Instructions for Converting Existing EC, ECS, SST, and Power Sensor Trip Systems to MicroVersaTrip® RMS-9

MicroVersaTrip® RMS-9 Conversion Kits

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

MicroVersaTrip® RMS-9 Conversion Kits

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SECTION 1—Introduction

1.1—General Information

These instructions cover installation of the MicroVersaTrip®-RMS-.9 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®-RMS-.9 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 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 installation of 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 rating; 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 kits provides an excellent opportunity to perform normal maintenance on the breaker, 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 1-5. 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 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-50/50H = TKR50 AKRU-50 AKRT-50/50H		S		3				AKR-50/50H 800A = 08 AKRU-50 1600A = 16 AKRT-50/50H 2000A = 20		LI = 01 LIT1 = 02 LIGT1 = 03
AKJ-50 = TKJ50 AKJT-50	+	OR	+	OR	+	F	+	AKJ-50 800A = 08 1600A = 16	+	LSIT1 = 04 LSIGT2 = 05
		D		4				AKJT-50 2000A = 20		LST1 = 06
AKR-75 = TKR75								AKR-75 3200 = 32		LSGT2 = 07
AKR-100 = TKR100								AKR-100 4000A = 40		LSIGT2X = 08
AKW-100 = TKW100								AKW-100 4000A = 40		

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 MicroVersaTrip® RMS- 9 Conversion Kit Model Selection For Tapped Sensors With Fixed Rating Plug

Frame Size		Stationary or Draw-out		3- or 4-Wire		Tapped Sensor		Sensor Rating		Programmer Functions
AK/AKU-50 = TK050 AKT-50		S*		3				AK/AKU-50	800A = 08 1600A = 16	LI = 01 LIT1 = 02
								AKT-50	2000A = 20	LIGT2 = 03
AKS/AKSU-50 = TKS50 AKST-50	+	OR D	+	OR 4	+	T	+	AKS/AKSU-50	800A = 08 1600A = 16	LSIT1 = 04 LSIGT2 = 05
								AKST-50	2000A = 20	LST1 = 06
AK-75 = TK075								AK-75	3000A = 30	LSGT2 = 07
AK-100 = TK010								AK-100	4000A = 40	LSIGT2X = 08

*Not Available for AK-75 or AK-100

EXAMPLE:

- AK-50, Stationary construction, 4-wire system, 800 Amp tapped sensor, LIGT2 programmer
- MicroVersaTrip® RMS- 9 conversion kit model number: TK050S4T0603 (fixed rating plug will be installed in programmer)

Table 1-3—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 1-4—Current Sensors

Breaker Type	Sensor Ampere Range	Cat. No.
AK/AKS-50	300-800	193A1439G14
AKU/AKSU-50	600-1600	193A1439G15
AKT/AKST-50	800-2000	193A1439G16
AK-75	1200-3200	193A1466G3
AKR-75	3200	139C4970G38
AK-100	1600-4000	193A1466G4
AKR-100	4000	139C4970G39

Table 1-5—Available Programmer Functions For MicroVersaTrip® RMS-9 Conversion Kits

Function	Model Code	Programmer Function Definition
LI	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

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 1-5), 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® RMS-9 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 mount the new mounting bracket (Fig. 2-2) 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.

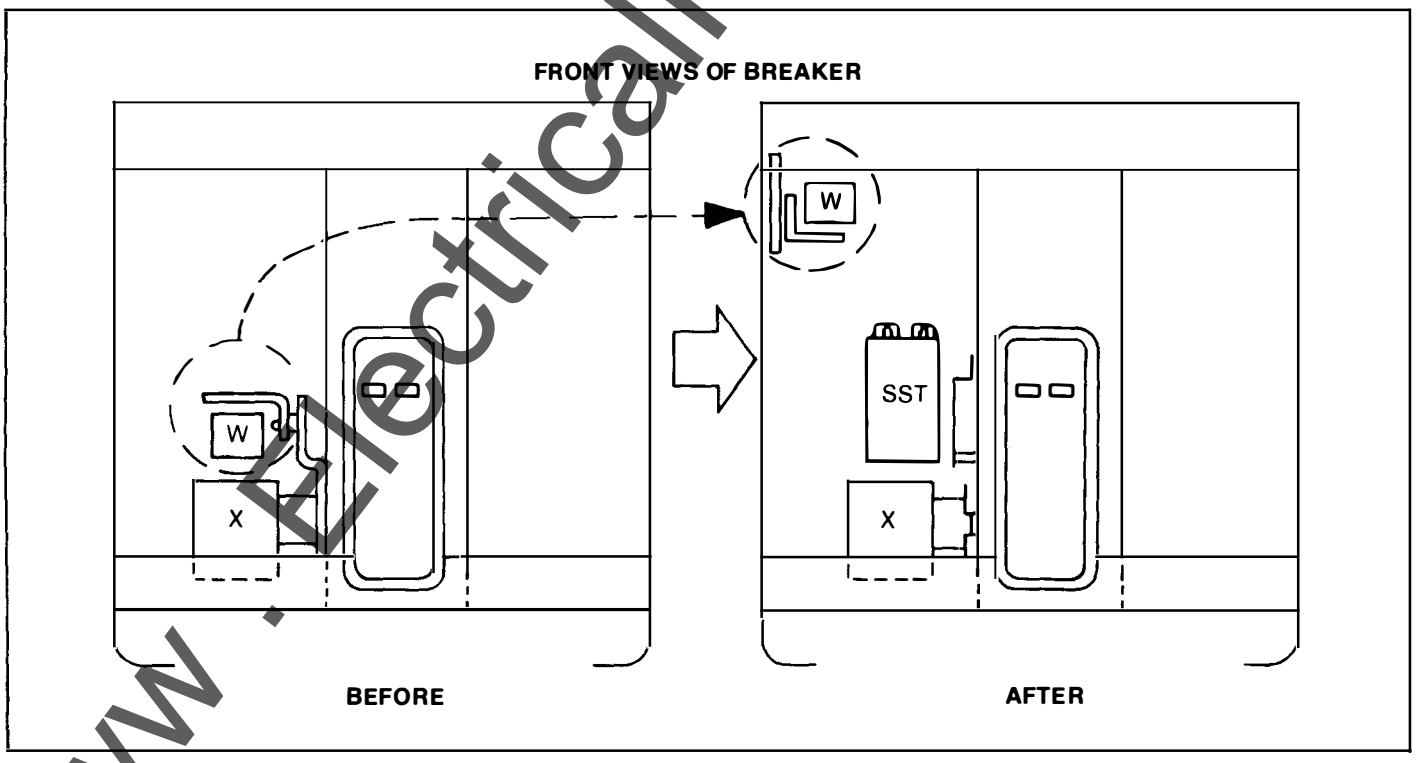


Fig. 2-1. Relocating W relay and remounting X relay

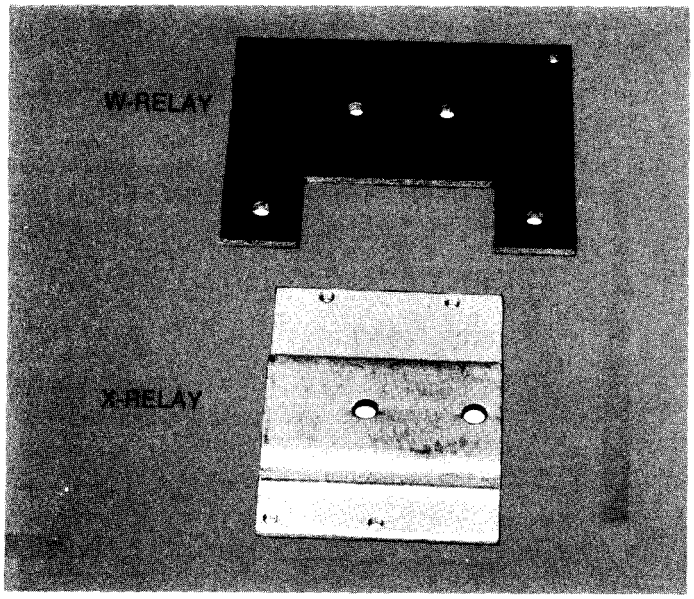
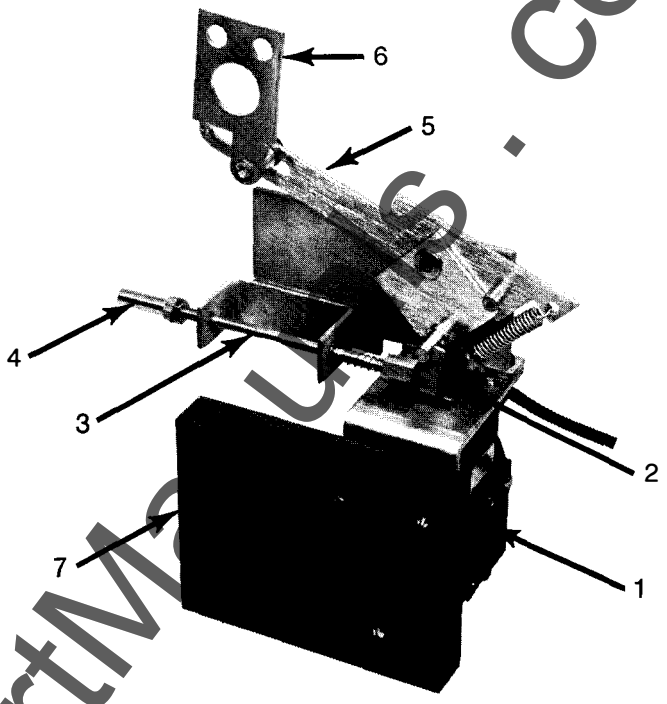


Fig. 2-2. New W and X relay mounting brackets



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® RMS- 9 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 lock-out (OFLO) device.

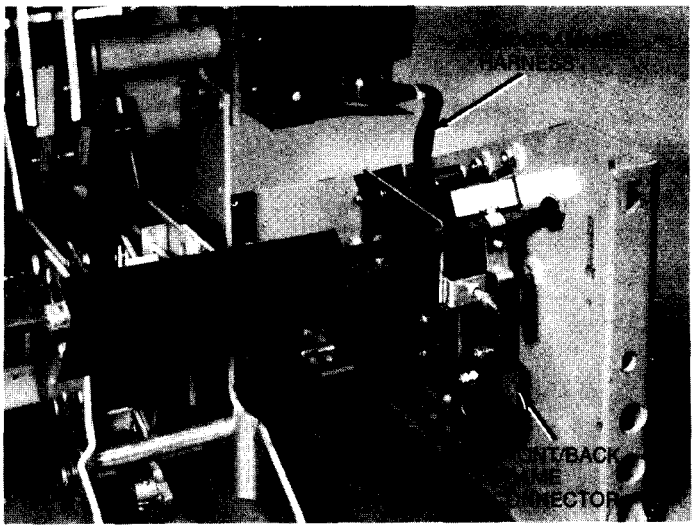


Fig. 2-4. Flux shifter installed

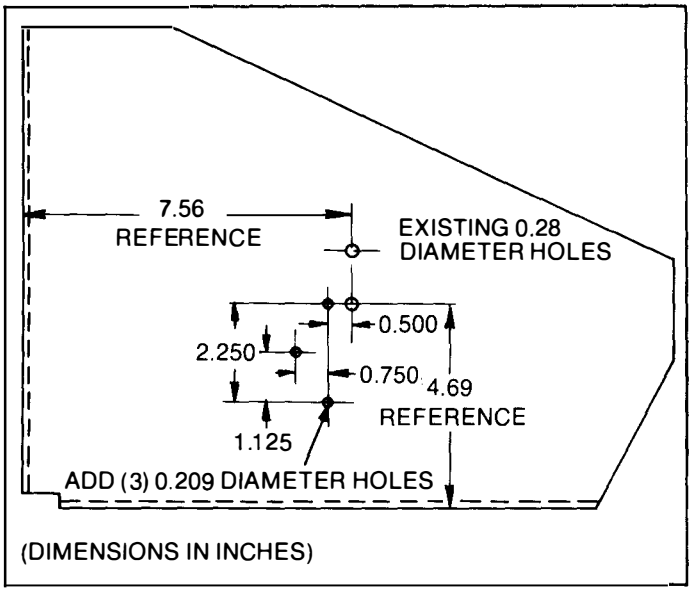


Fig. 2-5. Flux shifter mounting hole pattern

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.

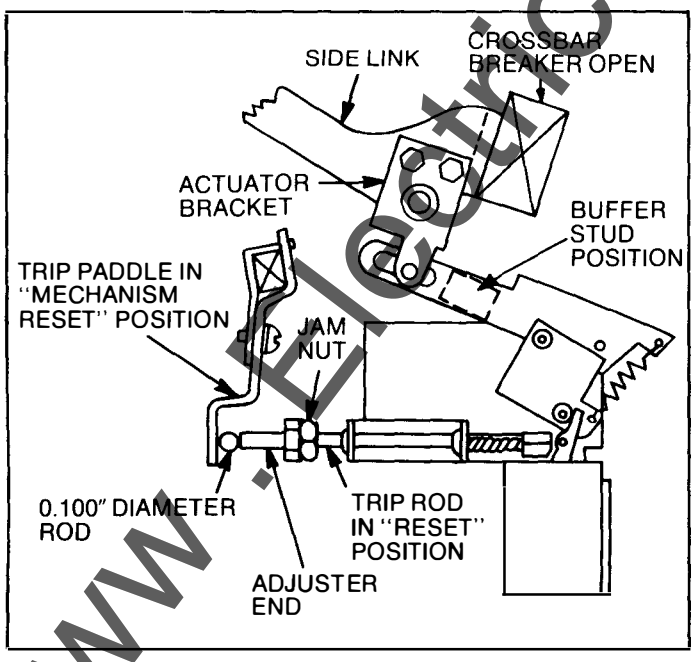


Fig. 2-6. Flux shifter adjustments

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 trip rod at 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.

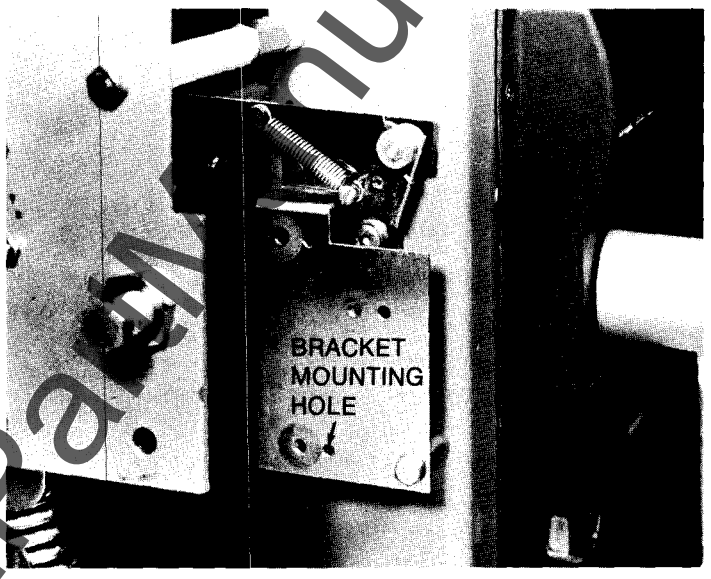
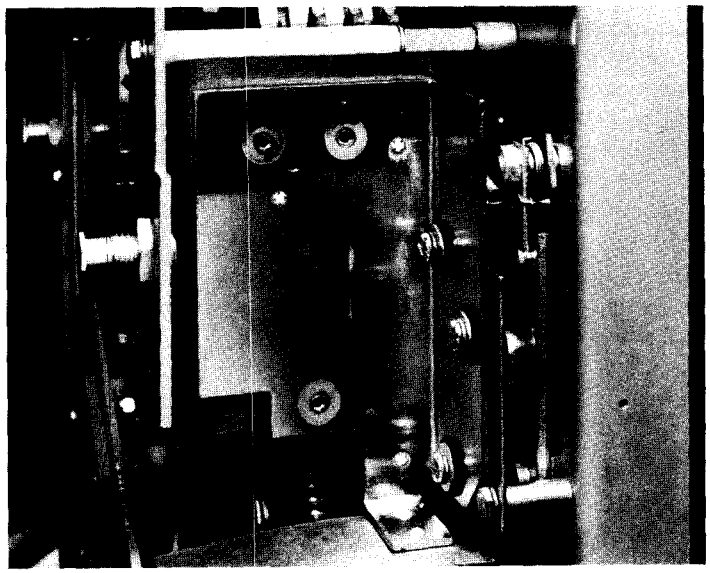


Plate Assembled to Channel



Mounting Bracket Installed To Plate

Fig. 2-7. Programmer mounting bracket and plate

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 its two mounting screws and rotate the bracket clockwise to take up mounting hole slack. Retighten screws.

2.5—Programmer Mounting Installation

The MicroVersaTrip® RMS-9 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).

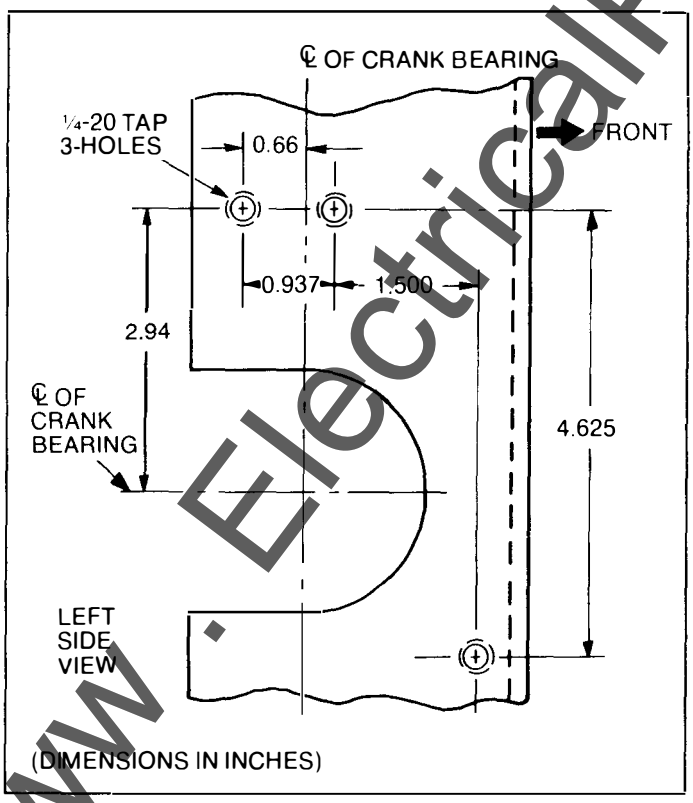


Fig. 2-8. Mounting plate hole pattern

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. Refer to Fig. 2-9. 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 Fig. 2-9 to complete assembly of programmer harness to programmer bracket.

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 toward the breaker's top, right-hand side.

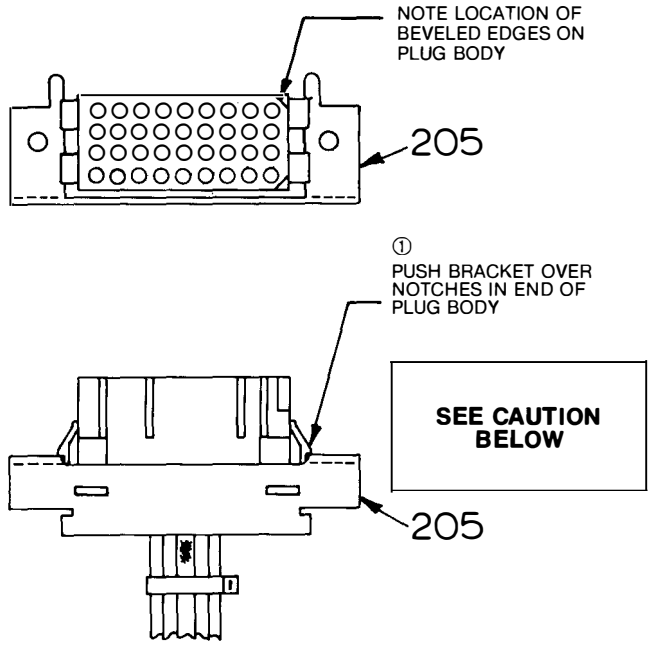
Route the harness under the flux shifter base. Attach the harness to this base using the wire keeper provided.

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

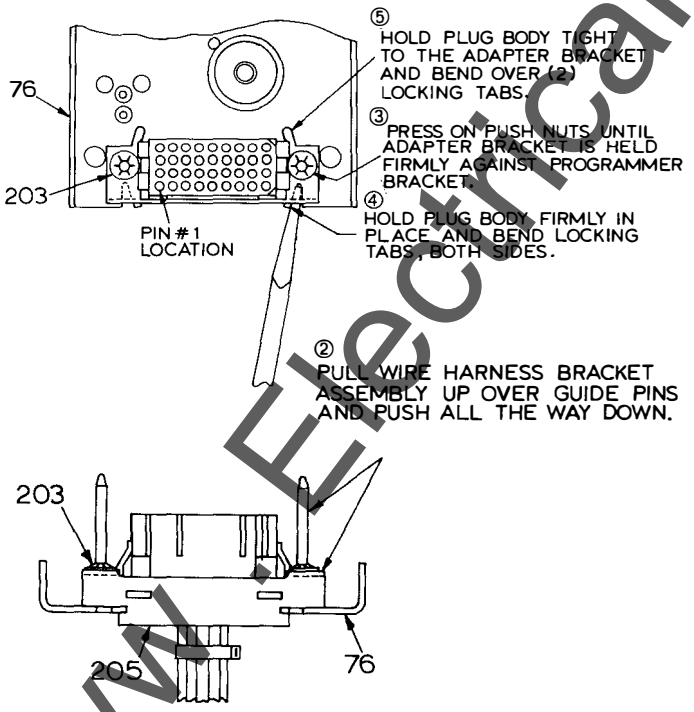
Before installing the programmer bracket to the mounting bracket, insert the flux shifter leads into the programmer connector. These leads are color-coded RED and WHITE. The required connector pins are factory-installed on the leads. Insert the RED lead into Pin Number 32 and the WHITE lead into Pin 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.

SECTION 2 (CONT'D)—Front Frame Conversion



PROGRAMMER HARNESS PLUG SUB-ASSEMBLY



PROGRAMMER HARNESS PLUG TO PROGRAMMER BRACKET

Fig. 2-9. Harness Connector

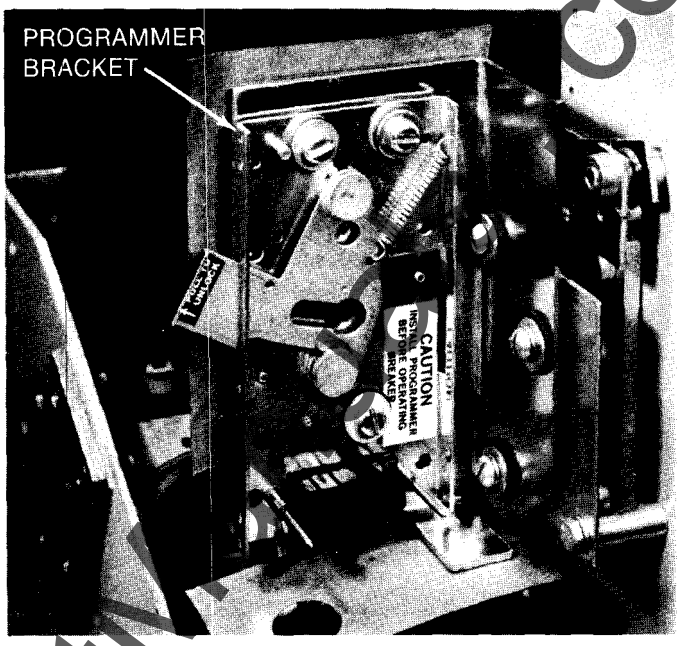


Fig. 2-10. Programmer plate installation

CAUTION—ADAPTER BRACKET (205) MUST BE INSTALLED ONTO HARNESS PLUG AS SHOWN IN FIG. 2-9. FAILURE TO DO SO WILL RESULT IN HARNESS PLUG FAILURE AND PROGRAMMER WILL NOT PROVIDE ANY PROTECTION.

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 $\frac{5}{16}$-18 holes using the hole pattern given in Fig. 3-2.

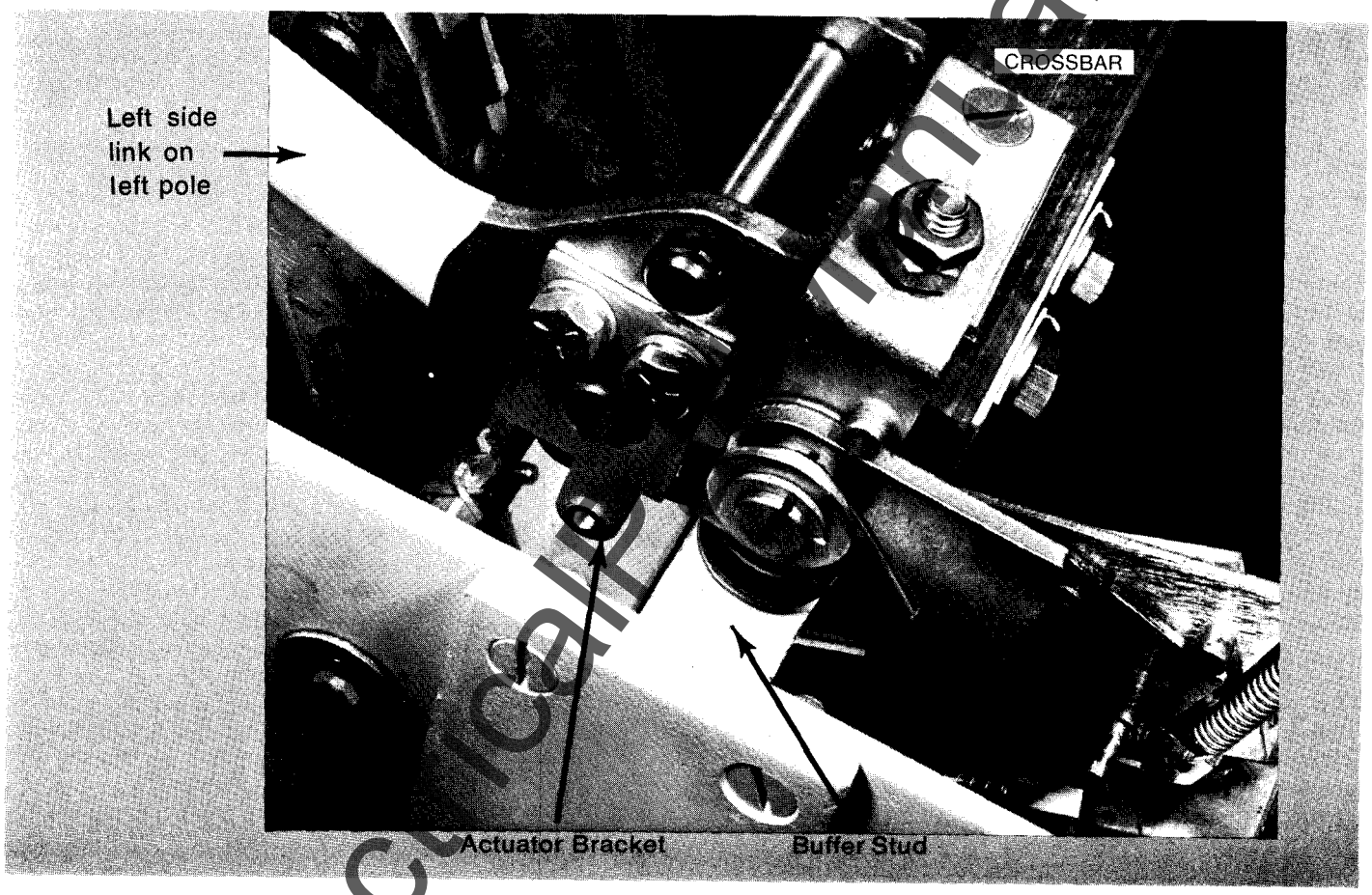


Fig. 3-1. Flux shifter actuator bracket installation

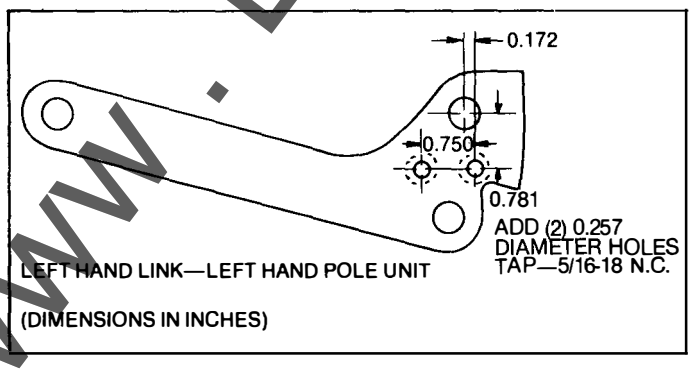


Fig. 3-2. Actuator bracket — mounting hole pattern

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® RMS- 9 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® RMS- 9 sensor.
2. Install as shown in Fig. 3-4.

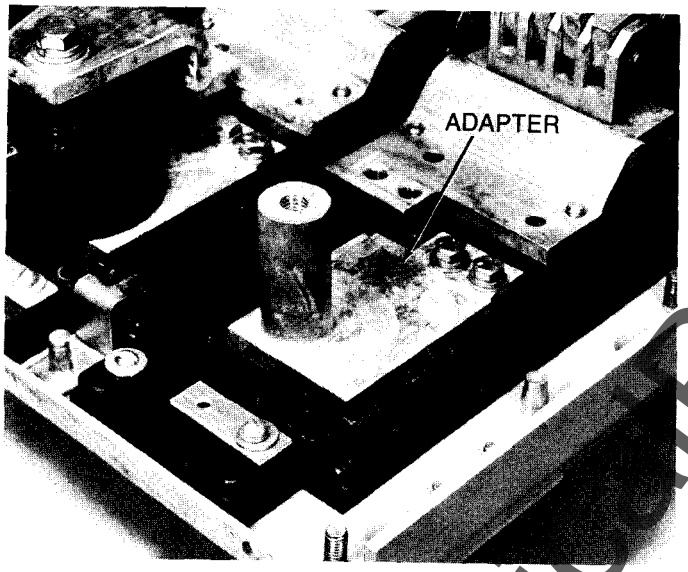


Fig. 3-3. Lower adapter connector

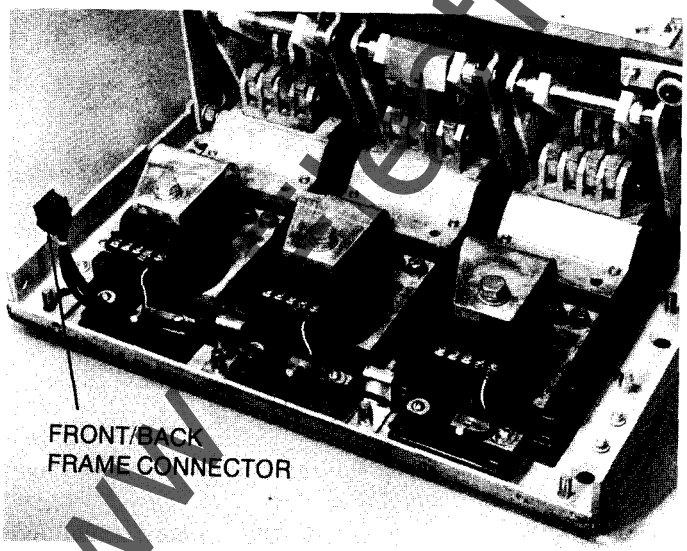


Fig. 3-4. MicroVersaTrip® RMS- 9 phase sensors and harness installed — AK/AKS-50

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 disconnect finger 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® RMS- 9 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).
7. Replace the primary disconnect finger assemblies.

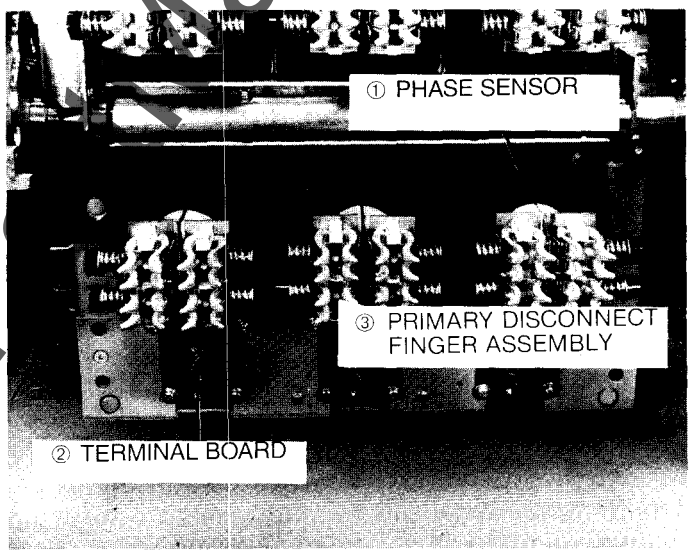


Fig. 3-5. MicroVersaTrip® RMS- 9 phase sensors installed

SECTION 3 (CONT'D)—Back Frame Conversion

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® RMS- 9 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 exit 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.

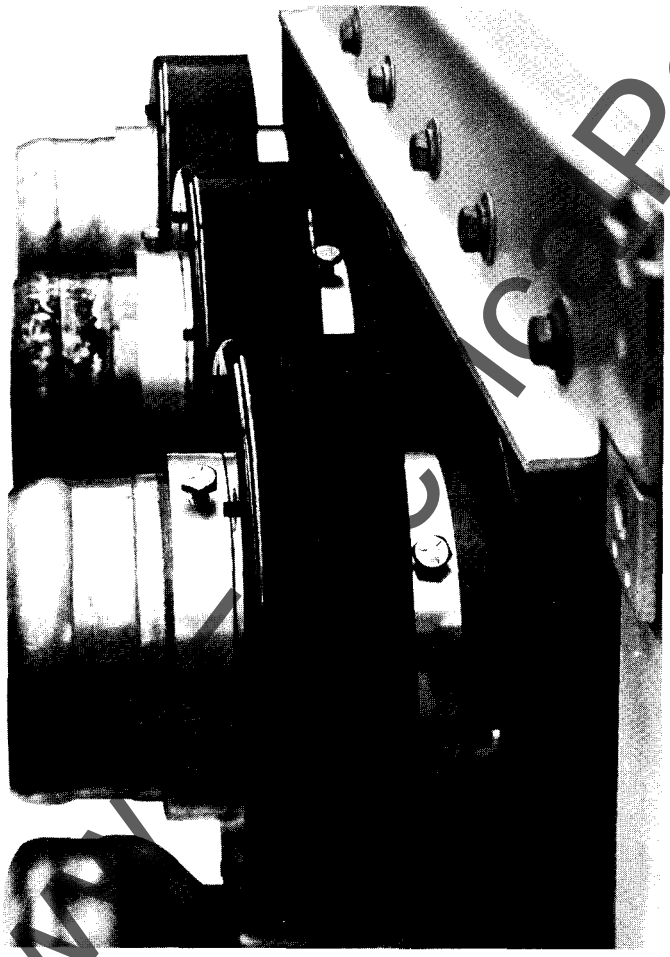


Fig. 3-6. Phase sensors installed — AK-75/100

For SST equipped breakers:

The MicroVersaTrip® RMS- 9 sensor is physically identical to the SST sensor. Follow the basic procedure given above and replace the SST with the MicroVersaTrip® RMS- 9 sensor.

3.6—Backframe Harness Installation

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

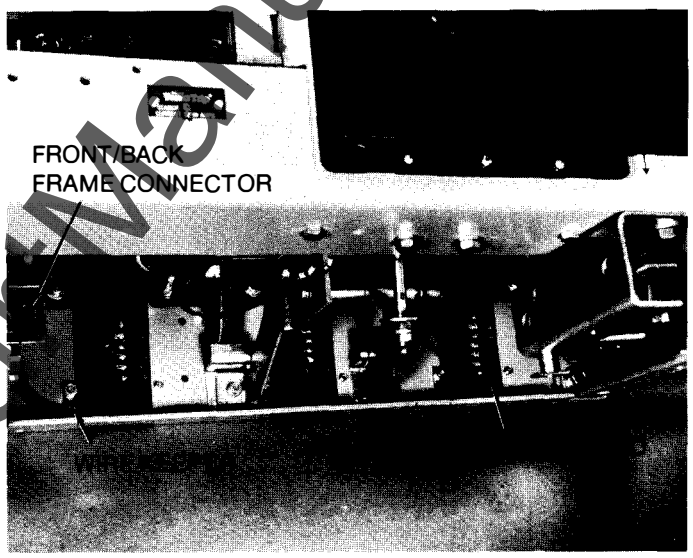


Fig. 3-7. Back frame harness installation — AK/AKR-75/100

SECTION 3 (CONT'D)—Back Frame Conversion

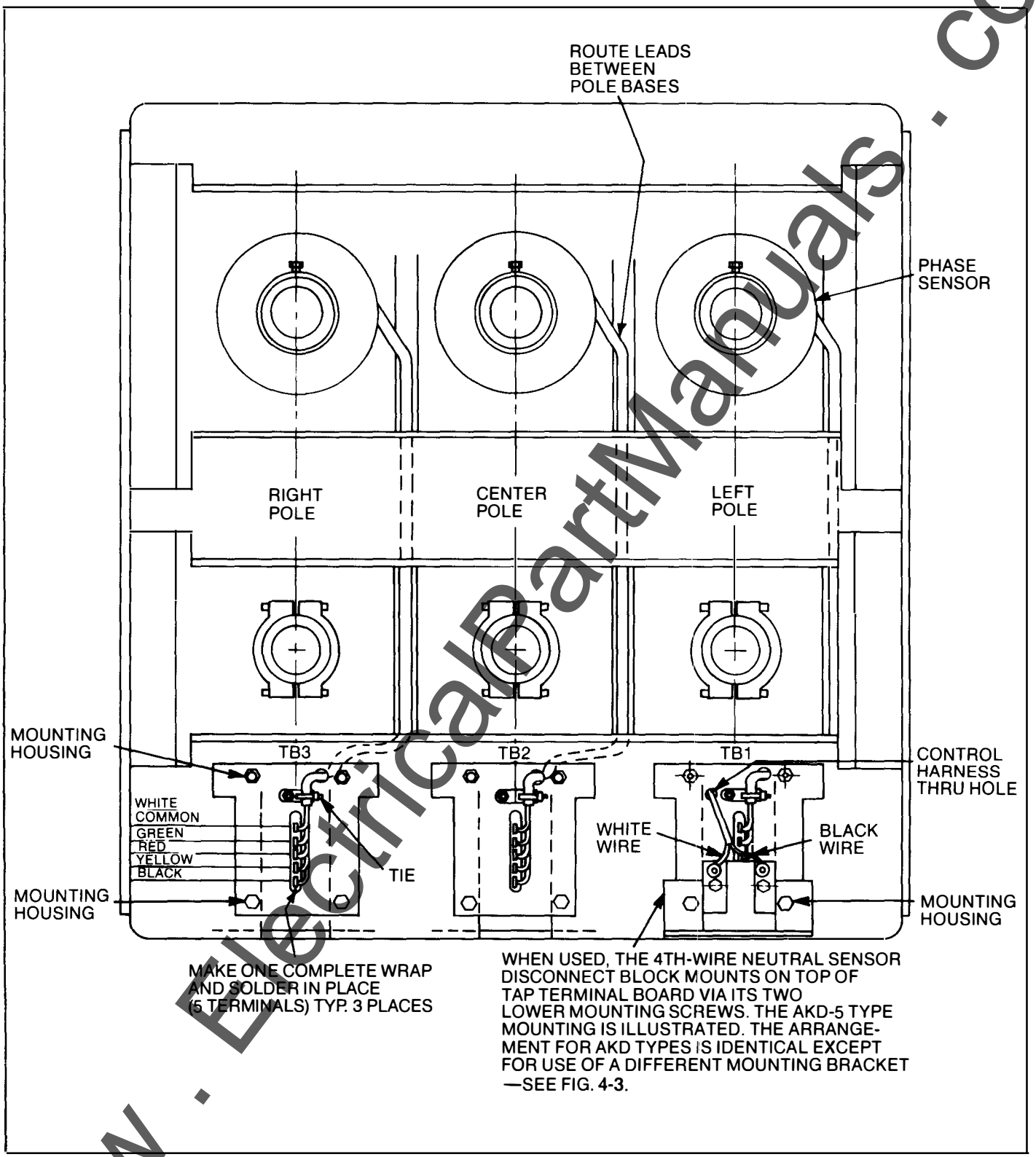


Fig. 3-8. Typical AK-75/100 backframe conversion — rear view

SECTION 4—Four Wire Ground Fault

4.1—General Information

The MicroVersaTrip® RMS-9 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 Draw-out

The 4th-wire disconnect for AK/AKS-50 draw-out 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.

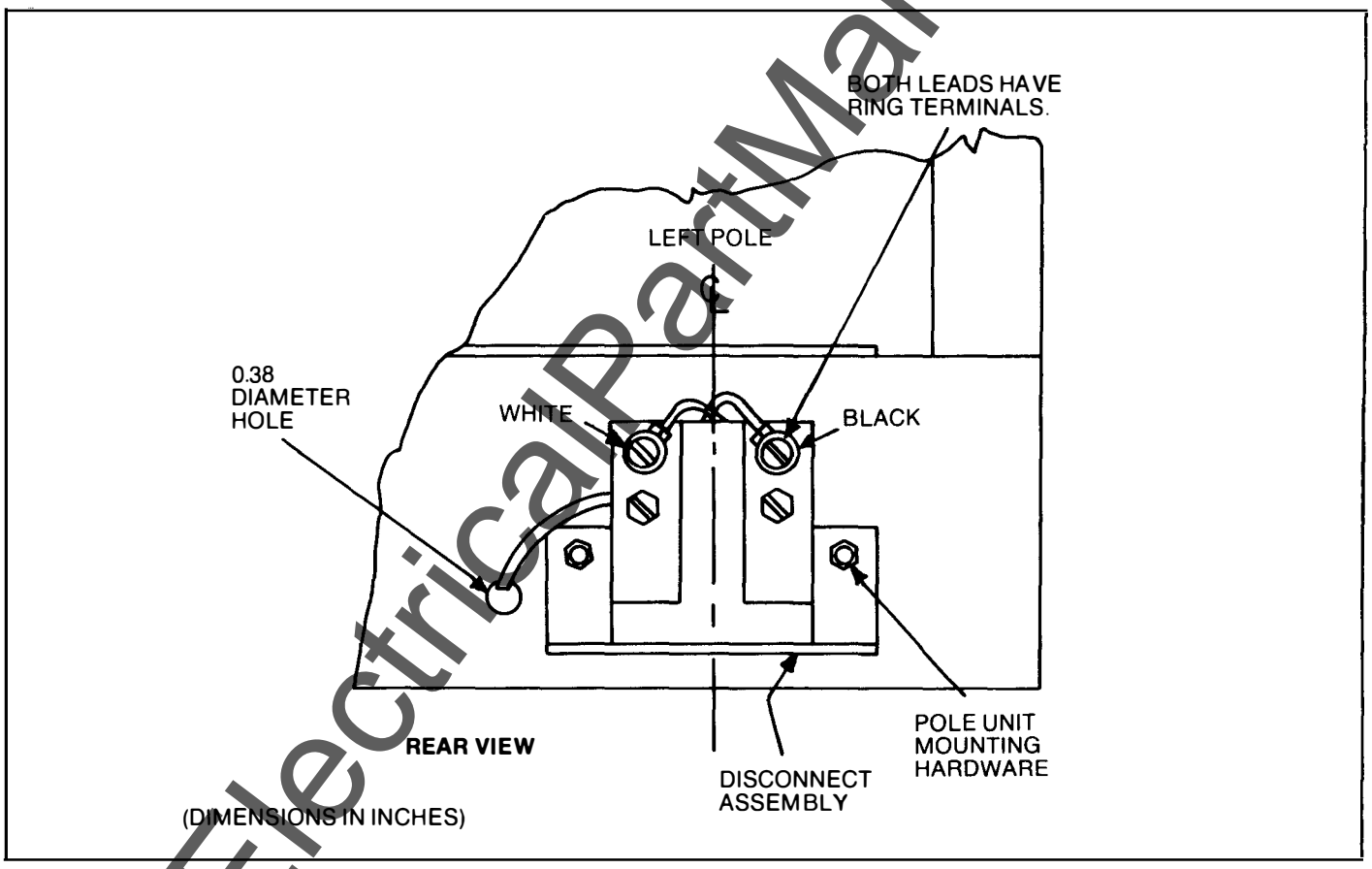


Fig. 4-1. 4th-wire neutral disconnect installed — AK/AKS-50 draw-out

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

4.3—Breaker Conversion— AK/AKS-50 Stationery

The 4th-wire disconnect for stationery 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 Draw-out

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.

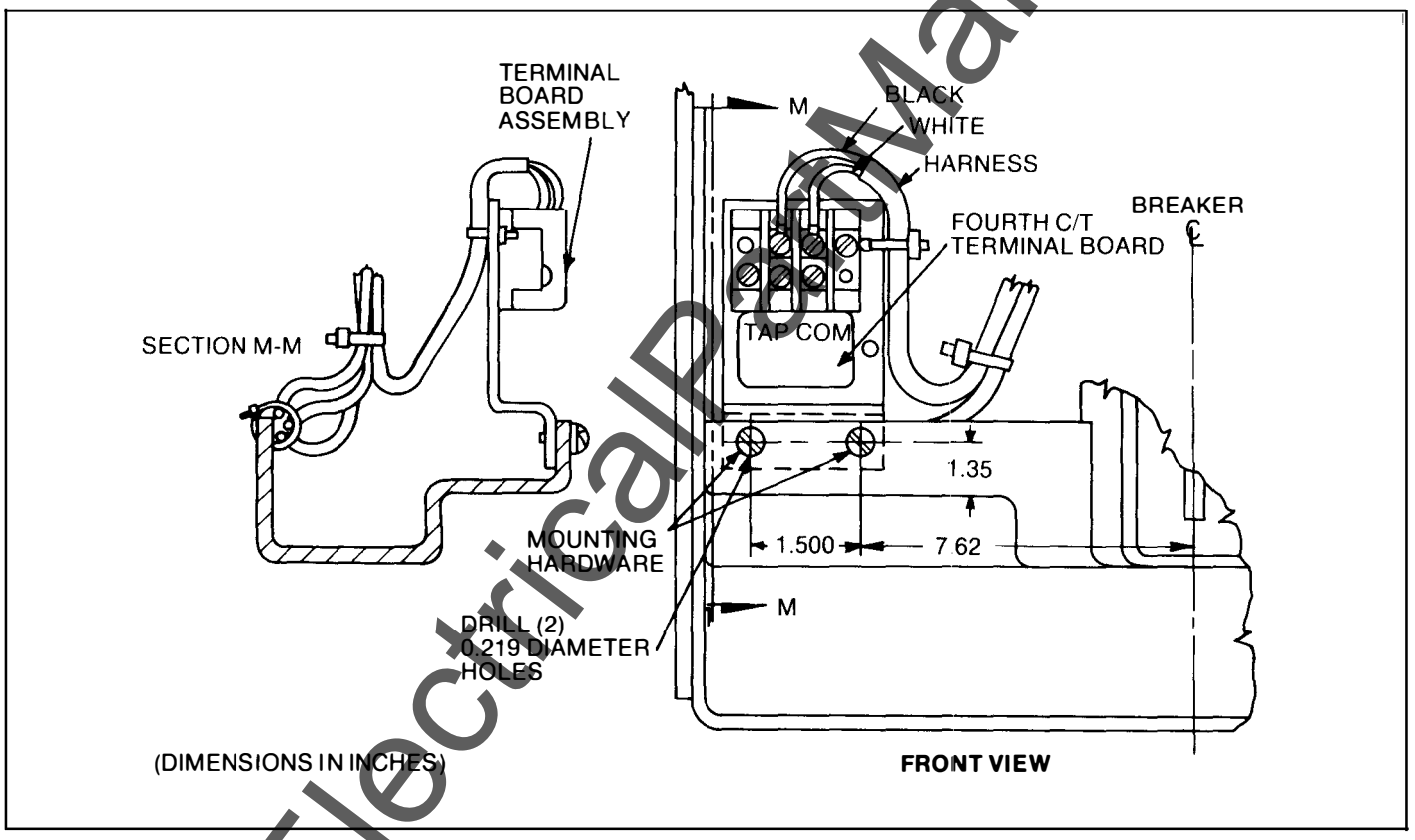
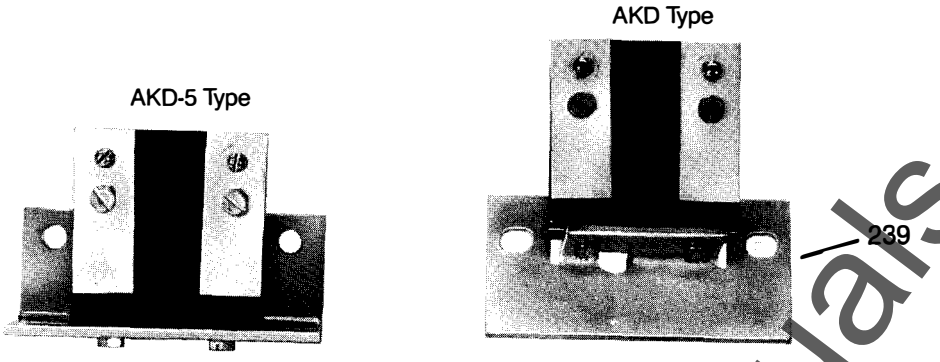


Fig. 4-2. 4th-wire terminal board installed — AK/AKS-50 stationary



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 draw-out breakers

The 4th-wire disconnect for the AKR-AKR-75/100 Draw-out 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

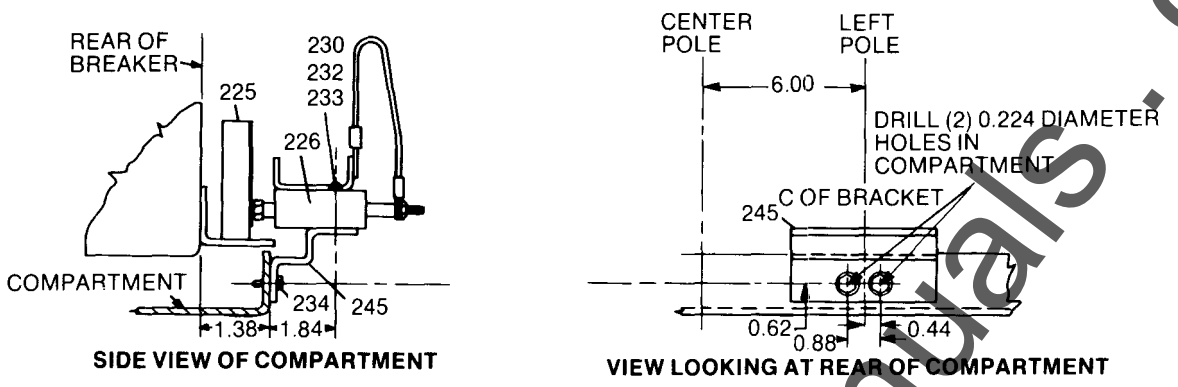
The 4th-wire disconnect for stationary AKR-75/100 breakers is similar to the terminal board used by the AKS-50 breakers. See Section 4.3 for details.

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.

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



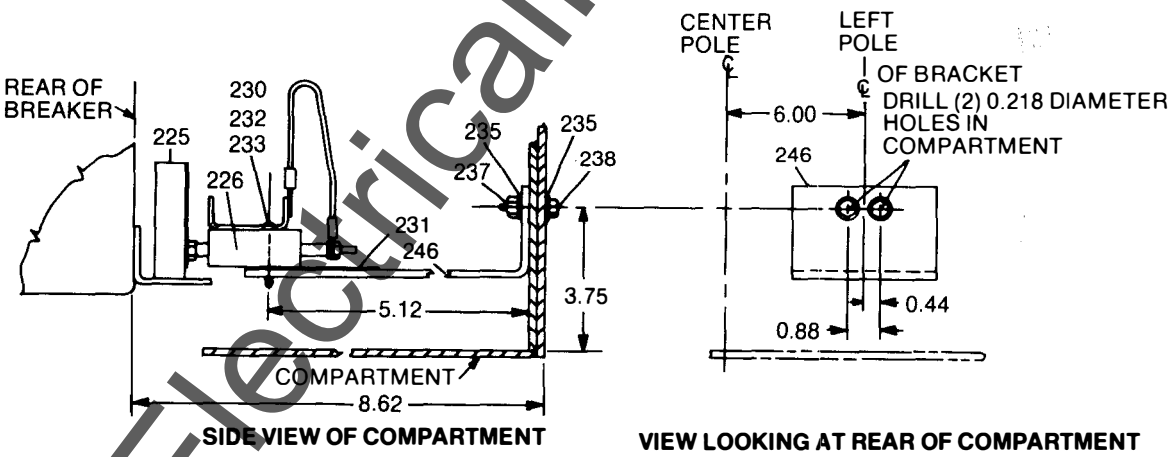
SIDE VIEW OF COMPARTMENT

VIEW LOOKING AT REAR OF COMPARTMENT

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
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



SIDE VIEW OF COMPARTMENT

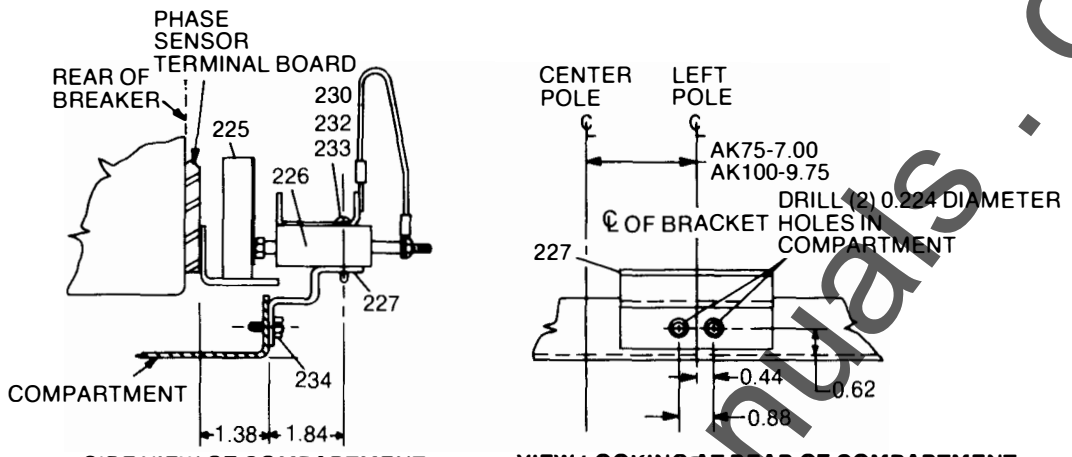
VIEW LOOKING AT REAR OF COMPARTMENT

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
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

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

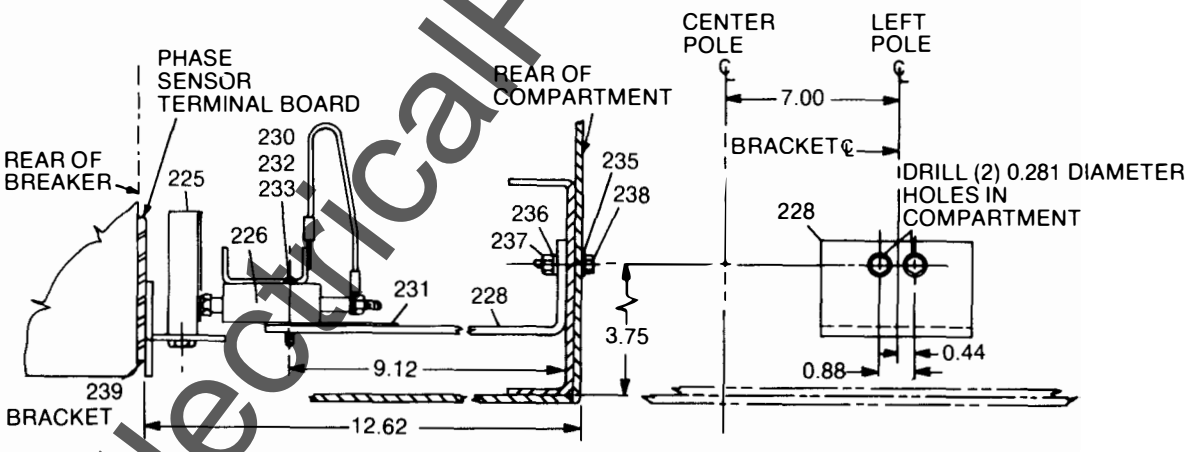


SIDE VIEW OF COMPARTMENT **VIEW LOOKING AT REAR OF COMPARTMENT**

(DIMENSIONS IN INCHES)

225. Breaker portion of 4th-wire disconnect
226. Equipment portion of 4th-wire disconnect
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



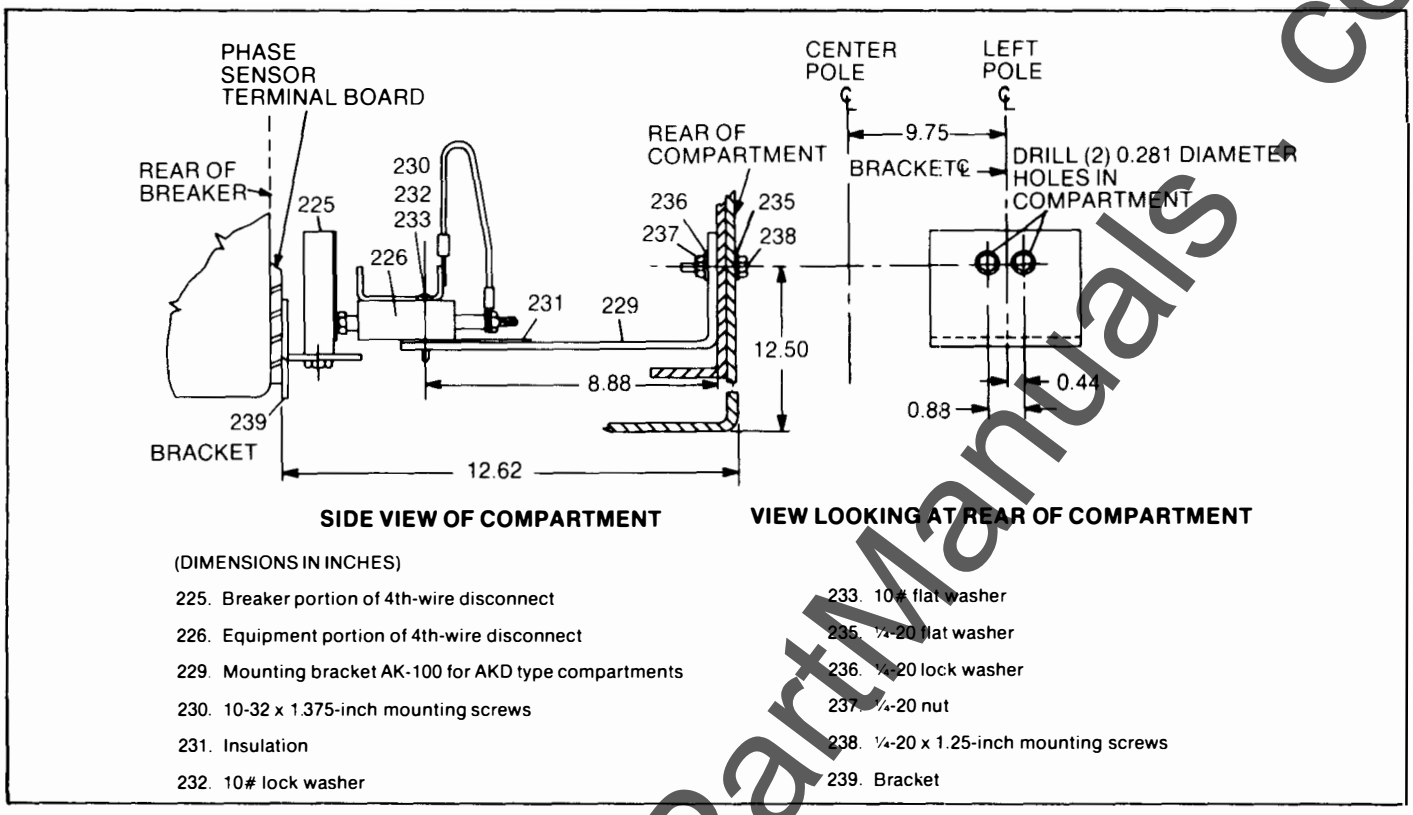
SIDE VIEW OF COMPARTMENT **VIEW LOOKING AT REAR OF COMPARTMENT**

(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

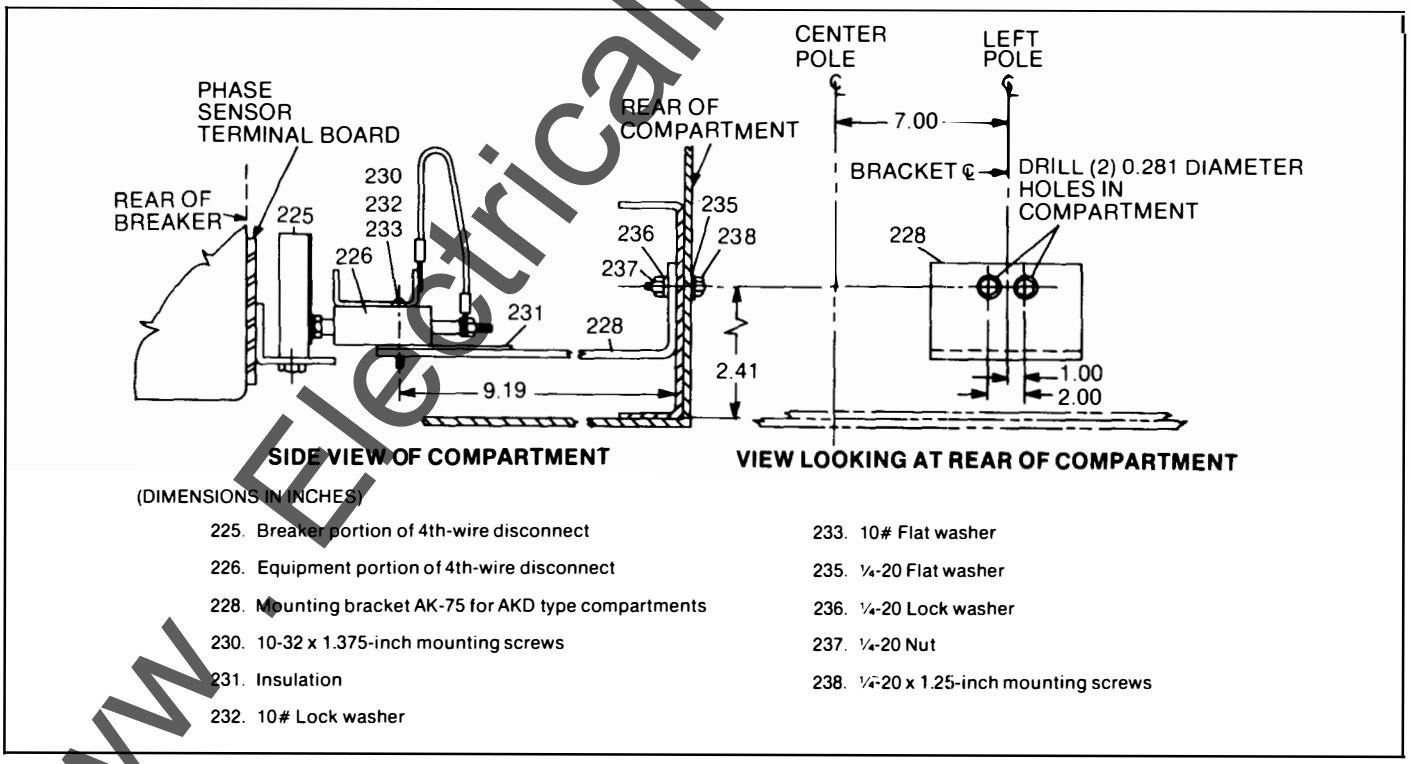
SECTION 4 (CONT'D)—Four-wire Ground Fault



(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



(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

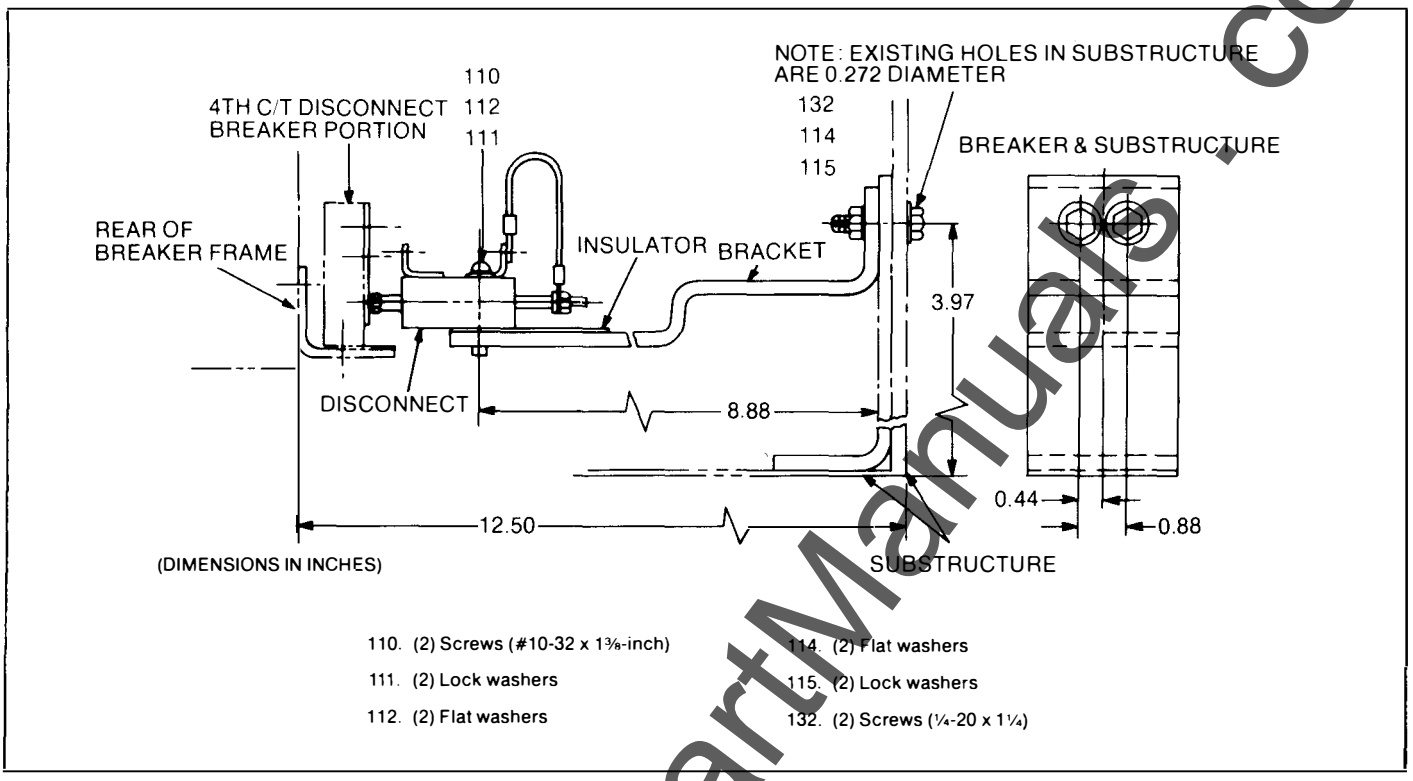


Fig. 4-10. AKR-75/100 4th-wire disconnect installation substructure

4.7—Neutral Sensors

The neutral sensor is an electrical duplicate of the phase sensor, including the taps. Therefore, when taps (if provided) are changed on the phase sensors, the taps on the neutral sensor must be correspondingly positioned. For kits with fixed phase sensors, be sure to use the corresponding tap on the neutral sensor.

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.

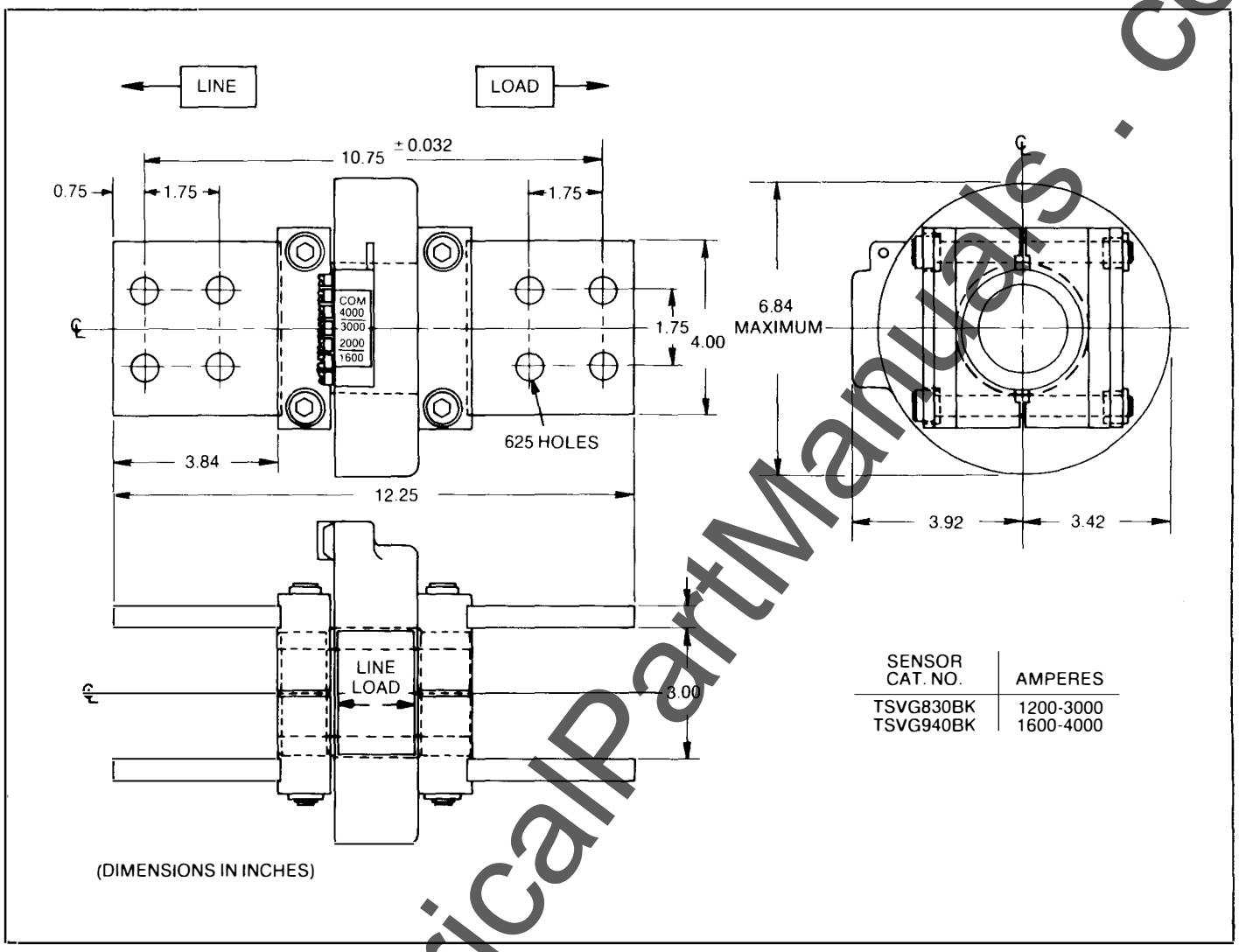
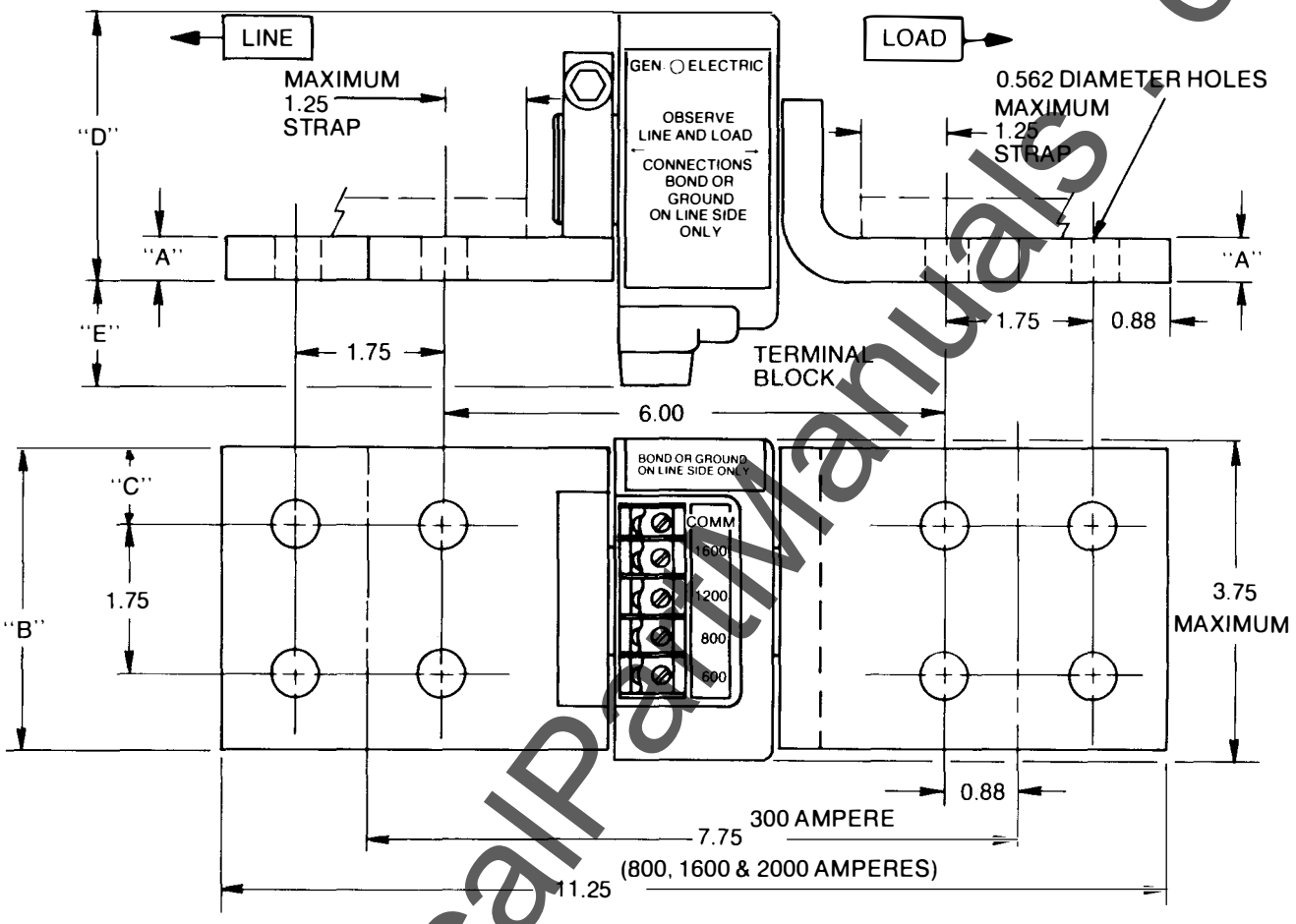


Fig. 4-11. Outline of the AKR-75/100 and AK-75/100 neutral sensor



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

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

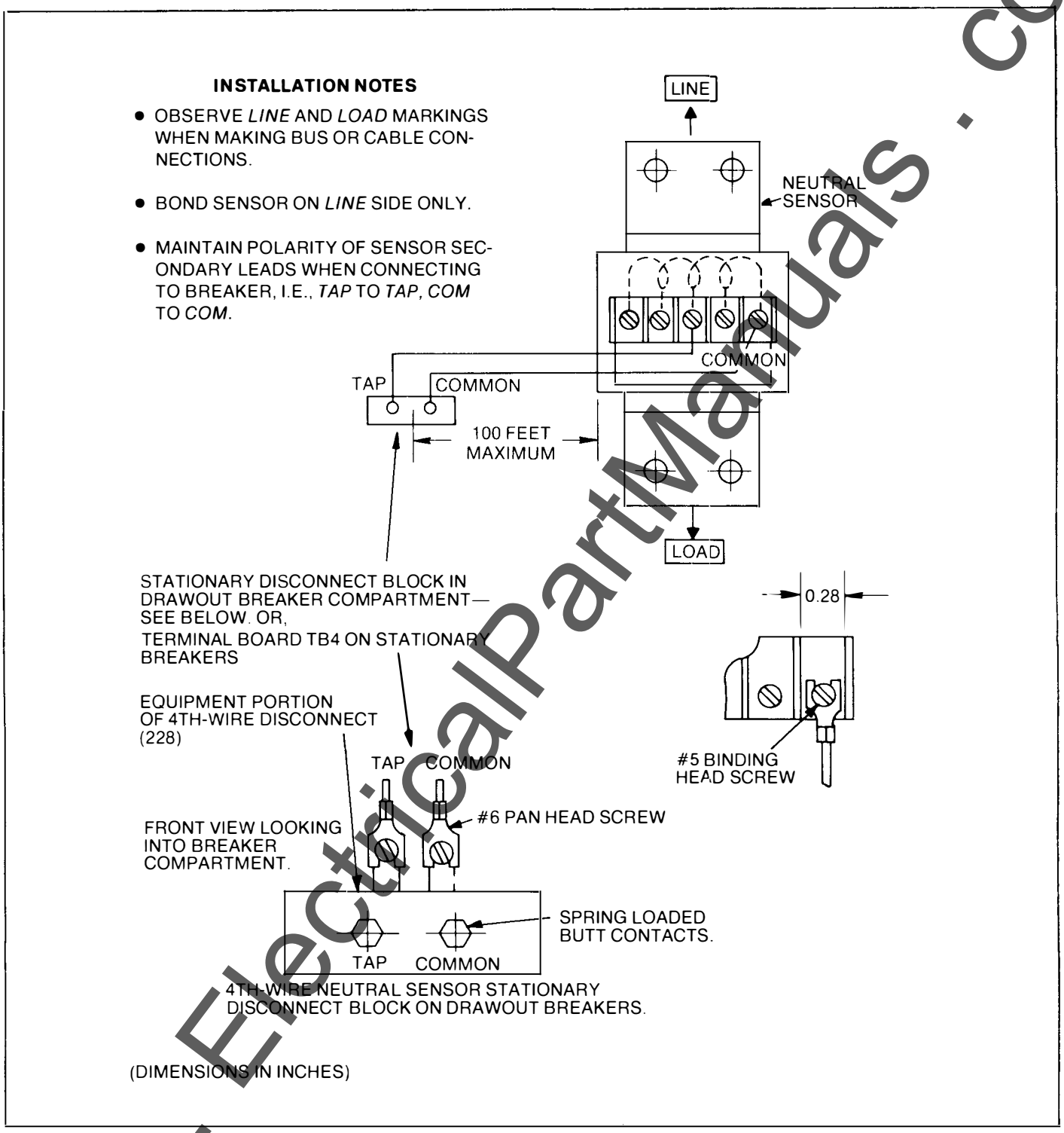


Fig. 4-13. Connecting the 4th-wire neutral sensor

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 box. 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. Release the locking lever, 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.

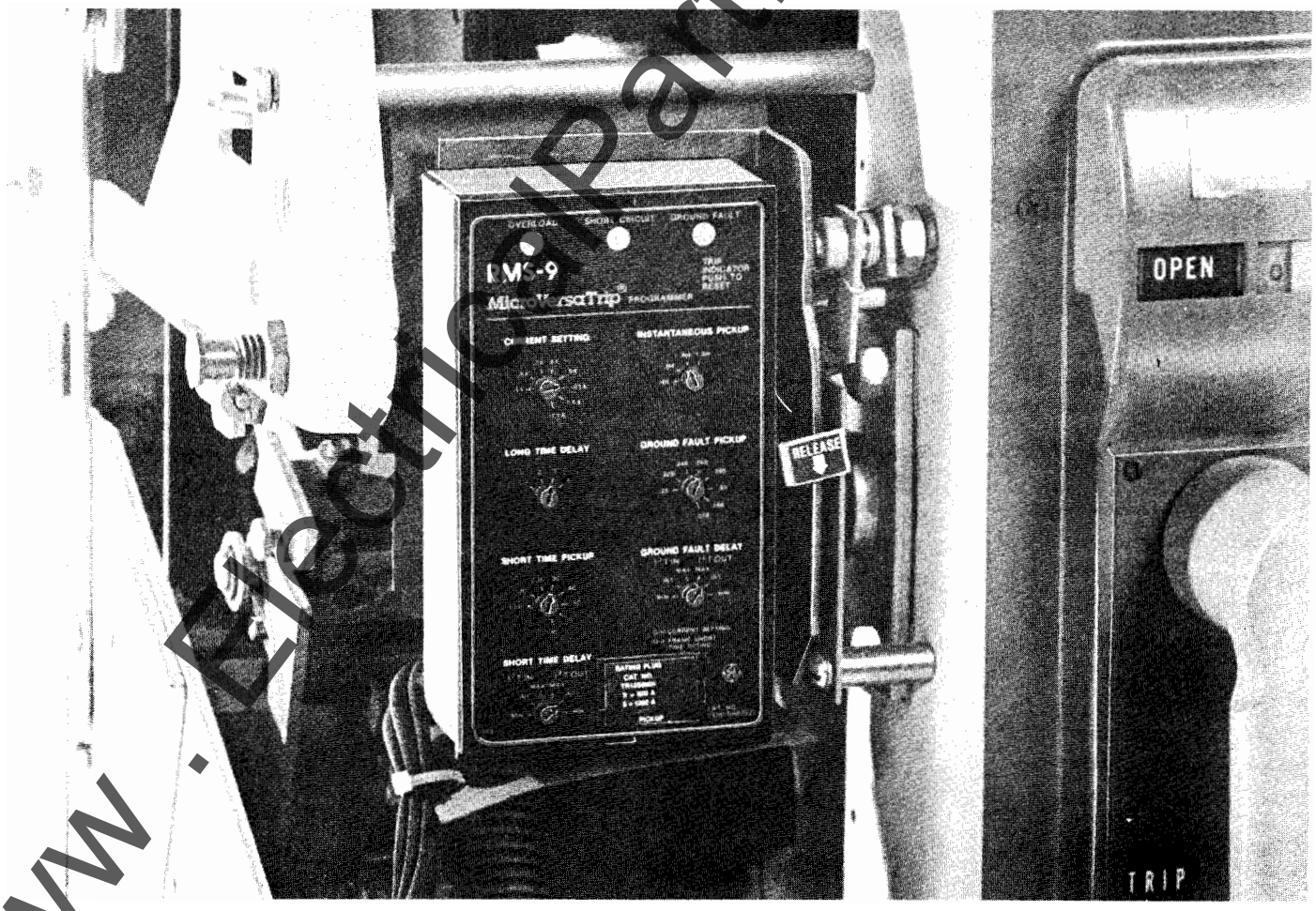


Fig. 5-1. AKS-50 programmer mounting

SECTION 6—Testing and Troubleshooting

6.1—General Information

Once the breaker has been converted but 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 using Cat. No. TVRMS which is a portable, battery powered, test kit providing MicroVersaTrip® RMS-9 programmer self-tests and functional trip/no trip tests. Interface is via a plug on the front of the programmer. Kit uses six rechargeable NiCad or standard alkaline "D" cells supplied by customer. Kit can also be powered by 120-volts ac source. Testing of a MicroVersaTrip® RMS-9 equipped circuit breaker may also be accomplished using primary current from a high current, low voltage test set. Test kit Cat. No. TVRMS can be used to temporarily defeat the MicroVersaTrip® RMS-9 programmer ground fault function (if so equipped). Ground fault defeat cable, Cat. No. TVTGD9 **CANNOT** and **MUST NOT** be used with MicroVersaTrip® RMS-9 programmers. Programmer damage may result. Likewise do not attempt to use test kit Cat. No. TVTS1 on this programmer.

6.3—Troubleshooting

When malfunctioning is suspected, the first step in trouble-shooting 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 6.2.

6.3.1—Resistance Values

For use in troubleshooting the MicroVersaTrip®-RMS-.9 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	20-24
	400	27-32
	600	42-50
	800	58-68
	600	42-50
	800	58-68
	1200	93-109
	1600	130-154
AKT-50 AKST-50	800	74-88
	1200	116-136
	1600	162-190
	2000	210-246
AK-75 AKR-75	1200	20-24
	1600	28-34
	2000	37-44
	3000	61-72
AK-100 AKR-100	1600	36-43
	2000	47-55
	3000	75-88
	4000	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®-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, 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 measure the sensor resistances. Since the phase and neutral sensors are electrically identical, their resistance should closely agree. See Table 6-1.

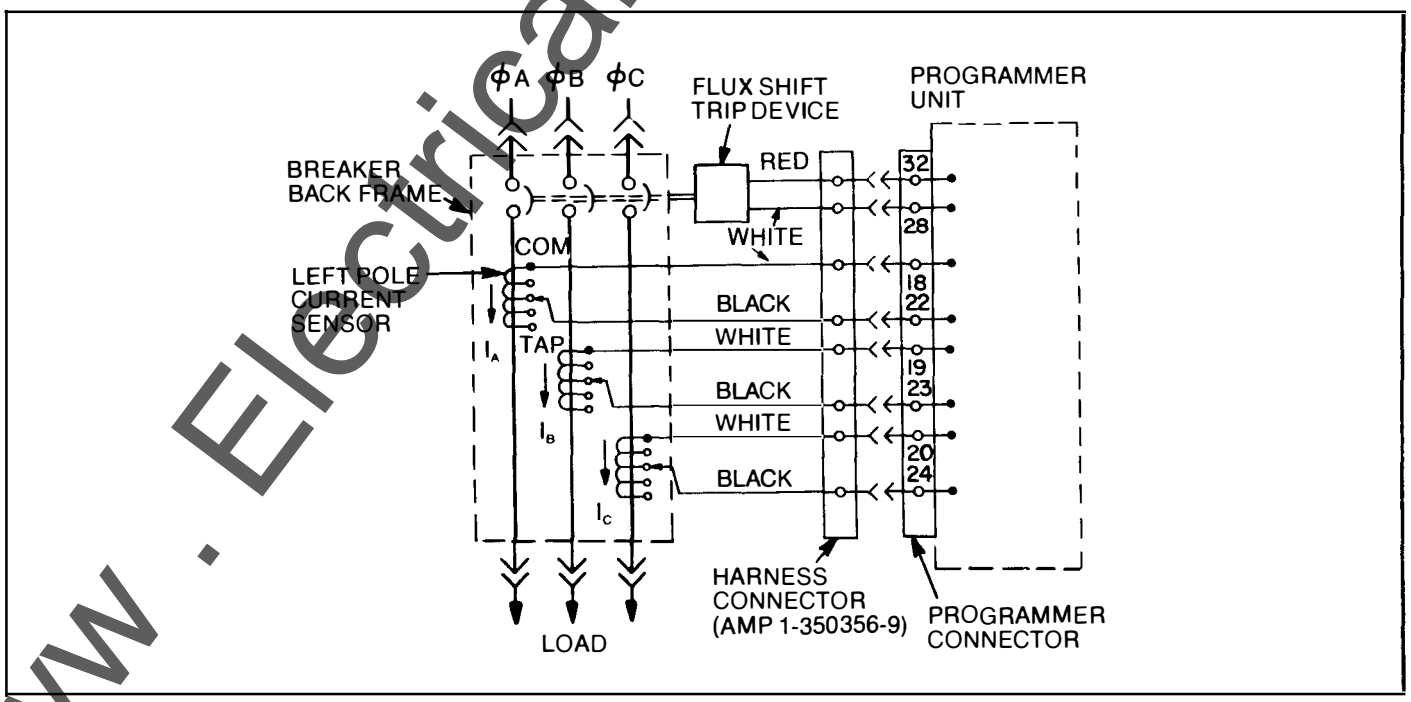


Fig. 6-1. Cabling diagram — MicroVersaTrip®-RMS-.9 without ground fault

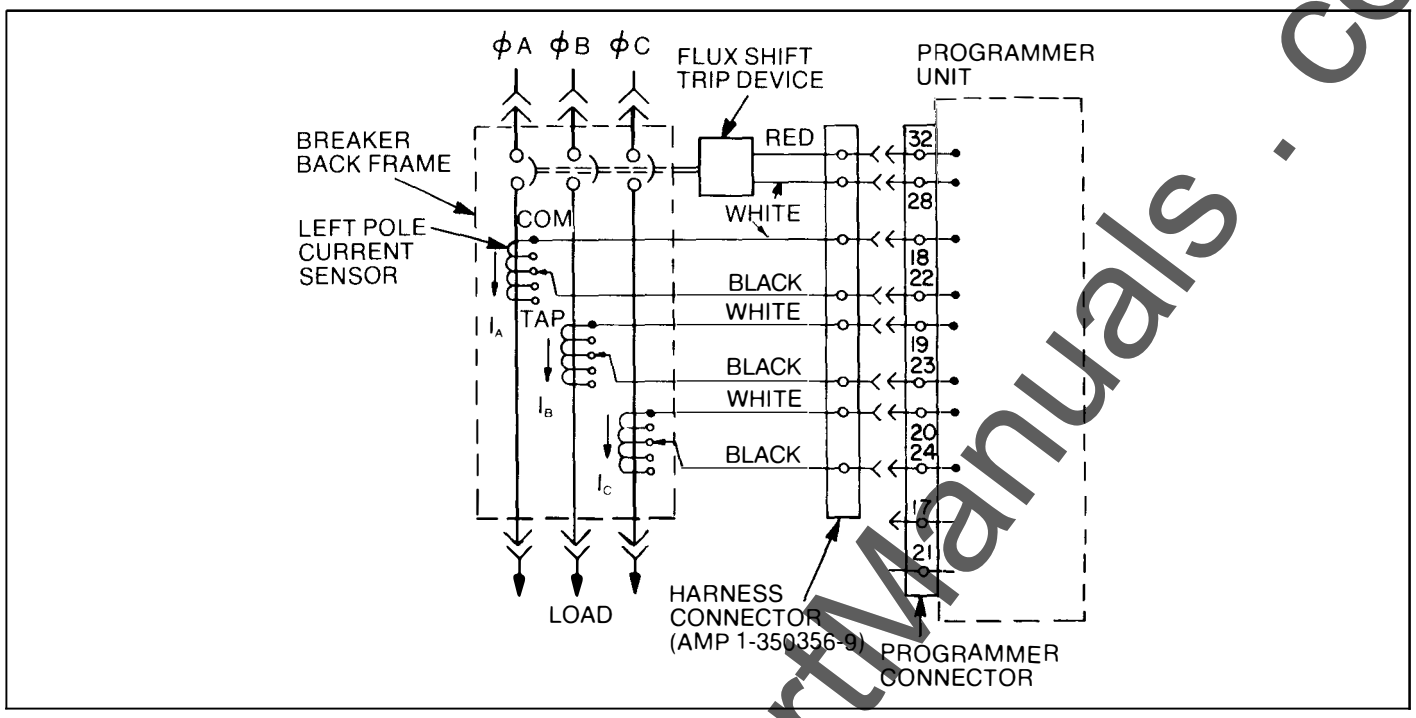


Fig. 6-2. Cabling diagram — MicroVersaTrip® RMS- 9 with ground fault on 3-wire load

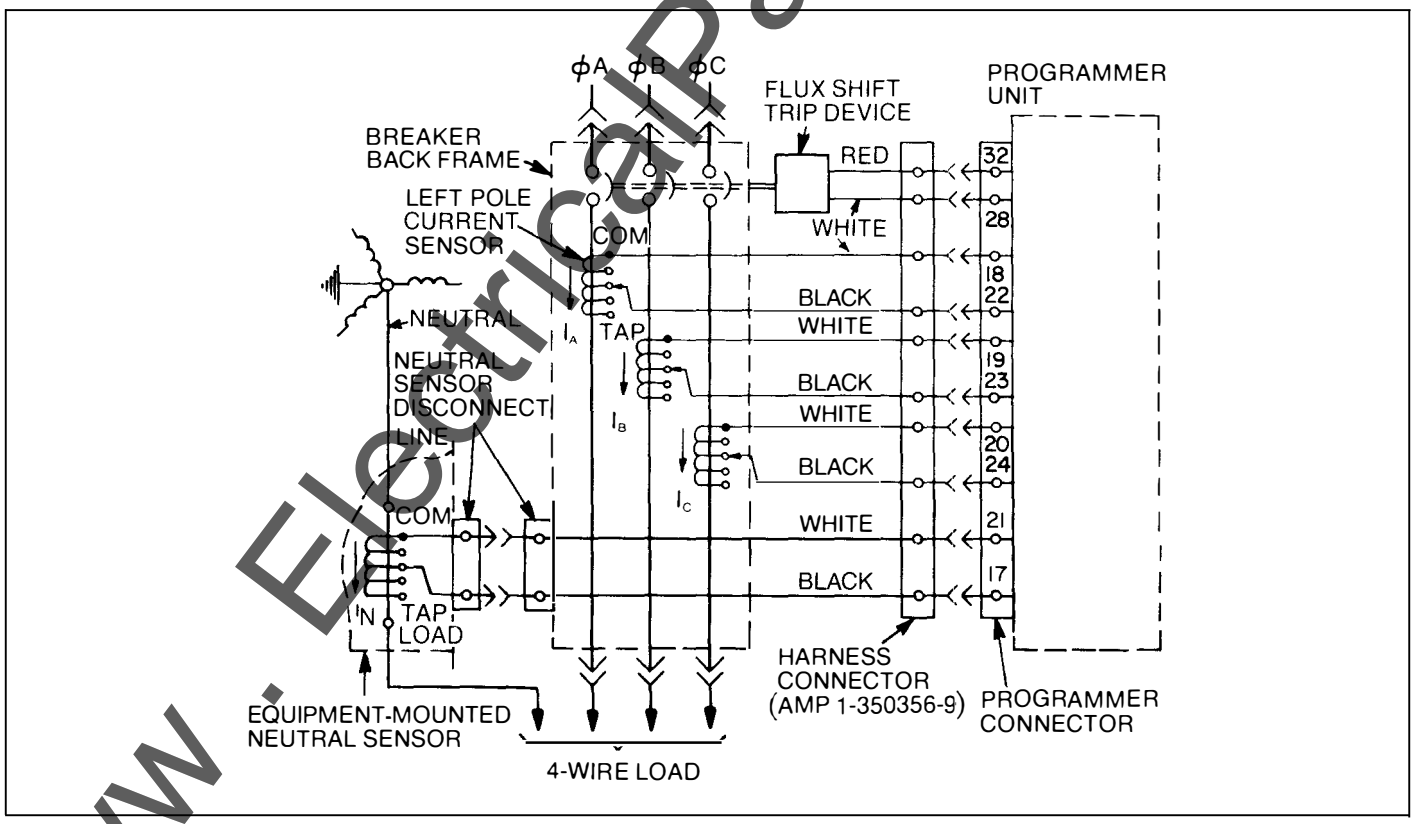


Fig. 6-3. Cabling diagram — MicroVersaTrip® RMS- 9 with ground fault on 4-wire load

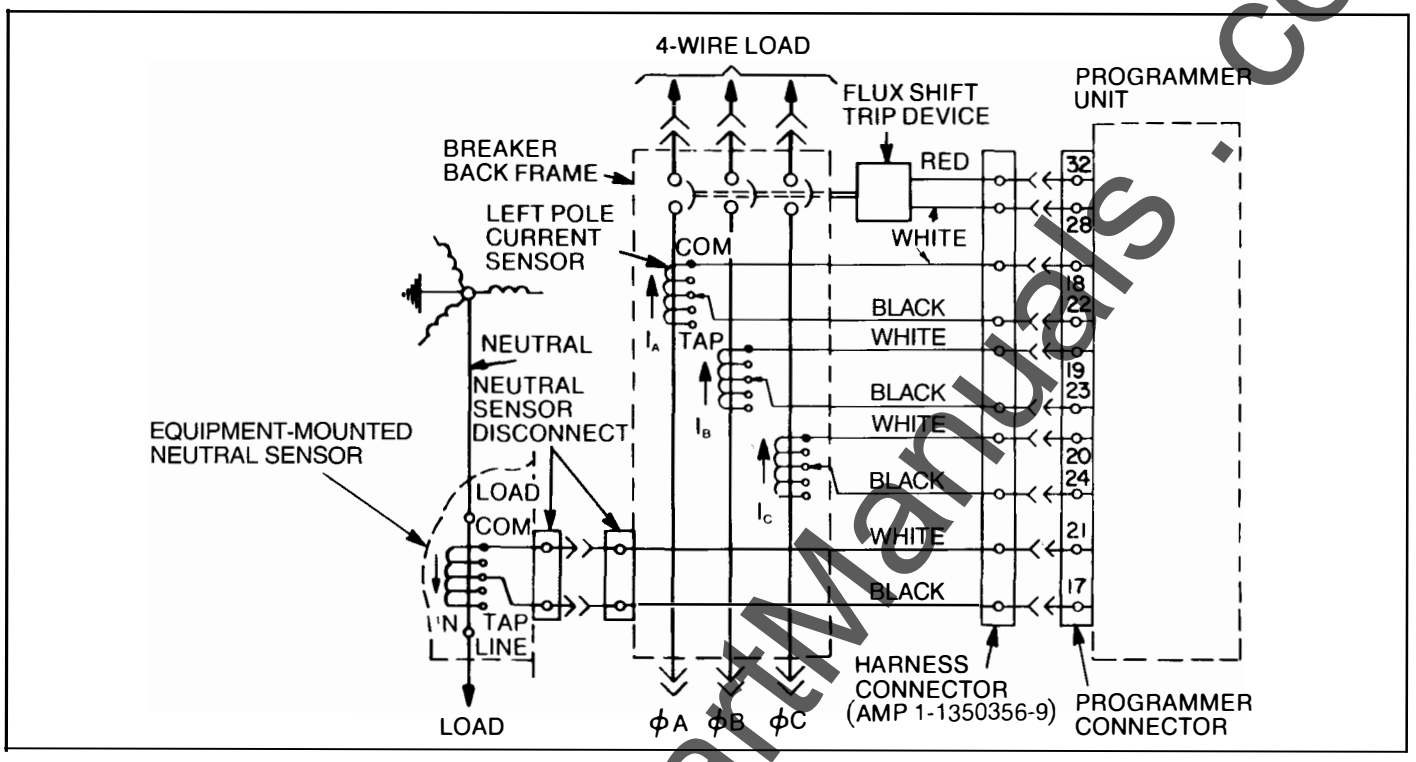


Fig. 6-4. Cabling diagram — MicroVersaTrip® RMS- 9 with ground fault on 4-wire load-breaker reverse feed

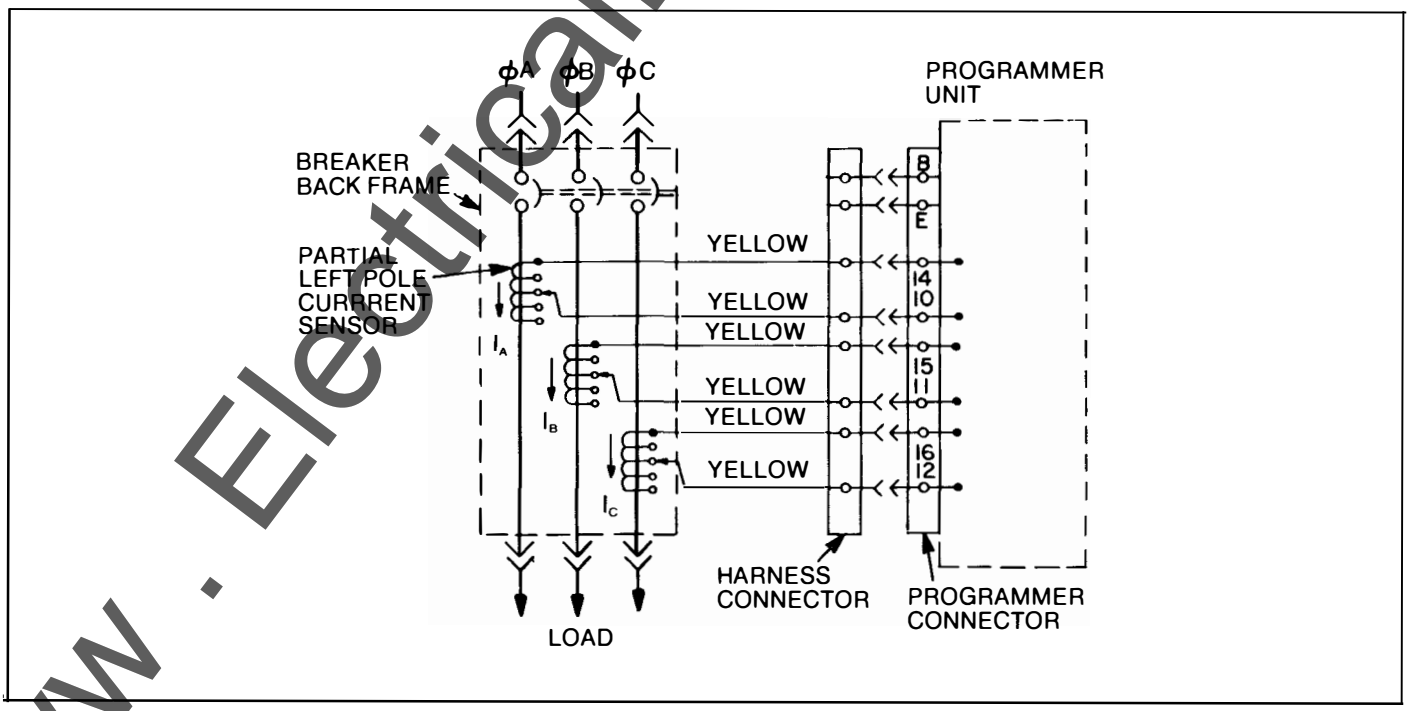


Fig. 6-5. Partial cable diagram — "H" option winding connections

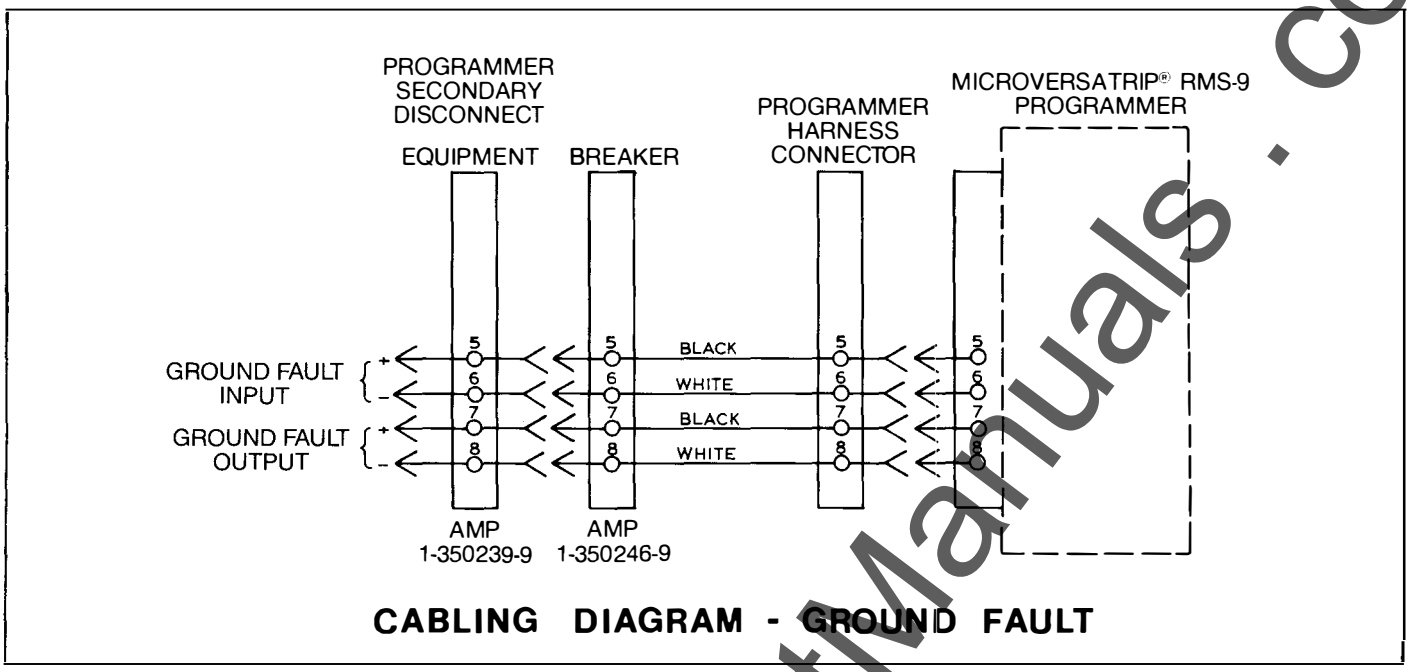
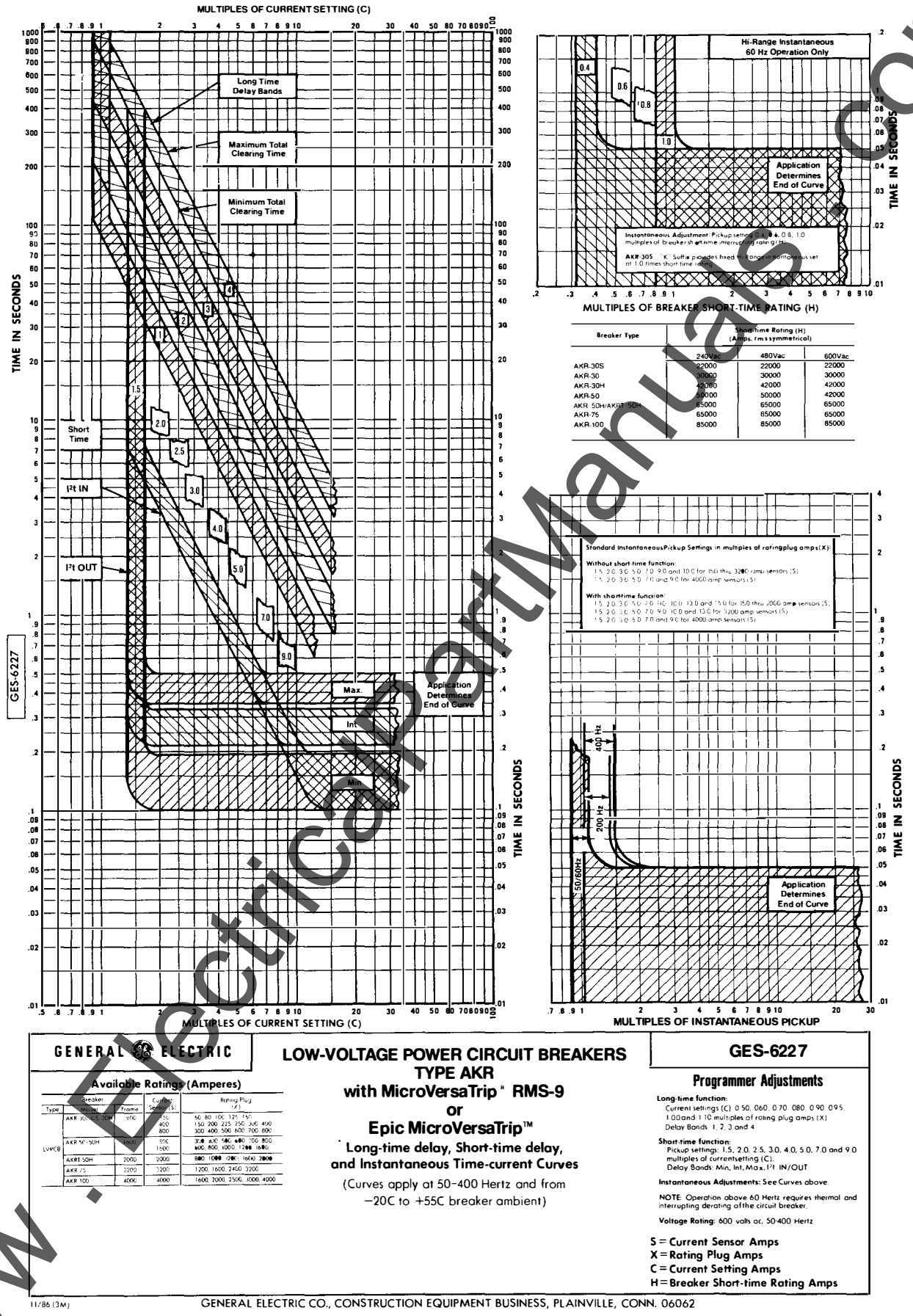


Fig. 6-6. Cabling diagram — Ground fault



Breaker Type	Short-time Rating (H) (Amps, rms symmetrical)		
	240Vac	480Vac	600Vac
AKR-30S	22000	22000	22000
AKR-30	30000	30000	30000
AKR-30H	42000	42000	42000
AKR-50	50000	50000	42000
AKR-50H/AKRT-50H	65000	65000	65000
AKR-75	65000	65000	65000
AKR-100	85000	85000	85000

GENERAL ELECTRIC

LOW-VOLTAGE POWER CIRCUIT BREAKERS
TYPE AKR
with MicroVersaTrip® RMS-9
or
Epic MicroVersaTrip™
Long-time delay, Short-time delay, and Instantaneous Time-current Curves
(Curves apply at 50–400 Hertz and from −20C to +55C breaker ambient)

GES-6227

Available Ratings (Amperes)

Type	Breaker Model	Frame	Current Sensors (S)	Rating Plug (X)
LVPCB	AKR-30, -30S, -30H	800	150 400 800	60, 80, 100, 125, 150 150, 200, 225, 250, 300, 400 300, 400, 500, 600, 700, 800
	AKR-50, -50H	1600	800 1600	300, 400, 500, 600, 700, 800 800, 800, 1000, 1200, 1600
	AKRT-50H	2000	2000	800, 1000, 1200, 1600, 2000
	AKR-75	3200	3200	1200, 1600, 2400, 3200
	AKR-100	4000	4000	1600, 2000, 2500, 3000, 4000

Programmer Adjustments

Long-time function:
Current settings (C): 0.50, 0.60, 0.70, 0.80, 0.90, 0.95, 1.00 and 1.10 multiples of rating plug amps (X)
Delay Bands: 1, 2, 3 and 4

Short-time function:
Pickup settings: 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.0 and 9.0 multiples of current setting (C).
Delay Bands: Min, Int, Max, I²t IN/OUT

Instantaneous Adjustments: See Curves above.

NOTE: Operation above 60 Hertz requires thermal and interrupting derating of the circuit breaker.

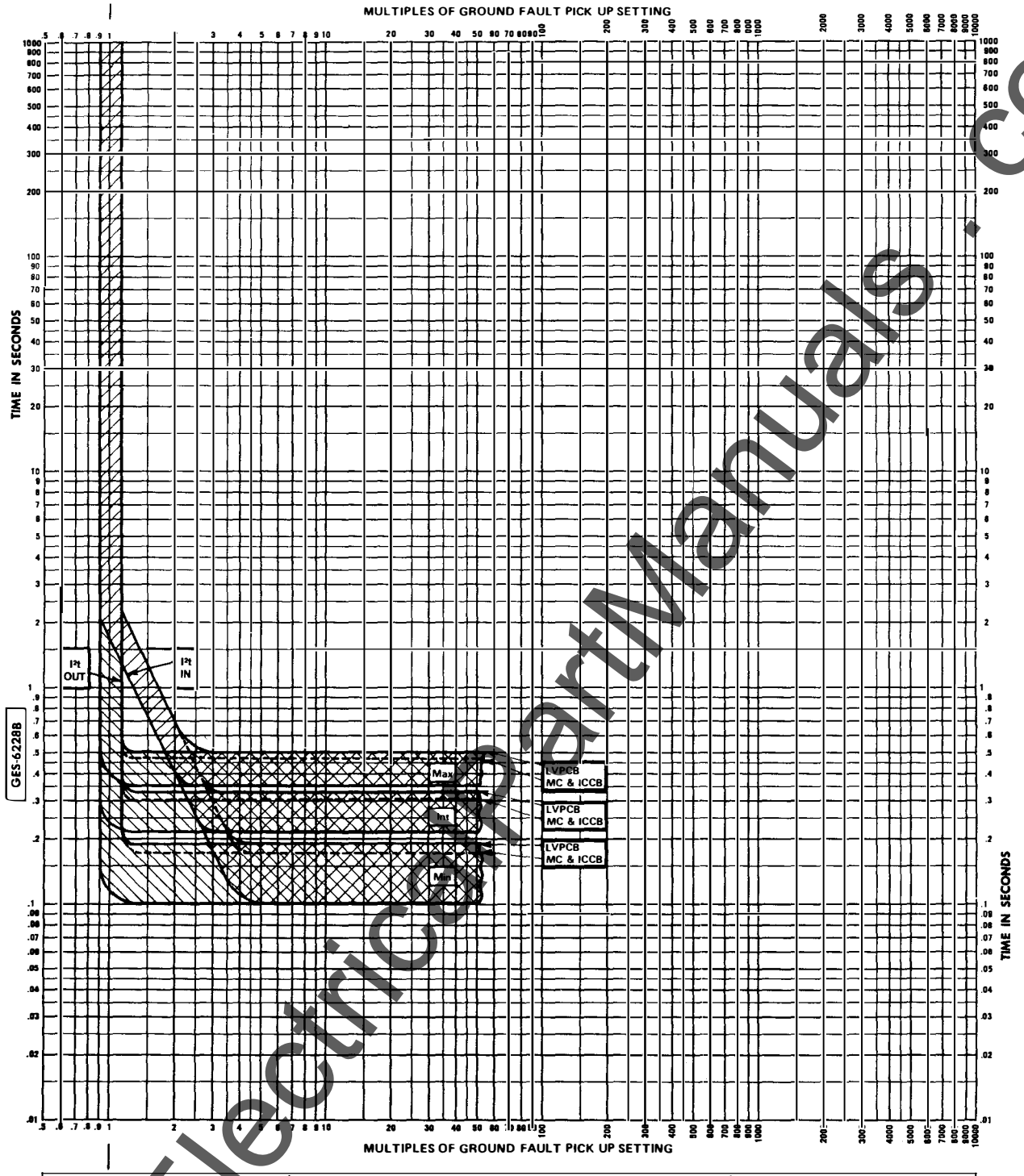
Voltage Rating: 600 volts ac, 50-400 Hertz

S = Current Sensor Amps
X = Rating Plug Amps
C = Current Setting Amps
H = Breaker Short-time Rating Amps

11/86 (3M)

GENERAL ELECTRIC CO., CONSTRUCTION EQUIPMENT BUSINESS, PLAINVILLE, CONN. 06062

Fig. 6-7. MicroVersaTrip® RMS- 9 long-time delay, short-time delay and instantaneous time versus current curves



GENERAL ELECTRIC

LOW-VOLTAGE POWER CIRCUIT BREAKERS
TYPE AKR
INSULATED-CASE CIRCUIT BREAKERS
TYPES TP, THP, TC, THC
MOLDED-CASE CIRCUIT BREAKERS
TYPES TJH, TJL, TKH, TKL
All with MicroVersaTrip® RMS-9
or
Epic MicroVersaTrip™
Ground Fault
Time-current Curves
(Curves apply at 50/400 Hertz and from −20C to +55C breaker ambient)

GES-6228B

Available Ratings (Amperes)

Breaker Type	Breaker Model	Breaker Frame	Current Sensor (S)
MCCB	TJH/TJL	400	150, 300, 400,
		600	600
	TKH/TKL	800	800
		1200	1200
ICCB	TP/THP/TC/THC	800	200, 400, 800
		1600	1000, 1600
		2000	2000
		2500	1000, 2000, 2500
		3000	3000
		4000	4000
LVPCB	AKR-30S/30H	800	150, 400, 800
	AKR-50/50H	1600	800, 1600
	AKRT-50H	2000	2000
	AKR-75	3200	3200
	AKR-100	4000	4000

S = Current Sensor Amps

Programmer Adjustments

Ground Fault Function:

Pickup settings in multiples of current sensor amps (S):
0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5 and 0.6 for 150 thru 2000 amps sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28, 0.30, and 0.34 for 2500 thru 3200 amp sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28 and 0.30 for 4000 amp sensors (S)

Delay bands:
Min, Int, Max; I²t IN/OUT

NOTE: Operation above 60 Hertz requires thermal and interrupting derating of the circuit breaker.

Voltage Rating: 600 Volts, ac, 50 through 400 Hertz.

Fig. 6-8. MicroVersaTrip®-RMS-.9 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 GE Company.

For further information, call or write your local GE sales office, or:
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Plainville, Connecticut 06062

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GE Export Operation
411 Theodore Fremd Avenue
Rye, New York 10580 USA

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