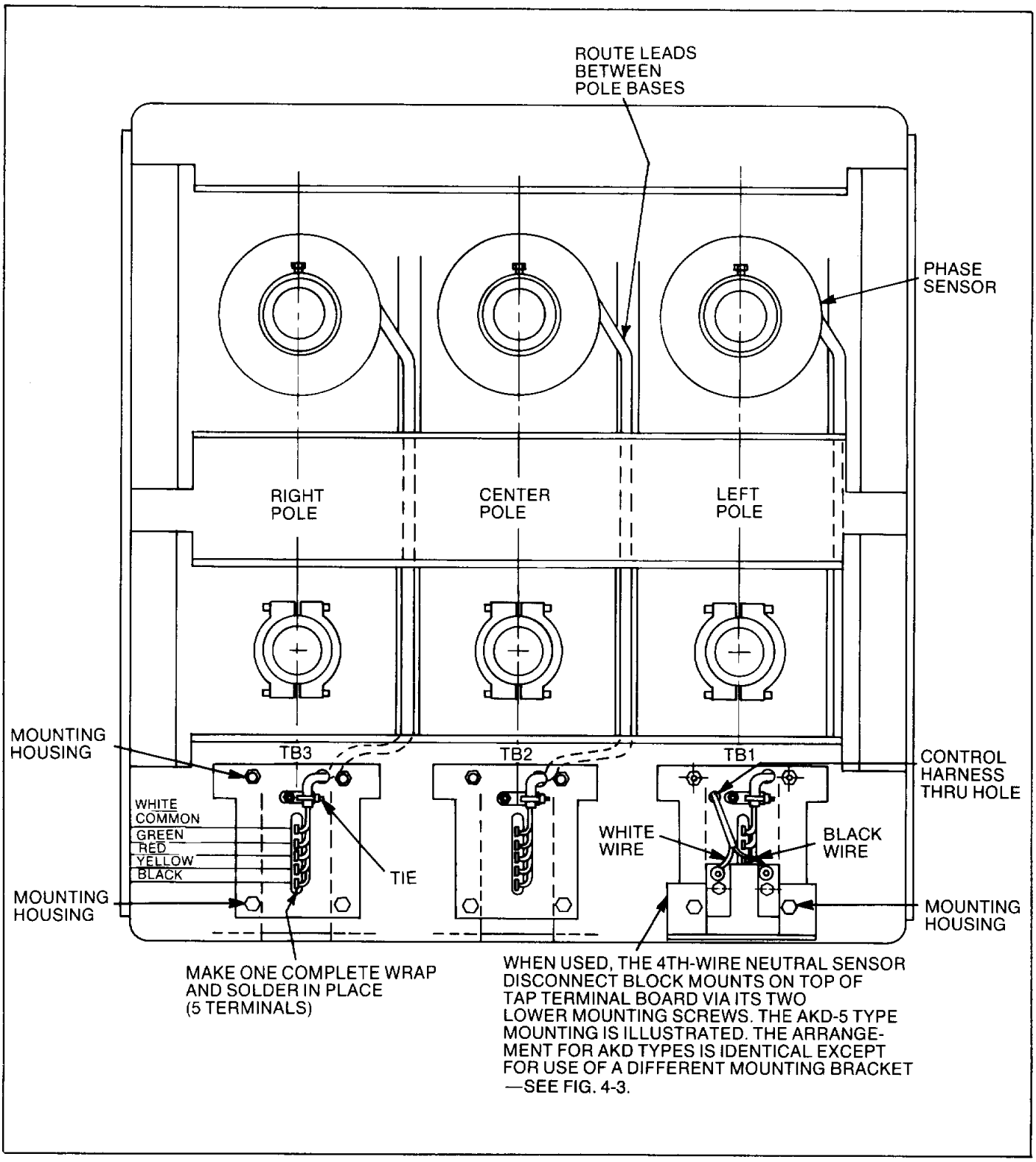


Fig. 3-8. Typical AK-75/100 brackframe conversion — rear view

SECTION 4—Four Wire Ground Fault

4.1—General Information

The MicroVersaTrip™ Ground Fault option requires an additional neutral sensor when used on a four-wire system having its neutral grounded at the transformer. The phase sensors are mounted on the breaker. However, 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.

4.2—Breaker Conversion— AK/AKS-50 Drawout

The 4th-wire disconnect for the AK/AKS-50 Drawout breaker mounts to the lower-back frame as shown in Fig. 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 as shown in Fig. 4-1.

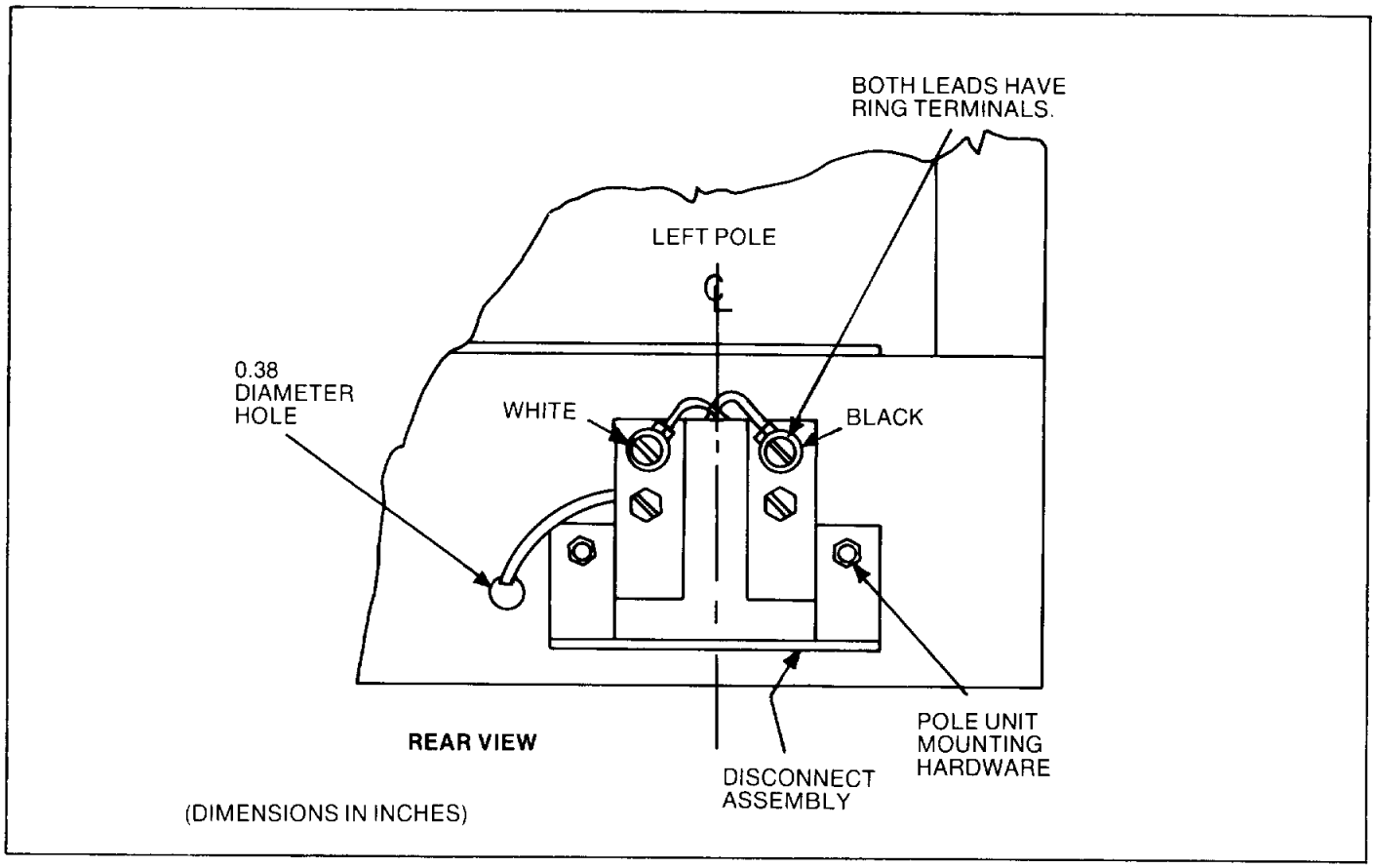


Fig. 4-1. 4th-wire neutral disconnect installed — AK/AKS-50 drawout

SECTION 4 (CONT'D)—Four-wire Ground Fault

4.3—Breaker Conversion— AK/AKS-50 Stationary

The 4th-wire disconnect for stationary breakers is a terminal board which is mounted to the lower front channel as shown in Fig. 4-2.

1. If the terminal board already 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 as shown in Fig. 4-2. The mounting holes may have to be added to the front channel. See Fig. 4-2.

4.4—Breaker Conversion— AK/AKR-75/100 Drawout

There are two 4th-wire disconnect designs used with these breakers. One design is used on breakers for AKD Type equipment. The other design is used on breakers for AKD-5/6 Type equipment. The difference in the designs is the bracket used for mounting the disconnect to the breaker. Figure 4-3 depicts the two designs.

The Conversion Kits are shipped with the AKD-5/6 Type assembled with only the bracket for the AKD Type. If an AKD Type is required, remove the AKD-5/6 Type bracket and replace it with AKD Type bracket.

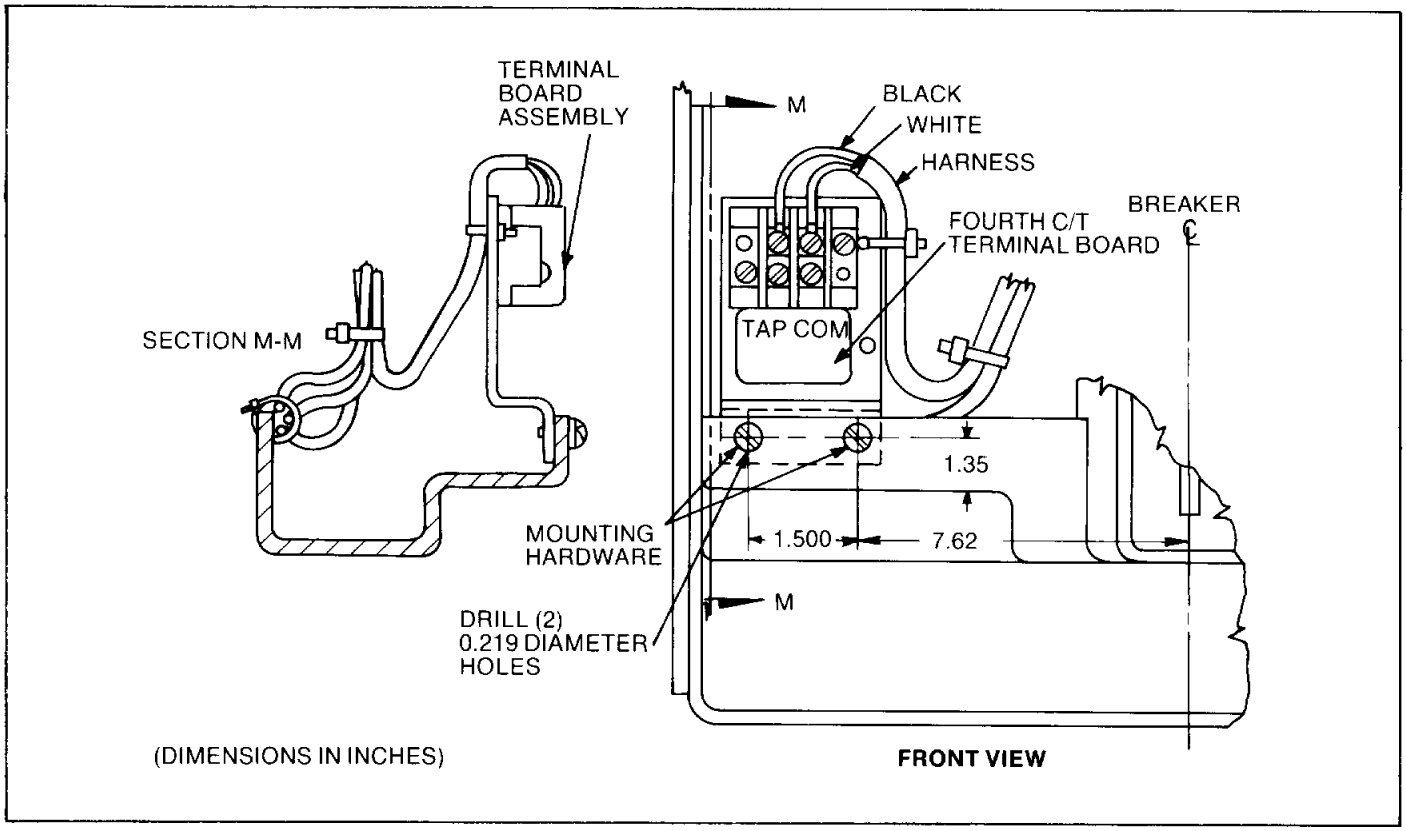
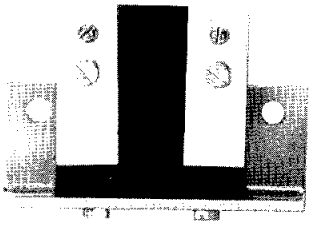
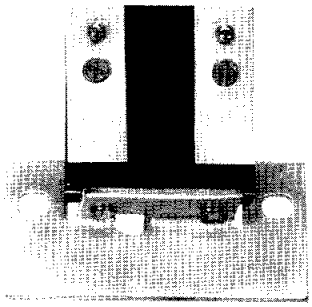


Fig. 4-2. 4th-wire terminal board installed — AK/AKS-50 stationary

AKD Type

AKD-5 Type





As received in kit, block is assembled to the AKD-5 type bracket.

For AKD installation, remove block from AKD-5 bracket and remount it on bracket 239.

Fig. 4-3. 4th-wire disconnects for AK/AKR-75/100 drawout breakers

The 4th-wire disconnect for the AKR-AKR-75/100 Drawout breaker mounts to the lower-back frame as shown in Fig. 3-8.

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 as shown in Fig. 3-8.

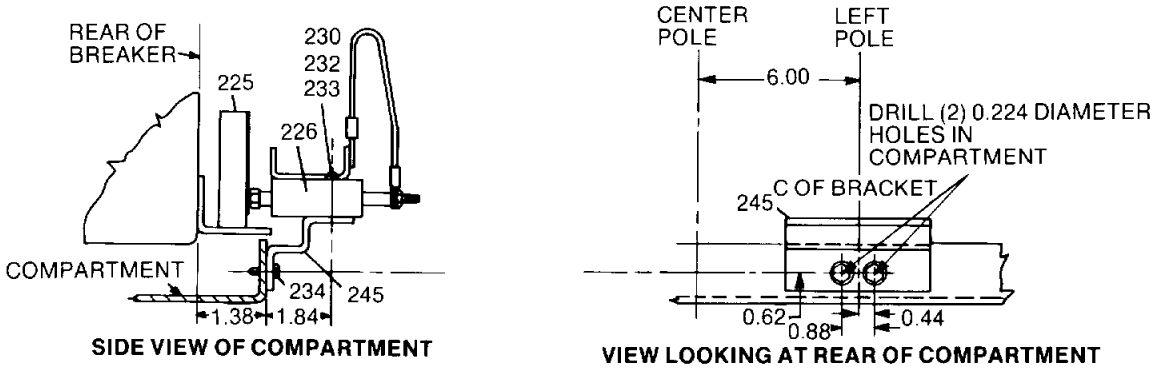
4.5—Breaker Conversion—AKR-75/100 Stationary

The 4th-wire disconnect for stationary AKR-75/100 breakers is similar to the terminal board used by the AKS-50 breakers. See Section 4.3 for details.

4.6—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 4.7.

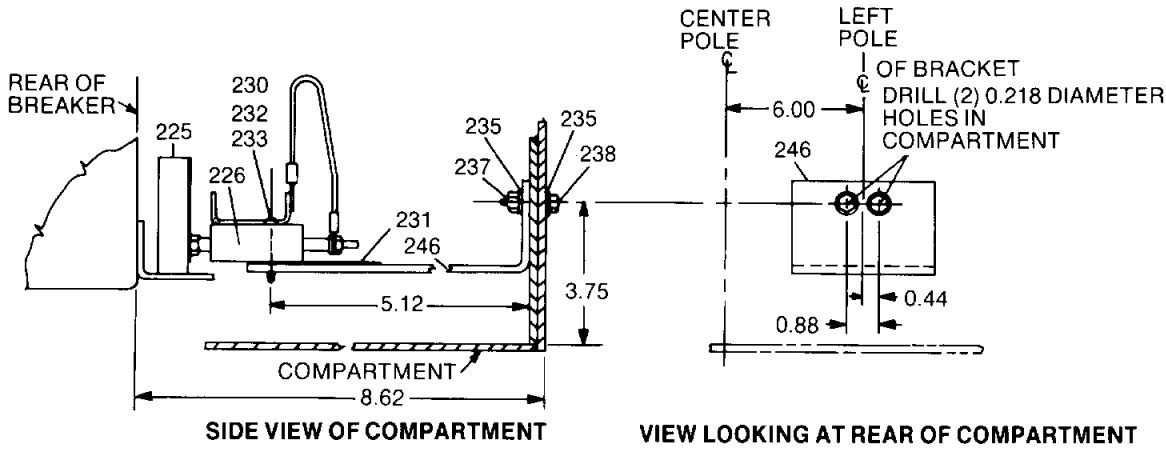
The AKD, AKD-5/6, and Substructure Type equipment compartments use the same disconnect assembly. There are different disconnect mounting brackets depending on the type of breaker and equipment involved. The specific breaker conversion kit provides the mounting brackets for each equipment type in which the breaker is used. Refer to Fig. 4-4 through Fig. 4-10 for details on mounting-bracket installation.



(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
230. 10-32 x 1.375-inch mounting screws
232. 10# lock washer
233. 10# flat washer
245. Mounting bracket AK/AKS-50 for AKD-5 type compartments

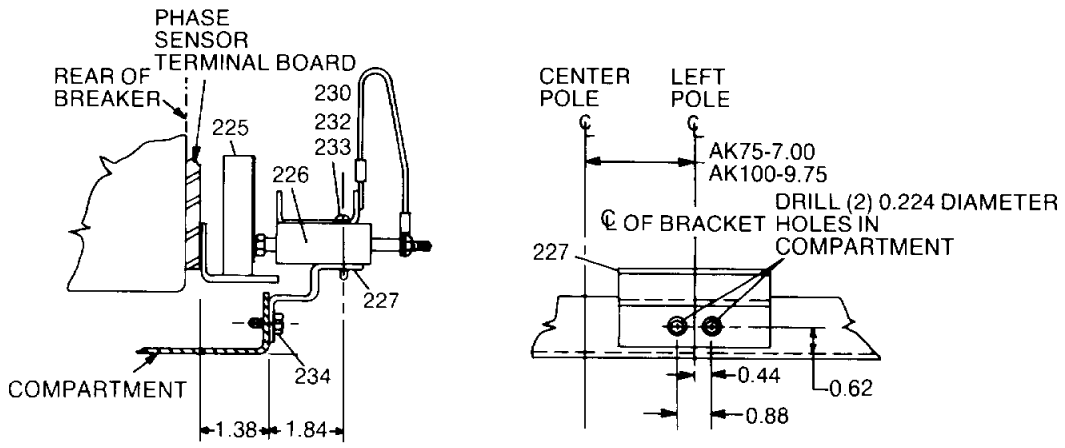
Fig. 4-4. AK/AKS-50 4th-wire disconnect installation AKD-5 type



(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
230. 10-32 x 1.375-inch mounting screws
231. Insulation
232. 10# lock washer
233. 10# flat washer
235. ¼-20 flat washer
236. ¼-20 lock washer
237. ¼-20 nut
238. ¼-20 x 1.25-inch mounting screws
246. Mounting bracket AK/AKS-50 for AKD type compartments

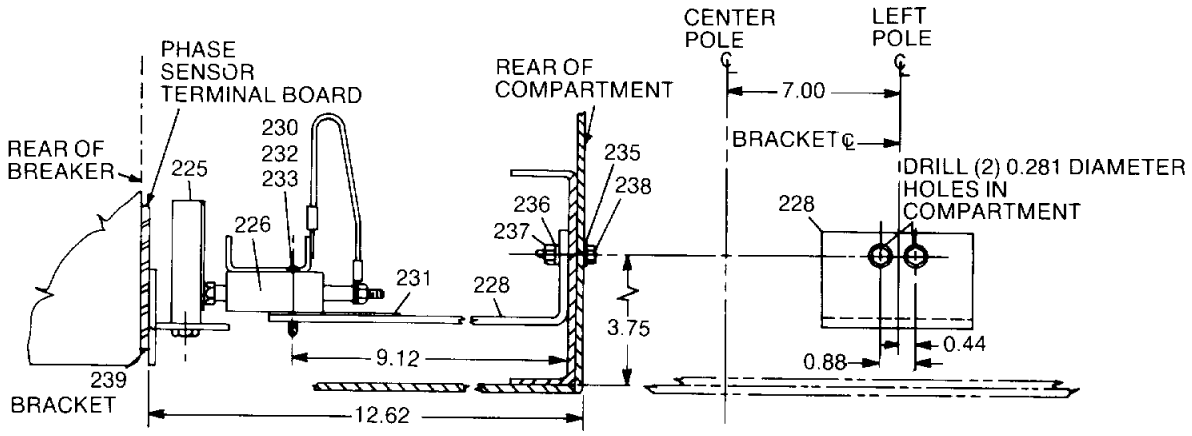
Fig. 4-5. AK/AKS-50 4th-wire disconnect installation AKD type



(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
227. Mounting bracket AK-75/100 for AKD-5 type compartments
230. 10-32 x 1.375-inch mounting screws
232. 10# lock washer
233. 10# flat washer
234. ¼-20 thread forming

Fig. 4-6. AK-75/100 4th-wire disconnect installation AKD-5 type



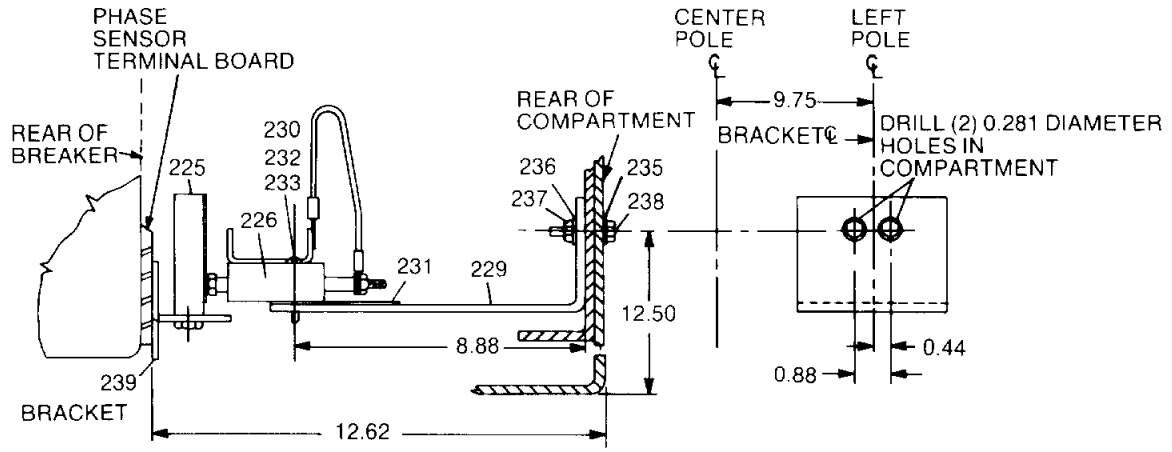
SIDE VIEW OF COMPARTMENT

VIEW LOOKING AT REAR OF COMPARTMENT

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
228. Mounting bracket AK-75 for AKD type compartments
230. 10-32 x 1.375-inch mounting screws
231. Insulation
232. 10# lock washer
233. 10# flat washer
235. ¼-20 flat washer
236. ¼-20 lock washer
237. ¼-20 nut
238. ¼-20 x 1.25-inch mounting screws
239. Bracket

Fig. 4-7. AK-75 4th-wire disconnect installation AKD type

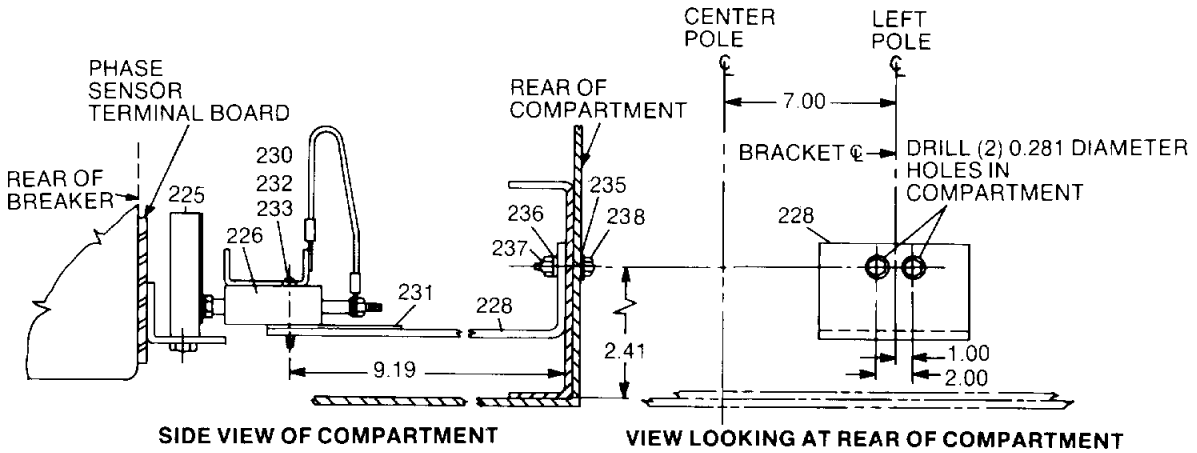


SIDE VIEW OF COMPARTMENT **VIEW LOOKING AT REAR OF COMPARTMENT**

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
229. Mounting bracket AK-100 for AKD type compartments
230. 10-32 x 1.375-inch mounting screws
231. Insulation
232. 10# lock washer
233. 10# flat washer
235. ¼-20 flat washer
236. ¼-20 lock washer
237. ¼-20 nut
238. ¼-20 x 1.25-inch mounting screws
239. Bracket

Fig. 4-8. AK-100 4th-wire disconnect installation AKD type



SIDE VIEW OF COMPARTMENT **VIEW LOOKING AT REAR OF COMPARTMENT**

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
228. Mounting bracket AK-75 for AKD type compartments
230. 10-32 x 1.375-inch mounting screws
231. Insulation
232. 10# Lock washer
233. 10# Flat washer
235. ¼-20 Flat washer
236. ¼-20 Lock washer
237. ¼-20 Nut
238. ¼-20 x 1.25-inch mounting screws

Fig. 4-9. AKR-75/100 4th-wire disconnect installation AKD-6 type

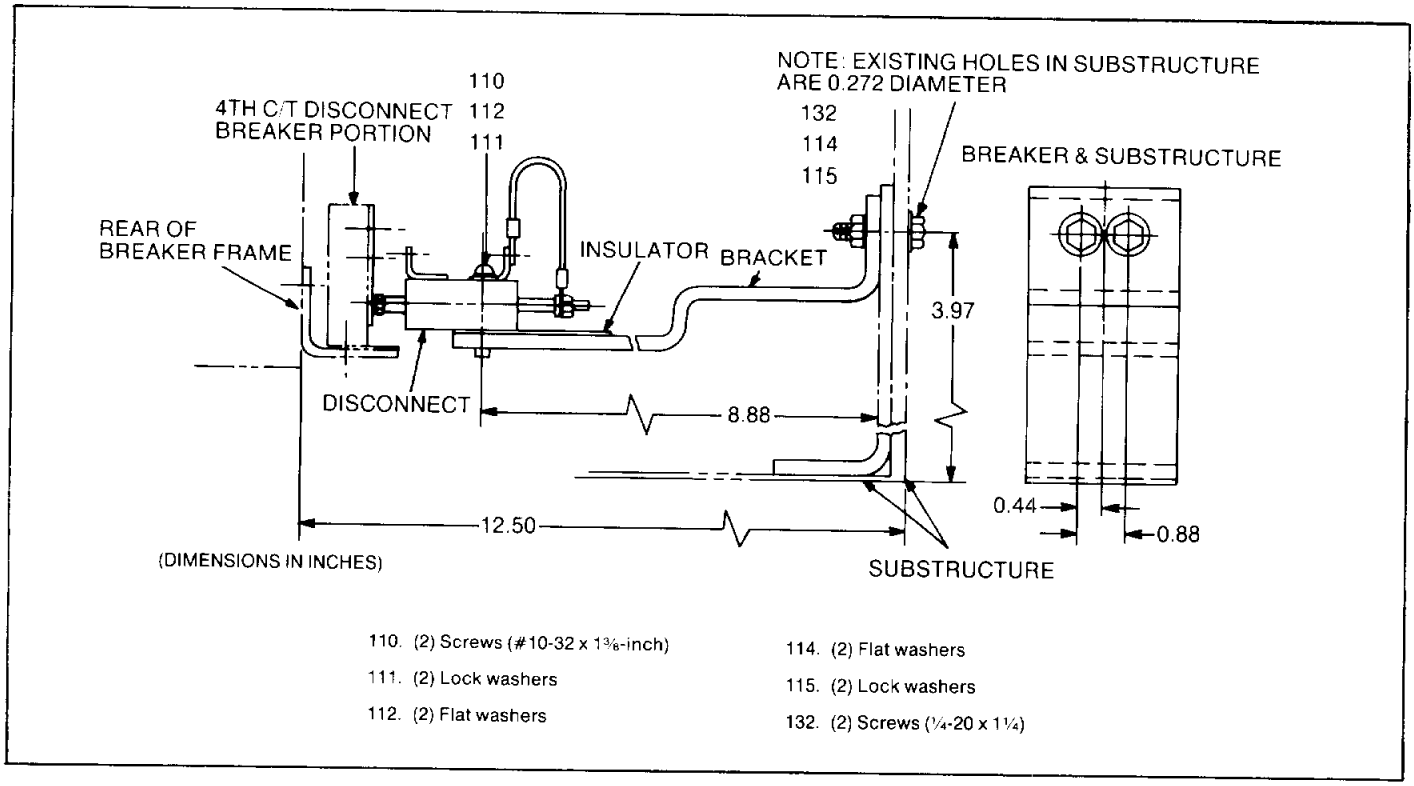


Fig. 4-10. AKR-75/100 4th-wire disconnect installation substructure

4.7—Neutral Sensors

The neutral sensor is an electrical duplicate of the phase sensor, including the taps. Therefore, when taps are changed on the phase sensors, the taps on the neutral sensor must be correspondingly positioned.

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 Fig. 4-11 and Fig. 4-12, for the sensor's bar drilling plan. Check to insure that the neutral and phase sensors match, i.e., have the same ampere range. Refer to Fig. 4-13 for additional neutral sensor installation information.

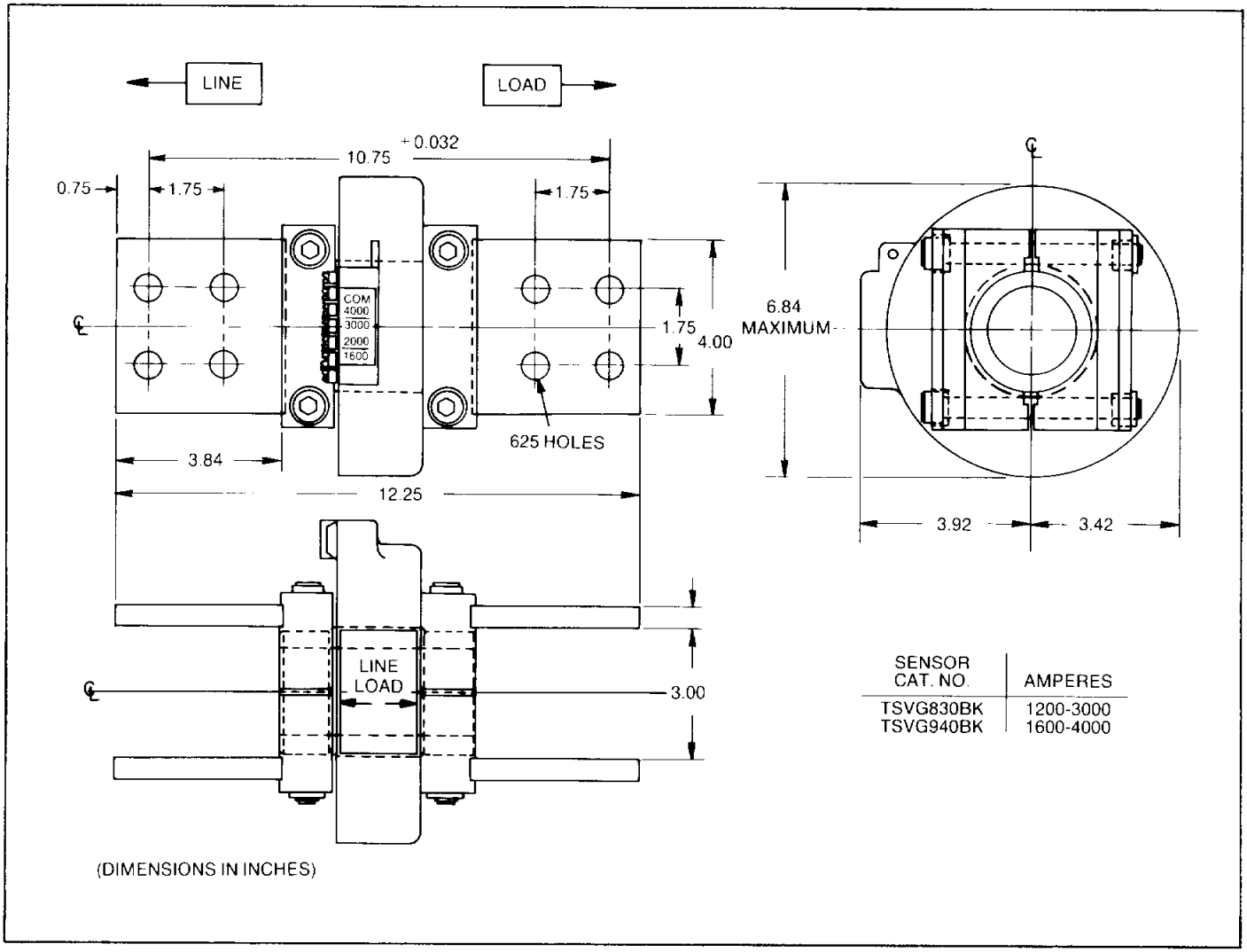
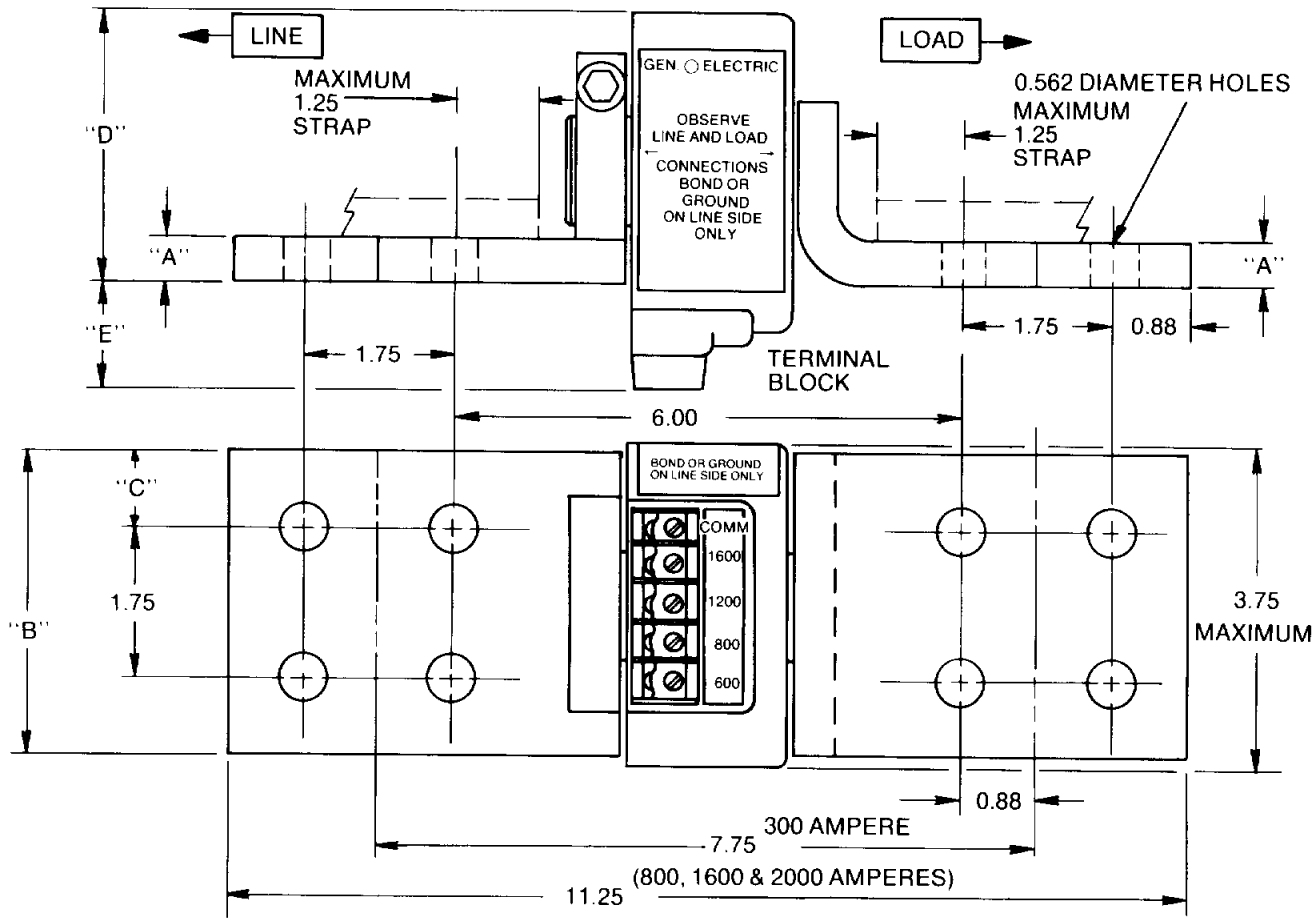


Fig. 4-11. Outline of the AKR-75/100 and AK-75/100 neutral sensor



(DIMENSIONS IN INCHES)

Sensor Cat. No.	Ampere Range	A	B	C	D	E
TSVG508BK	300-800	0.250	3.25	0.75	3.20	1.30
TSVG516BK	600-1600	0.500	3.62	0.94	3.20	1.30
TSVG620BK	800-2000	0.625	3.25	0.75	3.33	1.18

Fig. 4-12. Outline of the AK/AKS-50 neutral sensor

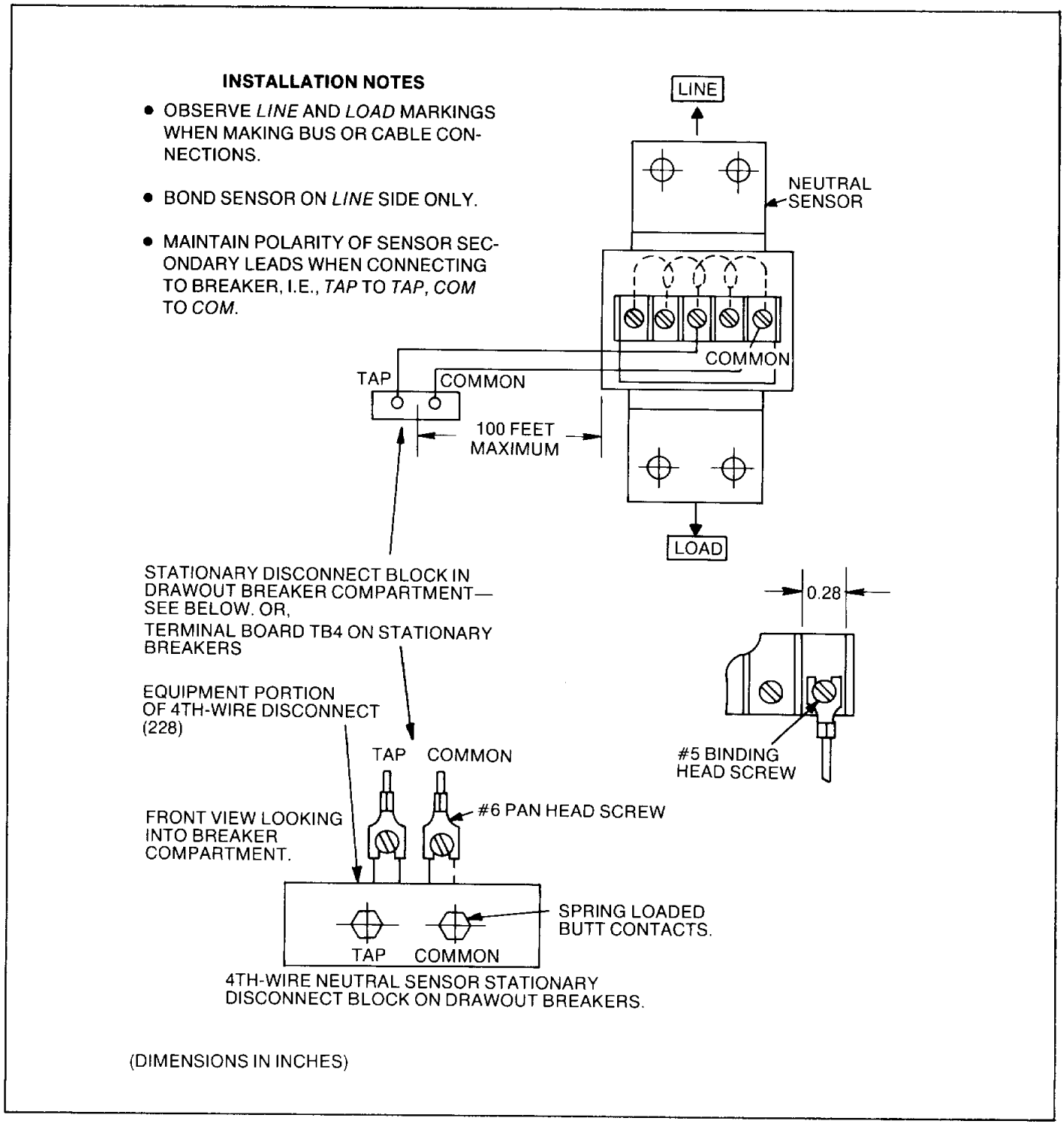


Fig. 4-13. Connecting the 4th-wire neutral sensor

SECTION 5—Programmer Installation

5.1—General Information

The programmer is attached to the bracket mounted to the left side of the breaker's center channel as shown in Fig. 2-9. The guide pins on this bracket mate with the holes on either side of the programmer connector. The guide pins provide the necessary alignment for the connector engagement. The locking lever engages with the pin which is assembled to the programmer frame and secures the programmer to the mounting bracket.

5.2—AK/AKS-50 Installation

The AKS-50 mounting bracket is shown in Fig. 5-1. Installation is as follows:

1. Insert the guide pins into the hole and push on the programmer. This will engage the connectors and release the locking lever which will move upwards.

2. Verify that the locking lever actually engaged the programmer pin.

To remove the programmer:

1. Move locking lever to horizontal position, thus releasing the programmer pin.

2. Remove programmer.

5.3—AK/AKR-75/100 Installation

The AK/AKR-75/100 mounting bracket is shown in Fig. 2-9. Installation is as follows:

1. Insert the guide pins into the holes and push on the programmer, engaging the connectors.

2. The locking lever is released, securing the programmer.

3. Verify that the locking lever actually engaged the programmer pin.

To remove the programmer pull out the locking lever which will release the programmer pin. Remove the programmer.

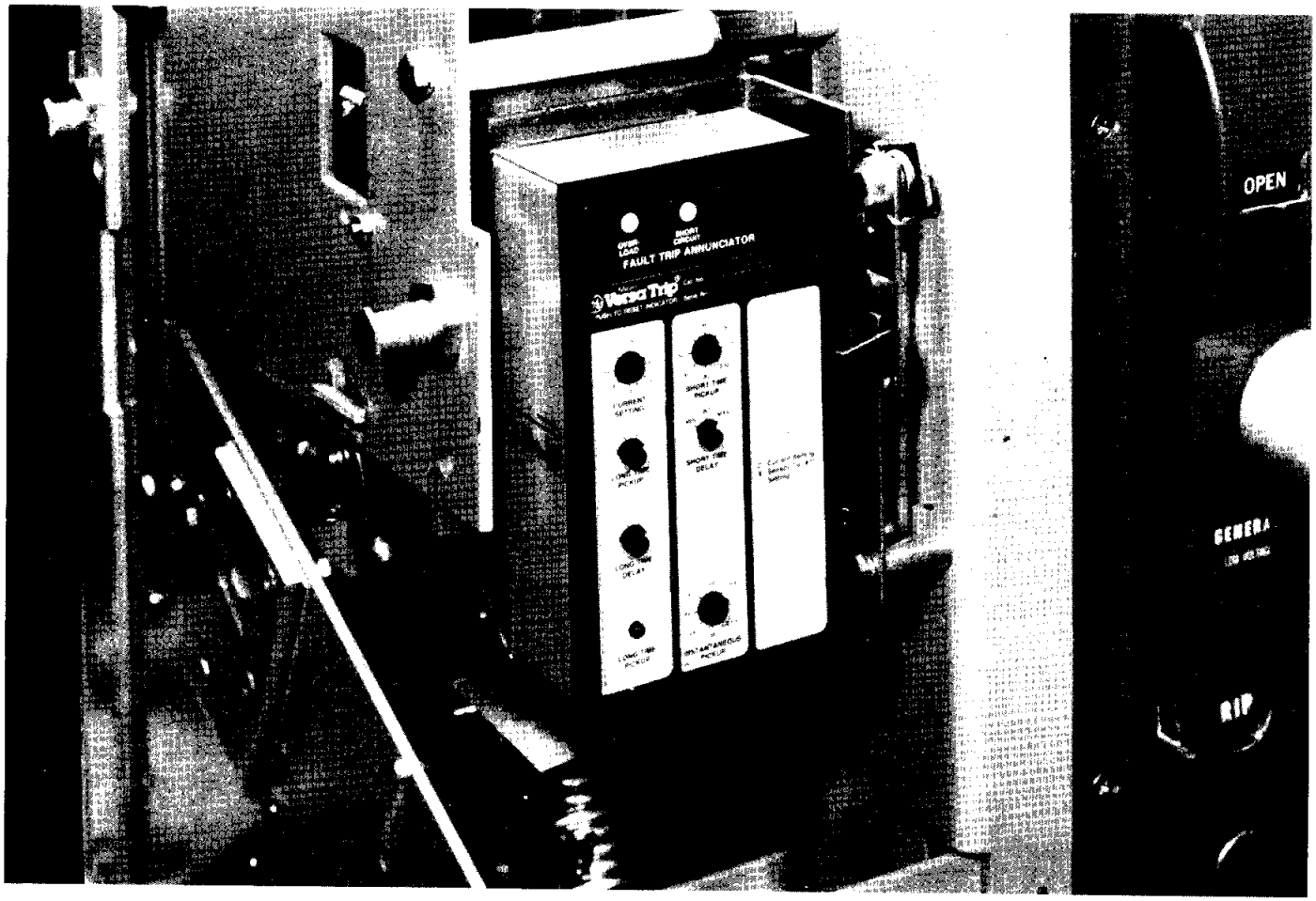


Fig. 5-1. AKS-50 programmer mounting

SECTION 6—Testing and Troubleshooting

6.1—General Information

Once the breaker has been converted and before it is energized, it must be tested as described in Section 6.2. If any problems develop with the trip device system, refer to Section 6.3 and Section 6.4 for troubleshooting details.

6.2—Testing

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

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

2. Megger breaker primary circuit using a 1,000-Volt Megger.

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

   A. 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™ 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 can be nullified either by
>
> 1. Testing two poles of the breaker in series, or
>
> 2. Using the Ground Fault Defeat Cable as shown in Fig. 6-5. This special test cable energizes the programmer circuit in a self-cancelling, series-parallel connection so that its output is always zero.
>
> Compare results with the applicable time-current characteristic curves given in Fig. 6-9 and Fig. 6-10.

   B. Test the components of the MicroVersaTrip™ system using portable Test Set Type TVTS1. The applicable test procedures are detailed in Instruction Book GEK-64464.

6.3—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:

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

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

3. Inadvertent shunt trip activations.

> **WARNING:** DO NOT CHANGE TAPS ON THE CURRENT SENSORS OR ADJUST THE PROGRAMMER 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, Step 2.

6.3.1—Resistance Values

For use in troubleshooting the MicroVersaTrip™ current sensors, the resistance of the windings is given in Table 6-1.

Table 6-1—Current Sensor Resistance

Breaker Frame Size	Ampere Tap	Resistance in Ohms Between Common and Tap Terminals
AK-50 AKS-50	300 400 600 800	20-24 27-32 42-50 58-68
	600 800 1200 1600	42-50 58-68 93-109 130-154
AKT-50 AKST-50	800 1200 1600 2000	74-88 116-136 162-190 210-246
AK-75 AKR-75	1200 1600 2000 3000	20-24 28-34 37-44 61-72
AK-100 AKR-100	1600 2000 3000 4000	36-43 47-55 75-88 108-127

6.4—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 Fig. 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™ components have previously demonstrated satisfactory performance via the TVTS1 Test Set, the sensors and their connections should be closely scrutinized. After disconnecting the breaker from all power sources, perform the following steps.

1. Check that all phase sensors are the same type (ampere range).

2. Ensure that the tap settings on all three-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 four-wire loads, check that the neutral sensor is properly connected. See cabling diagram Fig. 6-3. In particular, the following:

   A. Verify that the neutral sensor has the same rating and tap setting as the phase sensors.

   B. Check continuity between the neutral sensor and its equipment-mounted secondary disconnect block. Also check for continuity from the breaker-mounted neutral secondary disconnect block through to the female harness connector.

   C. If the breaker's lower studs connect to the supply source, then the neutral sensor must have its LOAD end connected to the source. See Fig. 6-4.

   D. Ensure 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, then the sensor resistances should be measured. Since the phase and neutral sensors are electrically identical, their tap-to-tap resistance should closely agree. See Table 6-1.

6.5—MicroVersaTrip™ Cabling Diagrams

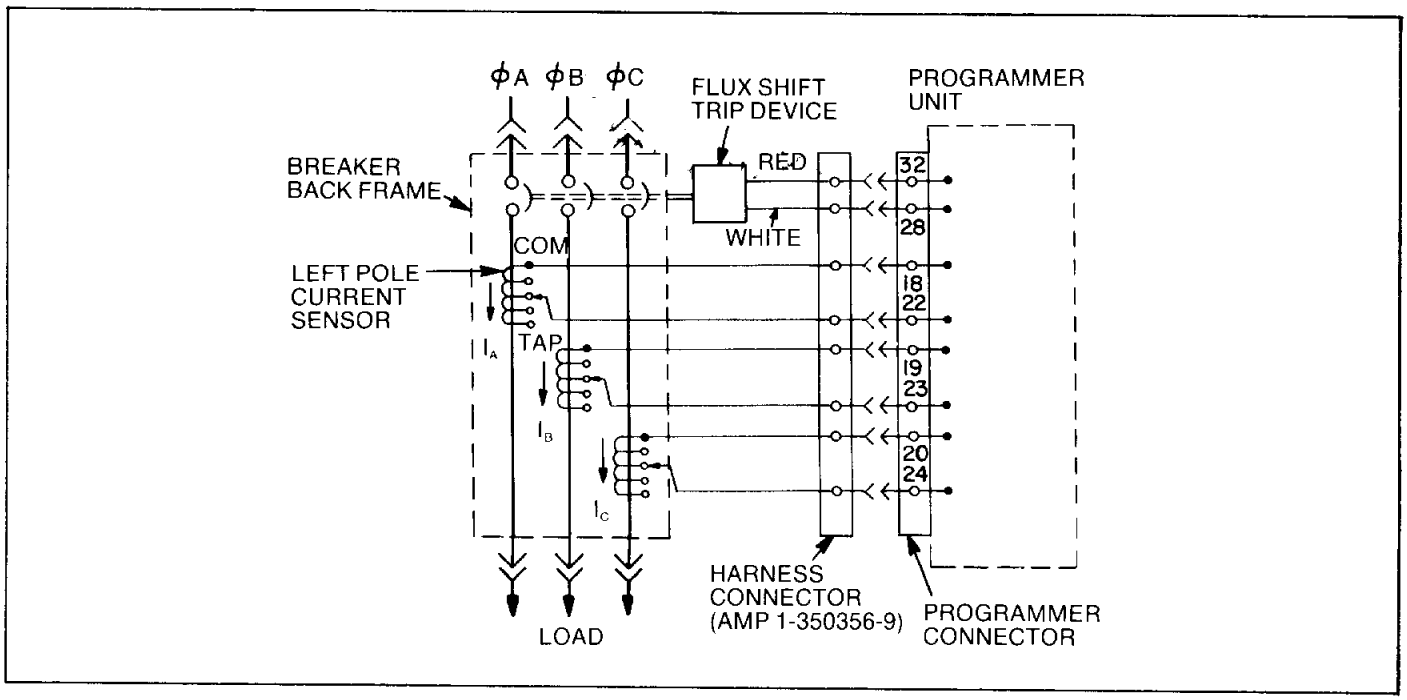


Fig. 6-1. Cabling diagram — MicroVersaTrip™ without ground fault

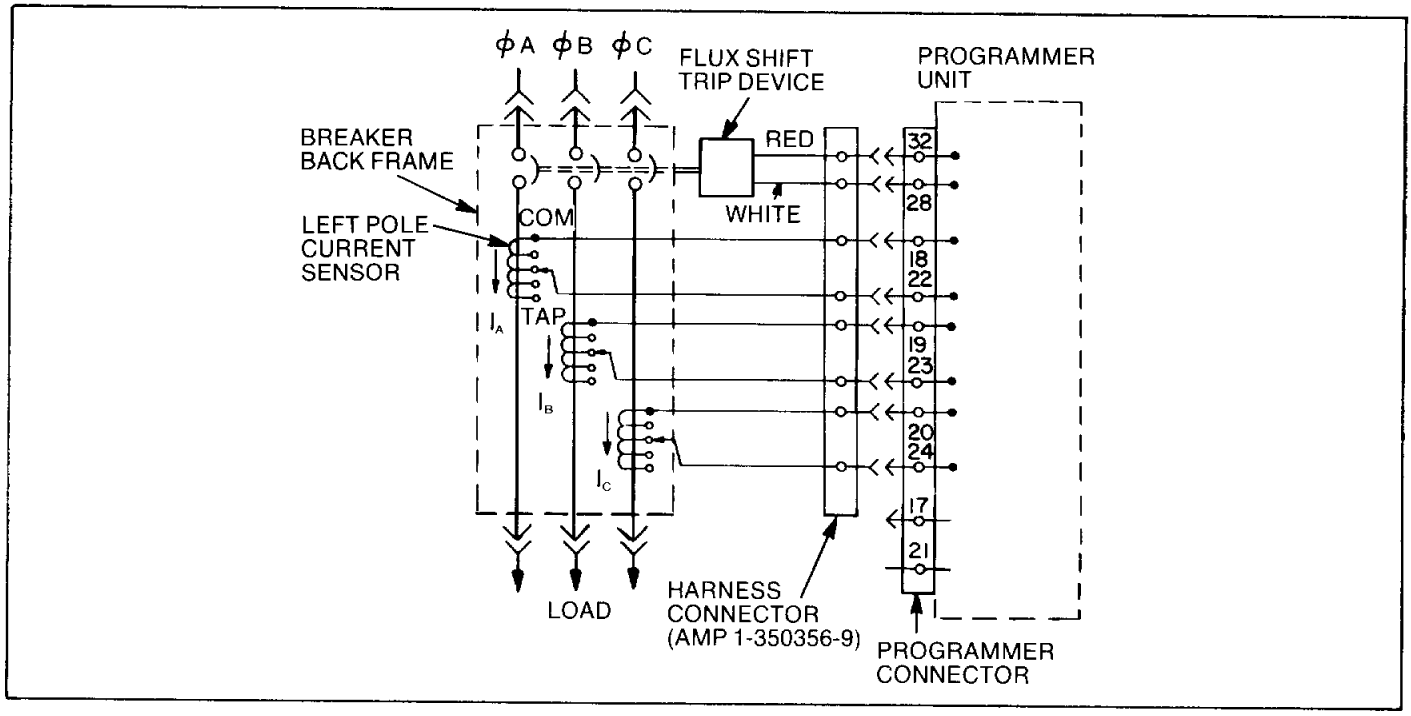


Fig. 6-2. Cabling diagram — MicroVersaTrip™ with ground fault on 3-wire load

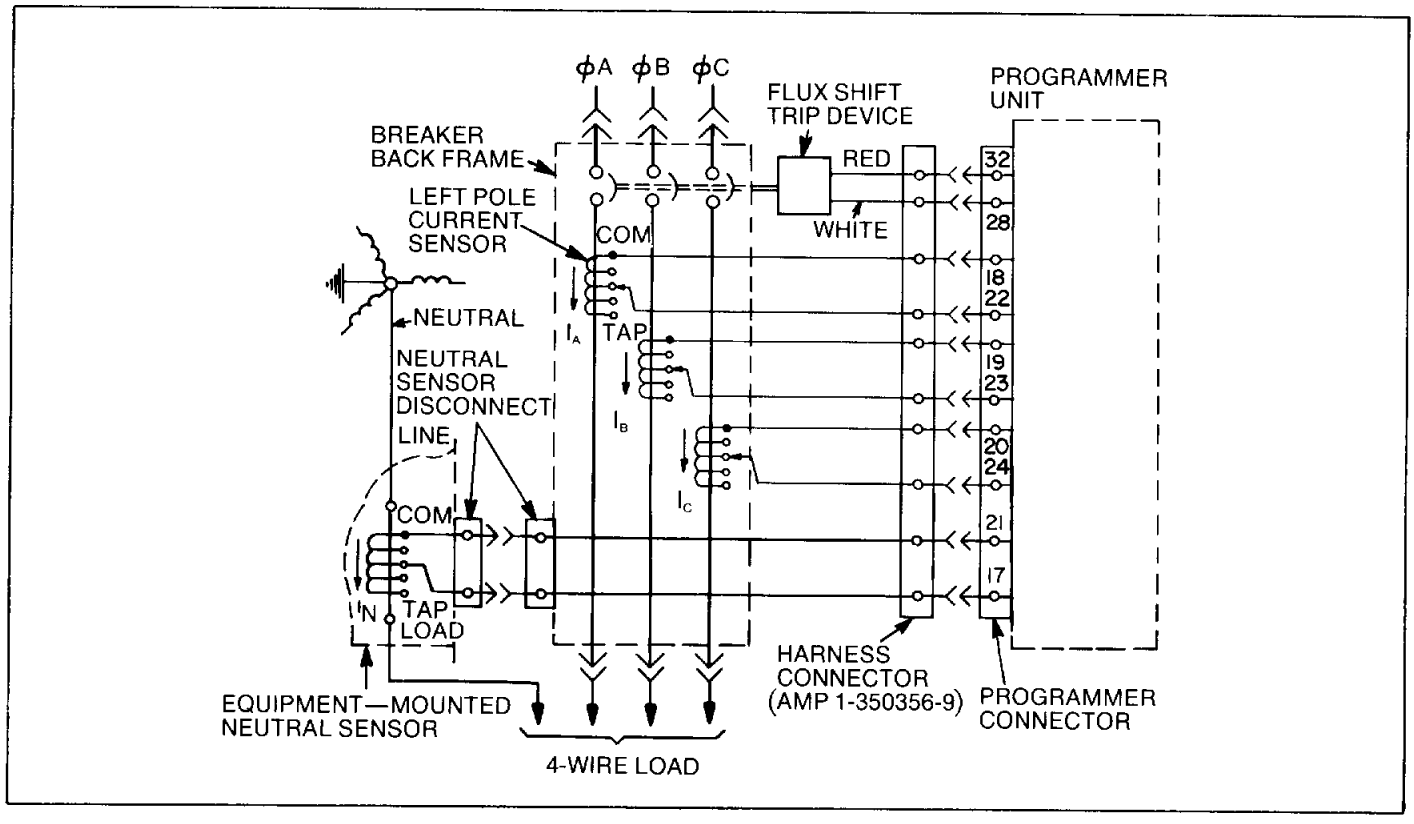


Fig. 6-3. Cabling diagram — MicroVersaTrip™ with ground fault on 4-wire load

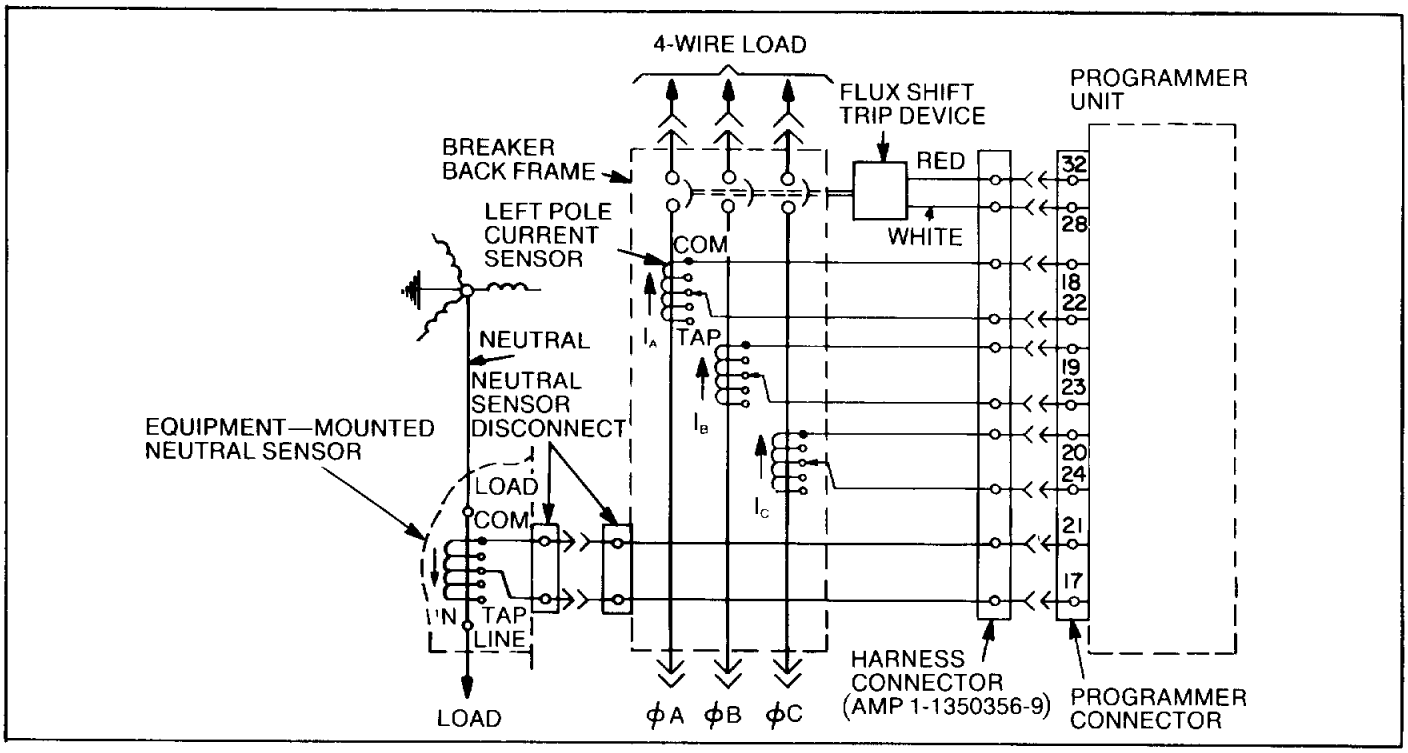


Fig. 6-4. Cabling diagram — MicroVersaTrip™ with ground fault on 4-wire load-breaker reverse feed

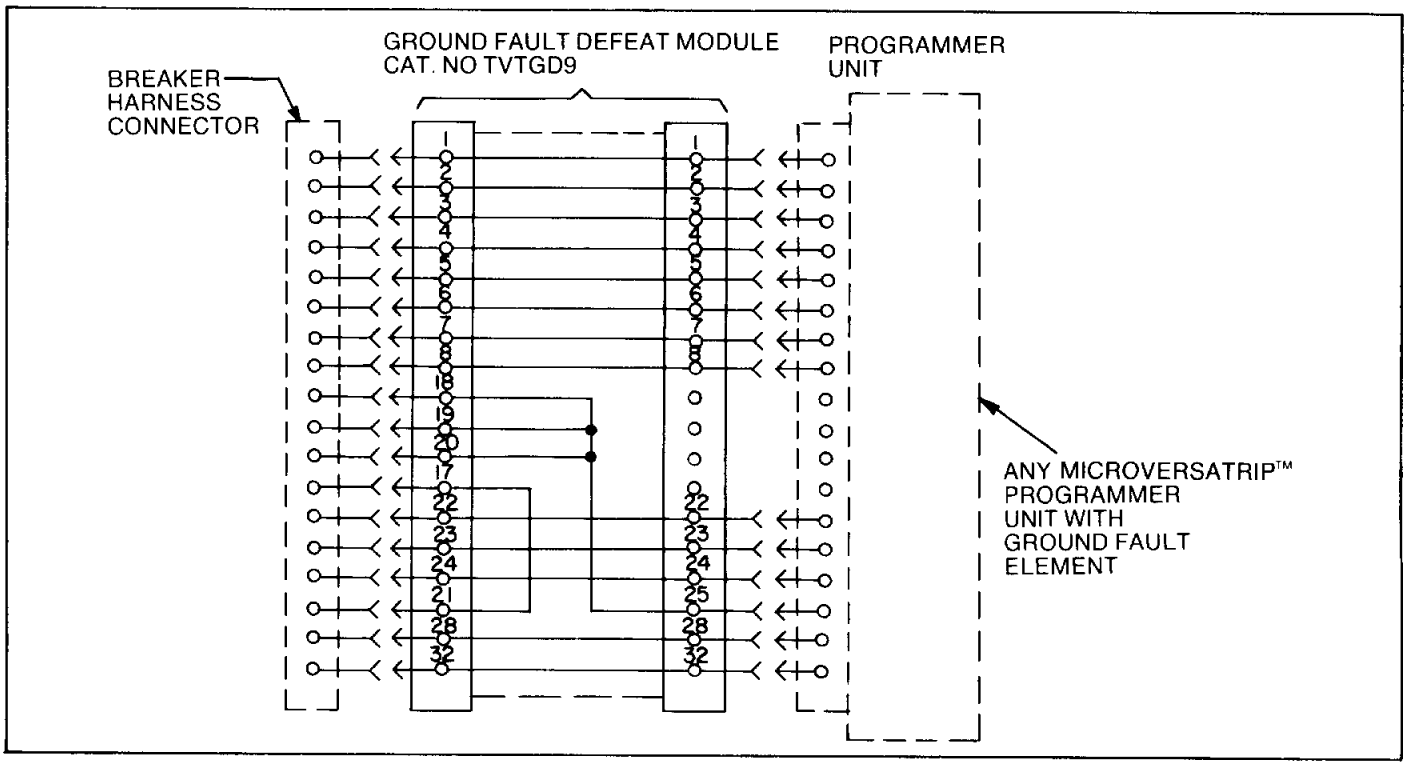


Fig. 6-5. Cabling diagram with ground fault defeat module inserted between breaker harness and MicroVersaTrip™ programmer unit — for use during single-phase, high-current, low-voltage testing

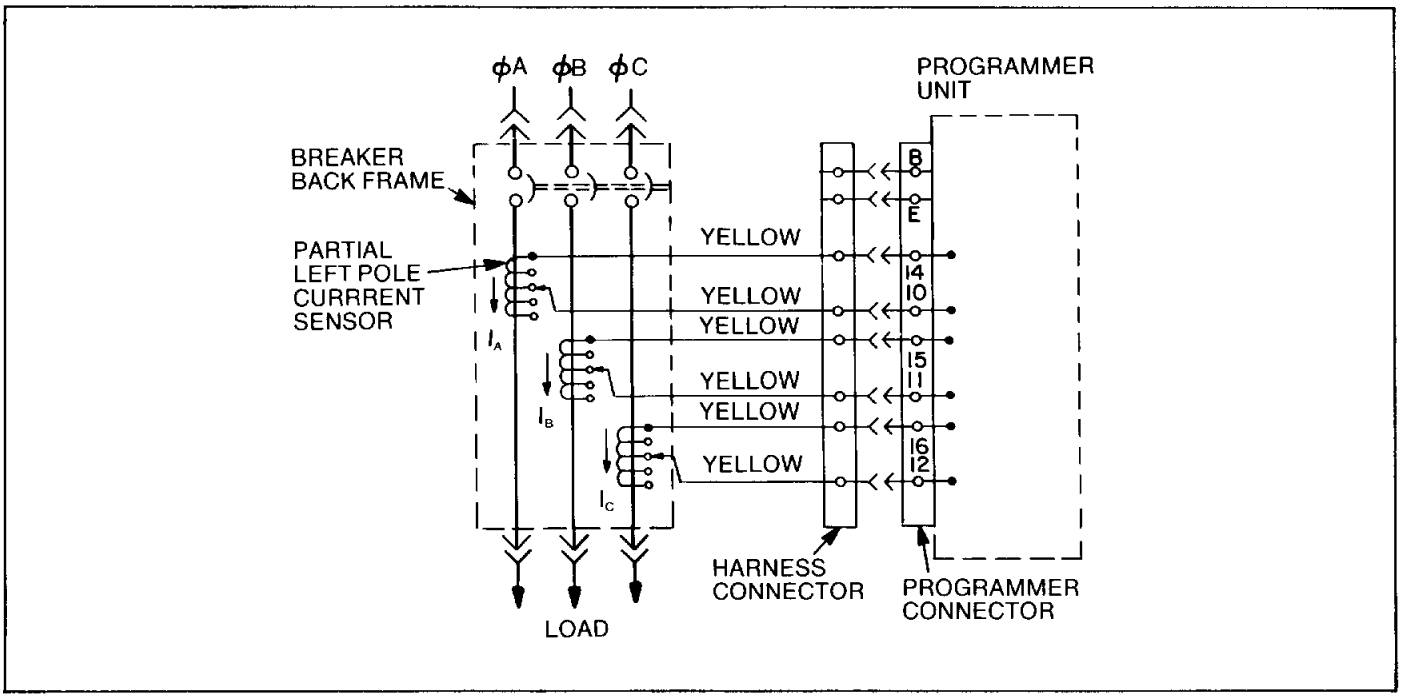


Fig. 6-6. Partial cable diagram — "H" option winding connections

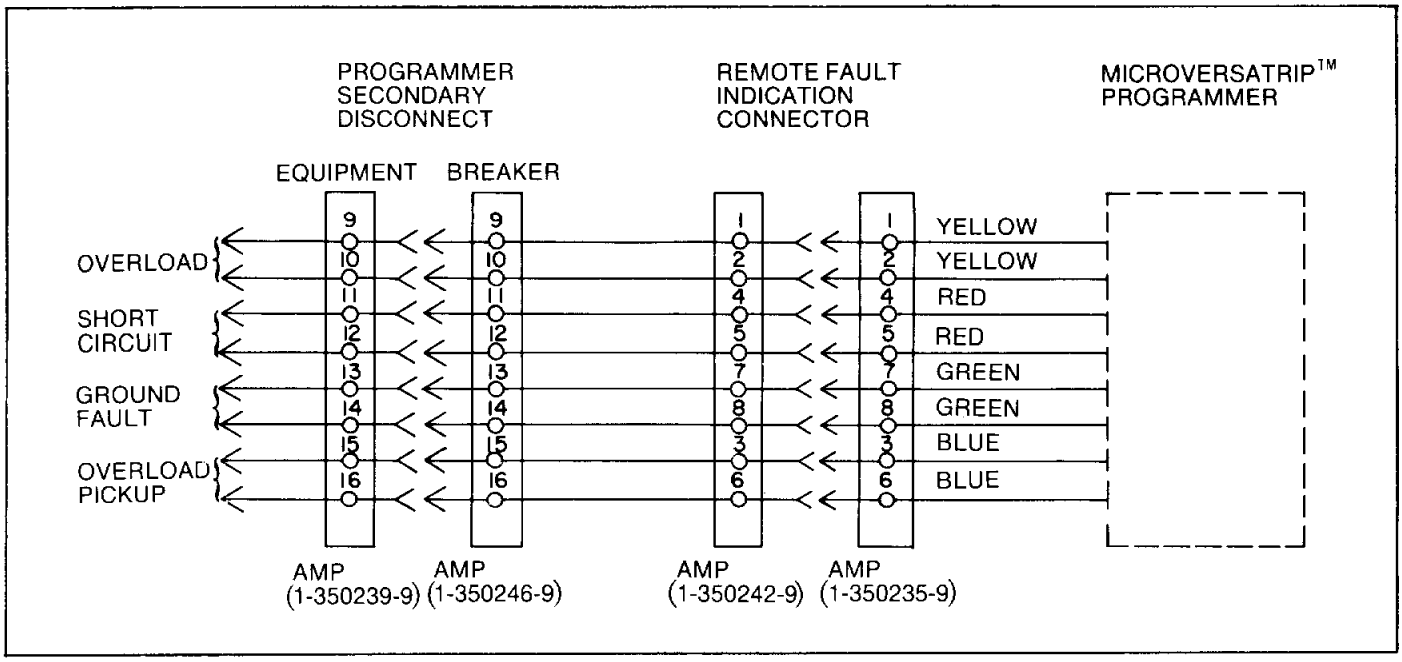


Fig. 6-7. Cabling diagram — remote fault indication

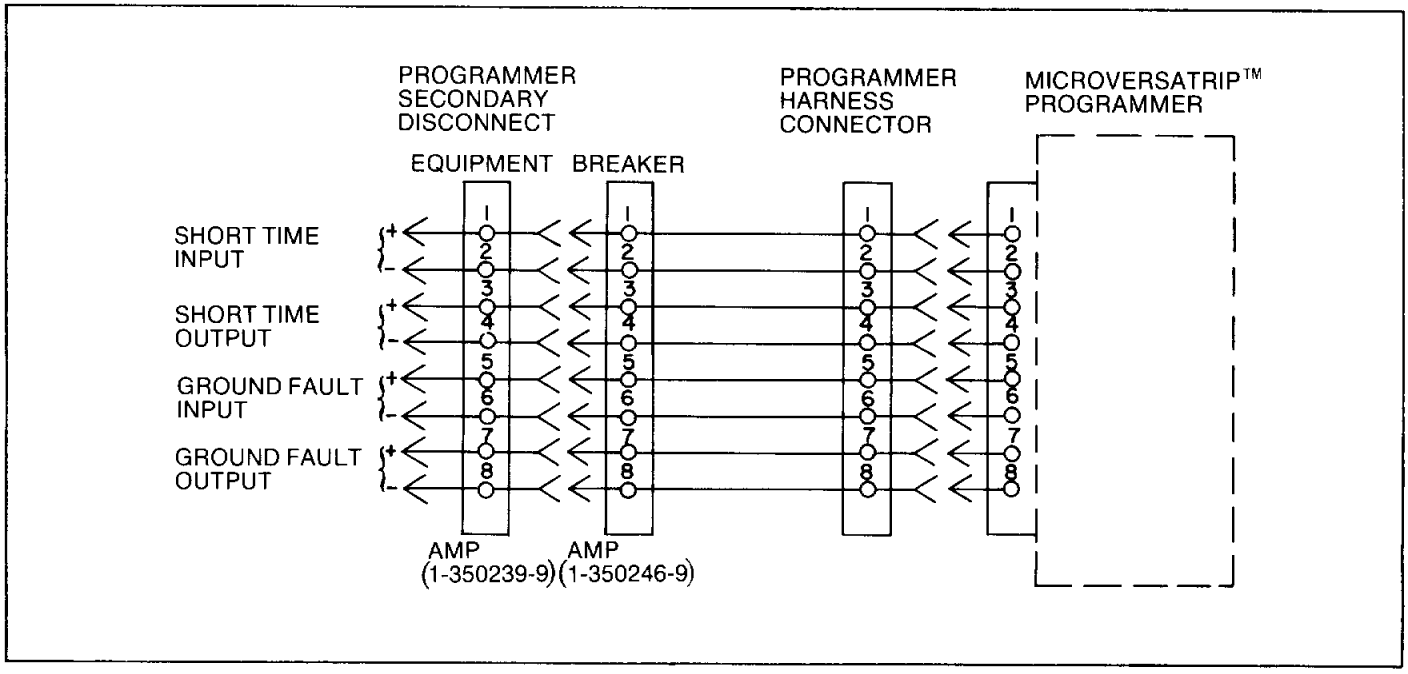


Fig. 6-8. Cabling diagram — zone selective interlock

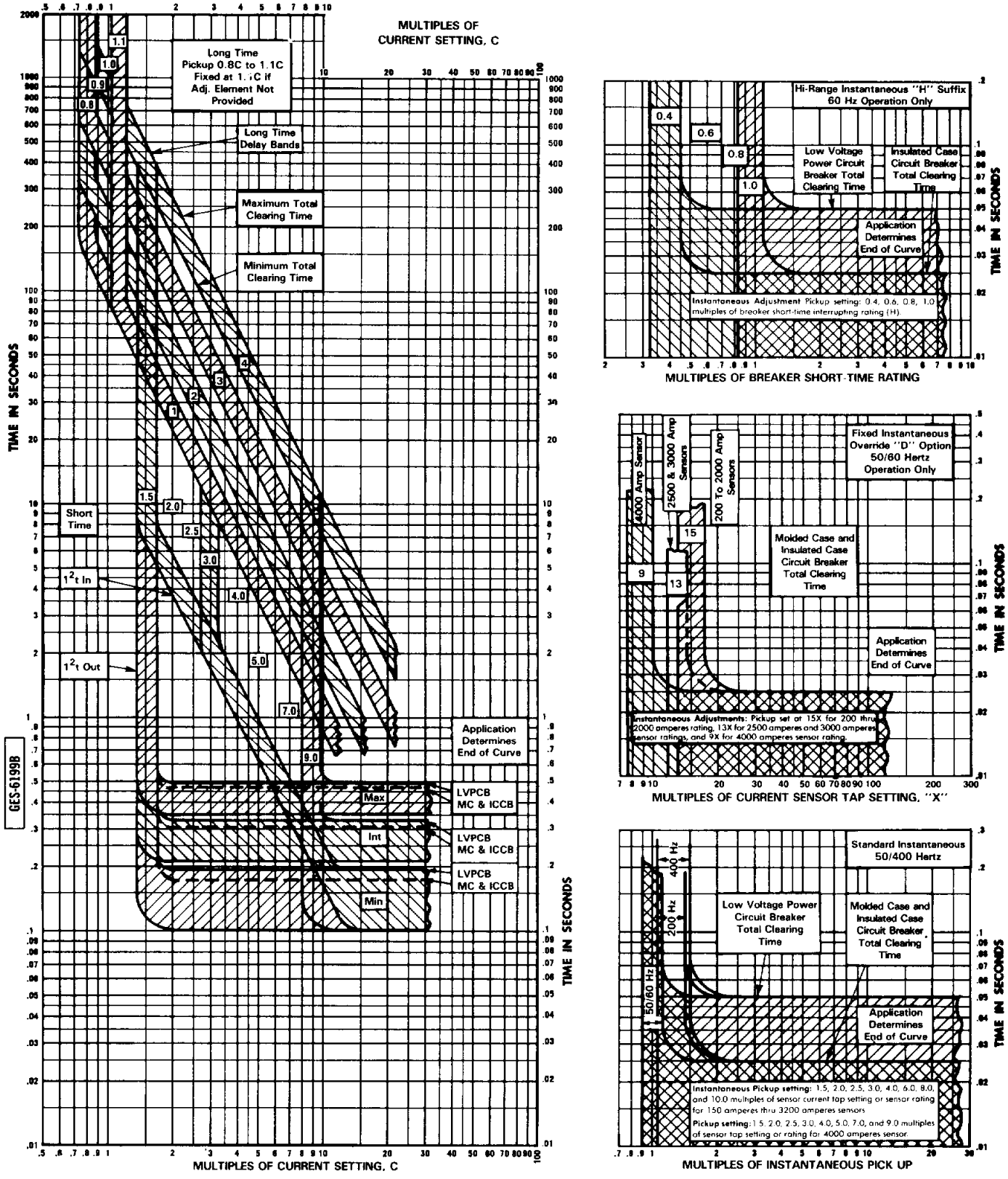


Fig. 6-9 MicroVersaTrip™ long-time delay, short-time delay and instantaneous time versus current curves

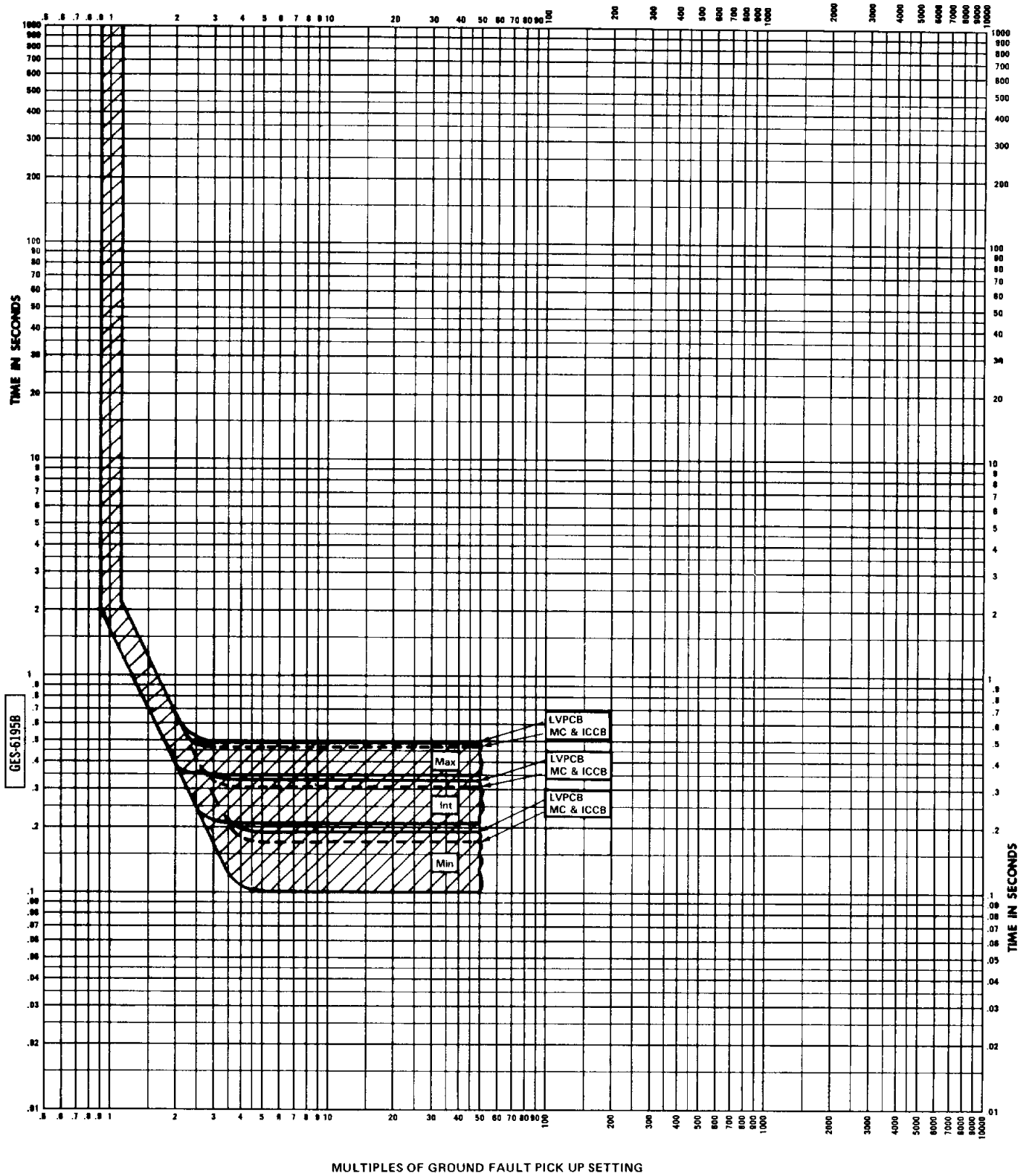


Fig. 6-10 MicroVersaTrip™ ground fault time versus current curves

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

For further information call or write your local General Electric Sales Office or . . .

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