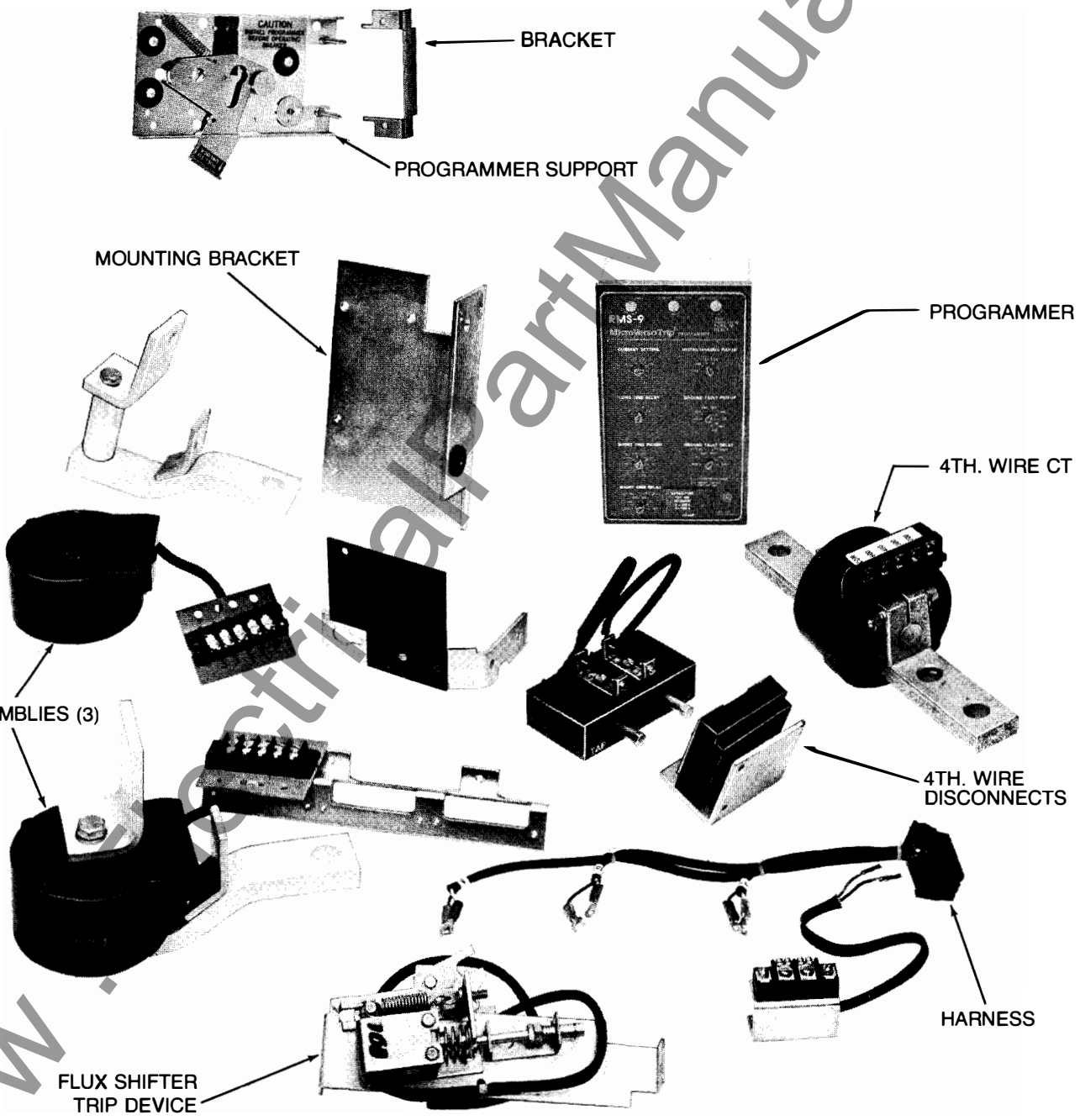
Instructions
For Installing
the MicroVersaTrip® RMS-9
Solid State Overcurrent
Trip Device on Low Voltage
Power Circuit Breakers

MicroVersaTrip® RMS-9 Conversion Kits

Breaker Types
AK-15, AK/AKU-25



Components of MicroVersaTrip® RMS-9 Conversion Kit for AK-15/25

CONTENTS

I. INTRODUCTION

These instructions cover installation of the MicroVersaTrip® RMS-9 solid state overcurrent trip device conversion kits on AK-15 and AK-25 frame breakers originally equipped with EC, Power Sensor or SST type trip devices. Each kit contains the variety of material necessary to convert any type. The kits are designed specifically for use on the following breakers:

Table 1 — Convertible Breaker Models

Frame Size (Amp.)	Breaker Type			Trip Device		
	Stationary*	AKD Draw-out	AKD-5 Draw-out	EC	Power Sensor	SST
225	AK-2-15	AK-2-15	AK-2A-15	X		
600	AK-2-25	AK-2-25	AK-2A-25	X		
	AK-3-25	AK-3-25	AK-3A-25		X	X
	—	AKU-2-25	AKU-2A-25	X		
	—	AKU-3-25	AKU-3A-25		X	X

*MicroVersaTrip® RMS-9 programmer extends 3/8″ beyond breaker's right side outline.

Kit installation is a straightforward operation 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 (either EC, SST or Power Sensor), then install the MicroVersaTrip® RMS-9 components. Following this, the converted breaker is performance-tested prior to restoring it to service.

For the majority of breaker models listed in Table 1, kit installation does 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 2, 3 and 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) must be separately mounted in the equipment. Insure also that retrofitted breakers are applied within their short circuit ratings; for example, as part of a conversion when the breaker's trip elements are to be changed from instantaneous to short time, the short time rating would govern the application.

TOOLS REQUIRED

- Socket Set — 3/8″ drive
- Open End Wrenches — Set
- Screwdrivers — Assorted
- Allen Wrenches — Assorted
- Tru-arc Pliers — Assorted
- Spring Scale 0-75 lbs.
- Pliers — Assorted
- Electric Drill
- Drill Bits
- 6″ Scale
- Crimping Tool

Users are reminded that the installation of MicroVersaTrip® RMS-9 kits provide an excellent opportunity to perform normal maintenance on the breaker particularly while the front and back frames are separated. Renewal parts are available as listed in bulletin GEF-4149G, a copy of which is included with each MicroVersaTrip® RMS-9 kit.

Table 2 — MicroVersaTrip® RMS-9 Conversion Kit Model Selection For Tapped Sensor With Fixed Rating Plug

Frame Size		Stationary or Draw-out		3- or 4-Wire		Tapped Sensor		Sensor Rating		Programmer Functions
AK-15=TK015 AK/AKU-25=TK025	+	S* OR D	+	3 OR 4	+	T	+	AK-15 225A=02 AK/AKU-25 225A=02 600A=06	+	LI=01 LIT1=02 LIGT2=03 LSIT1=04 LSIGT2=05 LST1=06 LSGT2=07 LSIGT2X=08

EXAMPLE:

- AK-25, Stationary construction, 4-wire system, 600 Amp tapped sensor, LIGT2 programmer
- MicroVersaTrip® RMS-9 conversion kit model number: TK025S4T0603 (fixed rating plug will be installed in programmer)

Table 4 — Tapped Current Sensors For Use With MicroVersaTrip® RMS-9 Conversion Kits

Breaker Type	Sensor Ampere Range	Cat. No.	
		Phase Sensors	4th-Wire Neutral Sensor
AK-15	70-225	568B632G25	TSVG225BK
AK-25, AKU-25	70-225		
	200-600	568B632G26	TSVG206BK

Table 3 — 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

II. PREPARING THE BREAKER

WARNING: Before starting any work, disconnect the breaker from all power sources (primary and secondary) and place in a clean work area.

1. Remove the steel arc quencher retainer by loosening the two ¼ x 20 hex capnuts. On electrically operated AK-3/3A-25 breakers, the "Y" relay is mounted on the left end of the retainer, but there is no need to remove it.

2. Remove the three arc quenchers by lifting upward and outward.

3. Separate the breaker's front and back frames. Refer to maintenance manual GEI-50299, page 5; if Power Sensor, see pp. 28-31 also.

CAUTION: Be careful to avoid damage to breaker components during this operation.

4. Remove the overcurrent trip devices. Refer to maintenace manual GEI-50299 pp. 23, 31.

5. On draw-out breakers, remove the primary disconnect fingers from the bottom (load-side) copper studs. Refer to maintenance manual GEI-50299, page 7.

6. Remove the three bottom (load-side) copper stud assemblies. On Power Sensor-equipped breakers, this will have been done during Step 4 above.

7. On electrically operated breakers equipped with EC trip devices, the "Y" relay is mounted on the front frame at the right side of the operating mechanism. To provide mounting space for the MicroVersaTrip® RMS-9 flux shift trip device, remove the "Y" relay and remount it on the left end of the arc quencher retainer as shown in Figs. 1 and 2 (using hardware and parts included). Modify the breaker's wiring harness to suit.

8. On EC-equipped breakers, remove and discard the four trip device support brackets mounted along the lower front of the back frame. See Fig. 3. At this point the breaker back frame is ready for installation of the kit.

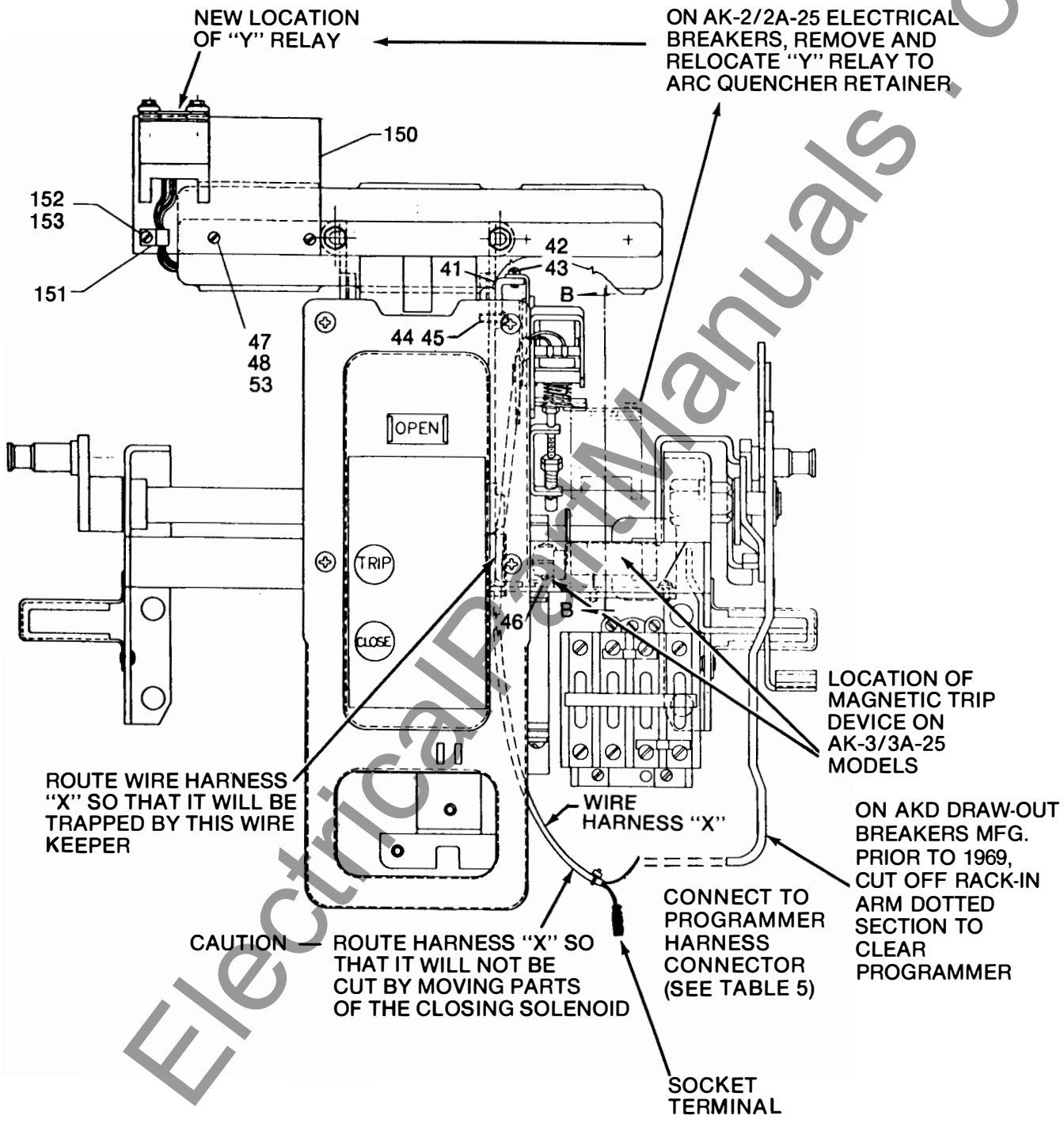
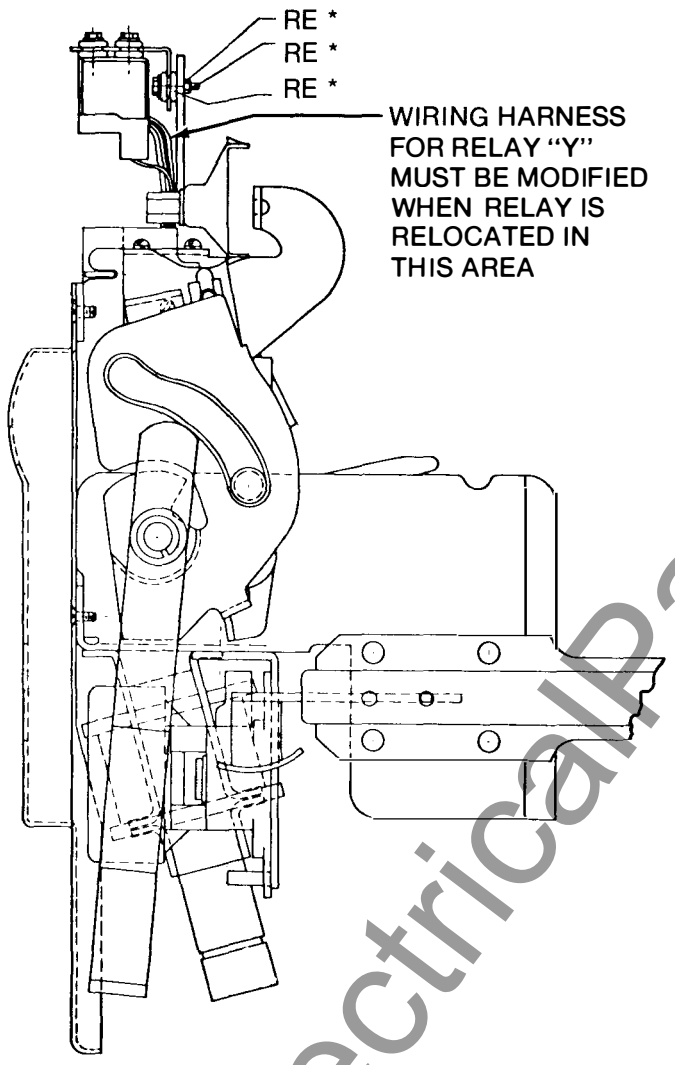
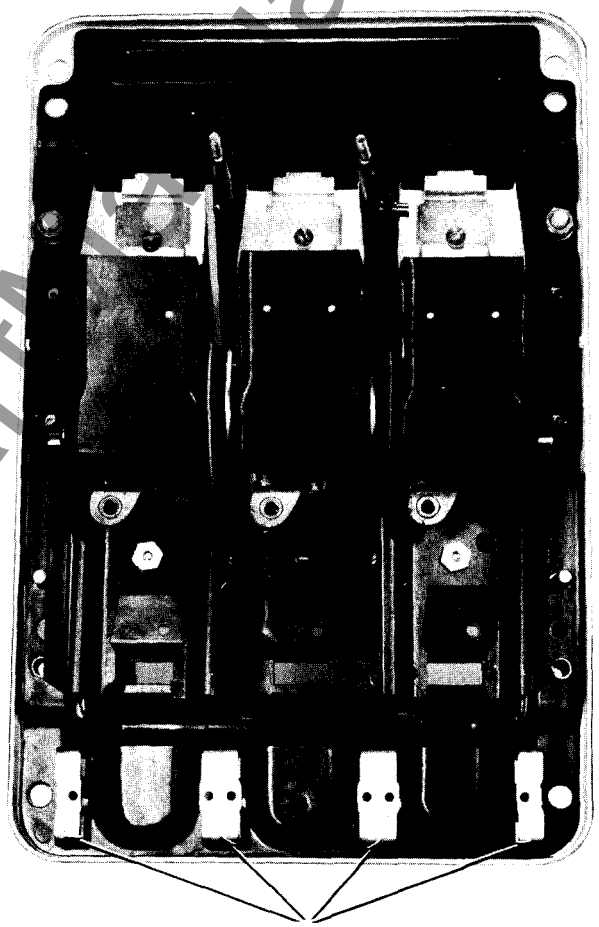


Fig. 1 — Front view of front frame (AKD type draw-out shown)



* RE denotes reuse of existing hardware

Fig. 2 — Right side view of front frame



EC TRIP SUPPORT BRACKETS

Fig. 3 — Front view of rear frame

III INSTALLING THE KIT

1. Modify the left and right pole lower stud insulator shields per Fig. 8; remount on back plate using original screws and special nut (item 93 on Fig. 7) supplied with kit.

2. Assemble and mount the three current sensor (CT) assemblies to the back frame. See Figs. 5, 6 and 7. For each pole, first insert lower copper stud 90 through the back plate and attach it via the mounting screw. Then position CT 18 with its terminals toward the rear and loosely mount it to stud 90 with copper parts 91 and 92. Align the assembly and torque the two 3/8″ bolts in strap 91 to 25 ft.-lbs. each to assure proper contact integrity.

3. Install CT terminal board-mounting bracket 80 below the CT's using the (2) 8-32 x ½″ screws provided. See Fig. 5. Mount terminal boards TB1, TB2 and TB3 to the bracket using the (6) 6-32 x ½″ screws and washers provided.

4. On draw-out type breakers, remount the primary disconnect fingers on the new lower studs. Refer to maintenance manual GEI-50299, pp. 7 and 13.

NOTE: On all AK-15 draw-out breakers, modify primary disconnects per instructions on Page 25.

CAUTION: Adequate primary contact force is mandatory. Tighten the nuts on the 1/4 x 20 mounting bolts to obtain a spring dimension of 13/16 to 27/32. The proper dimension between contact fingers is 7/16″. Proper contact force is 60 to 70 lbs. with the contacts spread to 1/2″.

5. Mount insulator bracket 70 to the lower right corner of the back frame utilizing existing holes — See Fig. 20.

6. Install wire harness 100 on back frame and connect per instructions on Figs. 9, 12 or 16 as applicable to the particular breaker type involved. For tie-down and forming details, see Fig. 5.

   This step completes conversion of the back frame — see example illustrated in Fig. 4.

7. Proceeding to the front frame, mount the flux shift trip paddle on the breaker's trip shaft per Figs. 17 and 18.

8. Mount the flux shift trip device per Figs. 17 and 19. NOTE: Adjustment of trip rod length will be performed later in Step 13.

9. On electrical breakers, remove "x" relay and mounting bracket from front frame. Assemble programmer shock mount bracket (76) to programmer support bracket (71) per Fig. 20. Mount "x" relay on bracket using (3) #10 screws and lock washers provided. Modify the "x" relay harness by adding 16 Ga. extension wire, splices, and ring terminals provided. Work one wire at a time to prevent wiring errors. Route wires as shown in Fig. 21, making certain they do not interfere with solenoid plunger or programmer. Install bracket assembly per Fig. 20.

10. Referring to Fig. 6, install flux shifter actuating bushing 49 in the right hand operating link, enlarging the link hole if necessary. See Fig. 4 also.

11. Rejoin the front and back frames. Refer to maintenance manual GEI-50299, Page 5.

12. Connect wire harness "X" (attached to flux shift trip device) to programmer connector per table 5. Exercise care in routing to prevent leads being damaged by moving breaker components such as contact assemblies.

13. Adjust flux shift trip rod gap per instructions on Fig. 17.

14. Place harness connector (100) into the programmer shock mount bracket (76). See Fig. 9A. Install the plug adapter (205) onto the harness connector. Refer to Fig. 9A for proper orientation of the plug connector. Place the combination plug adapter/harness connector over the guide pins and slide the assembly down the pins until the slots in the plug adapter align with the retaining tabs in the shock mount bracket. Bend the tabs in the shock mount bracket into the plug adapter to capture the plug assembly on both sides. Check that the "PULL TO UNLOCK" tab is out so that the bracket can accept the programmer. Install the programmer.

CAUTION: To avoid shock hazard and possible damage to wire harness and sensor coils, the harness connector must be securely mated with the programmer unit before the breaker is energized.

Conversion of the breaker is now complete. A typical example is shown in Fig. 22. Reassemble arc chutes.

Proceed to Section IV — EQUIPMENT MODIFICATIONS. If these are not required, proceed directly to Section V — FUNCTIONAL TESTING.

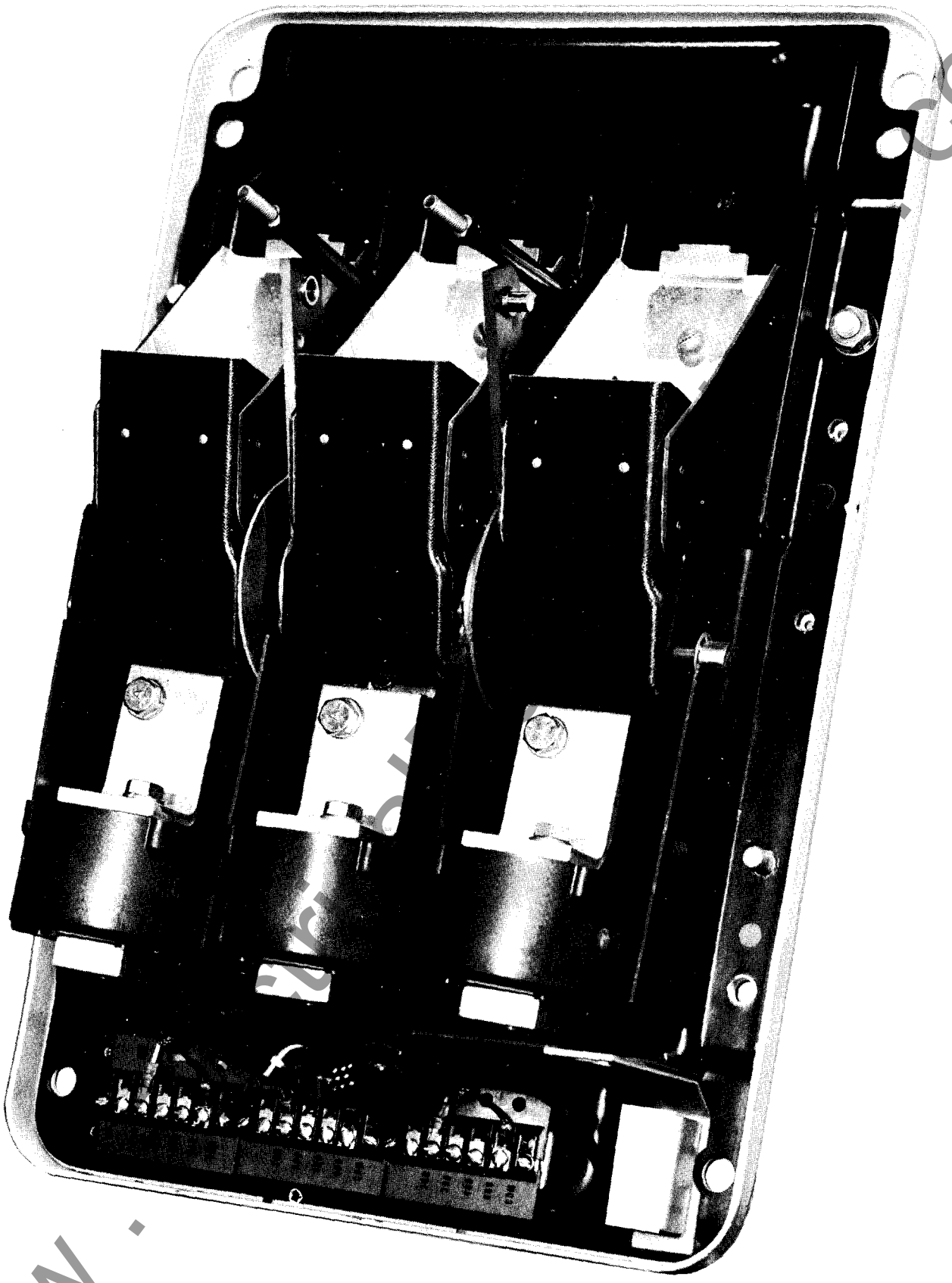


Fig. 4 — AK-25 back frame with MicroVersaTrip® RMS-9 conversion components installed and ready for reassembly to front frame.

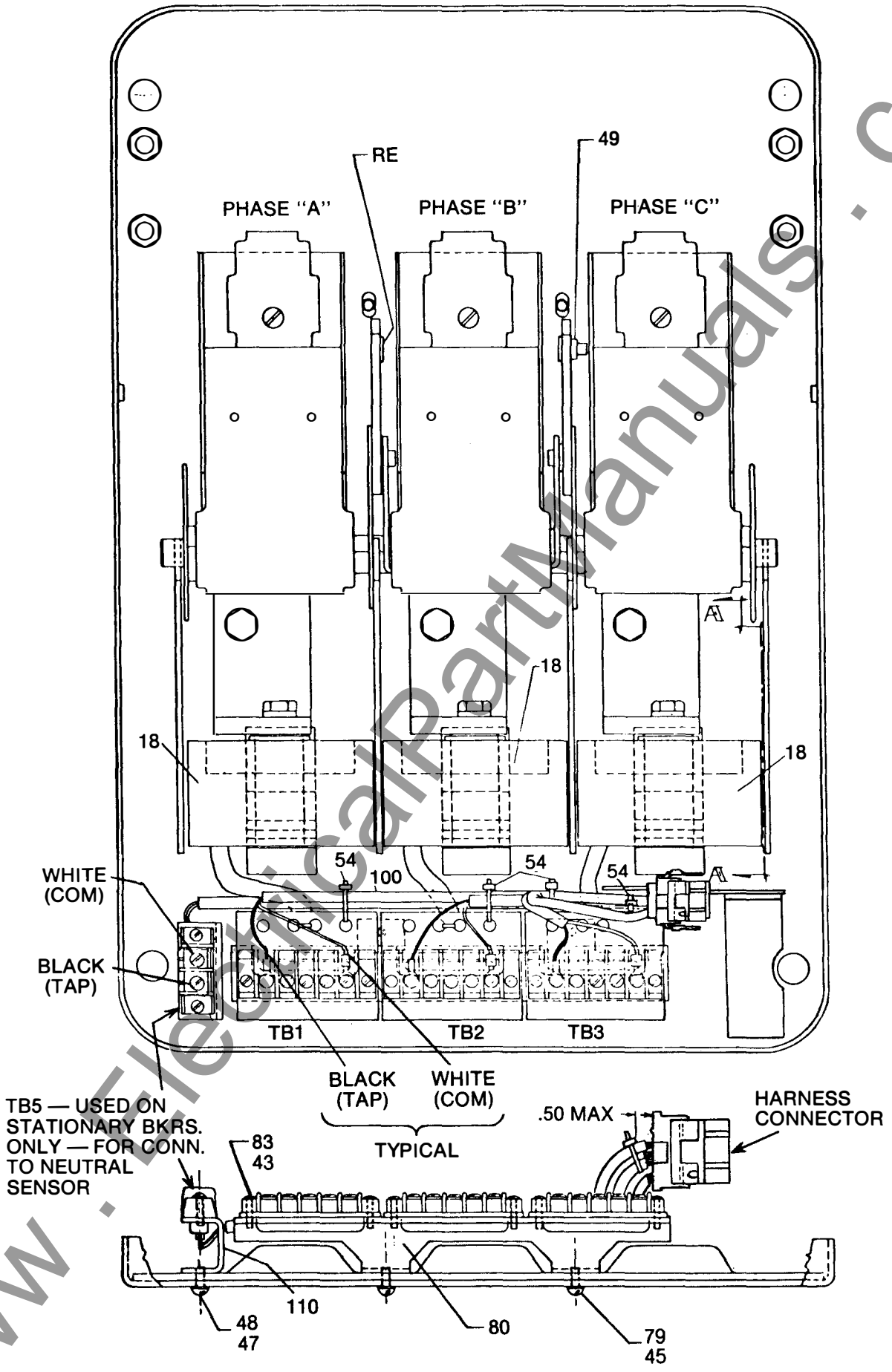


Fig. 5 — Back frame assembly

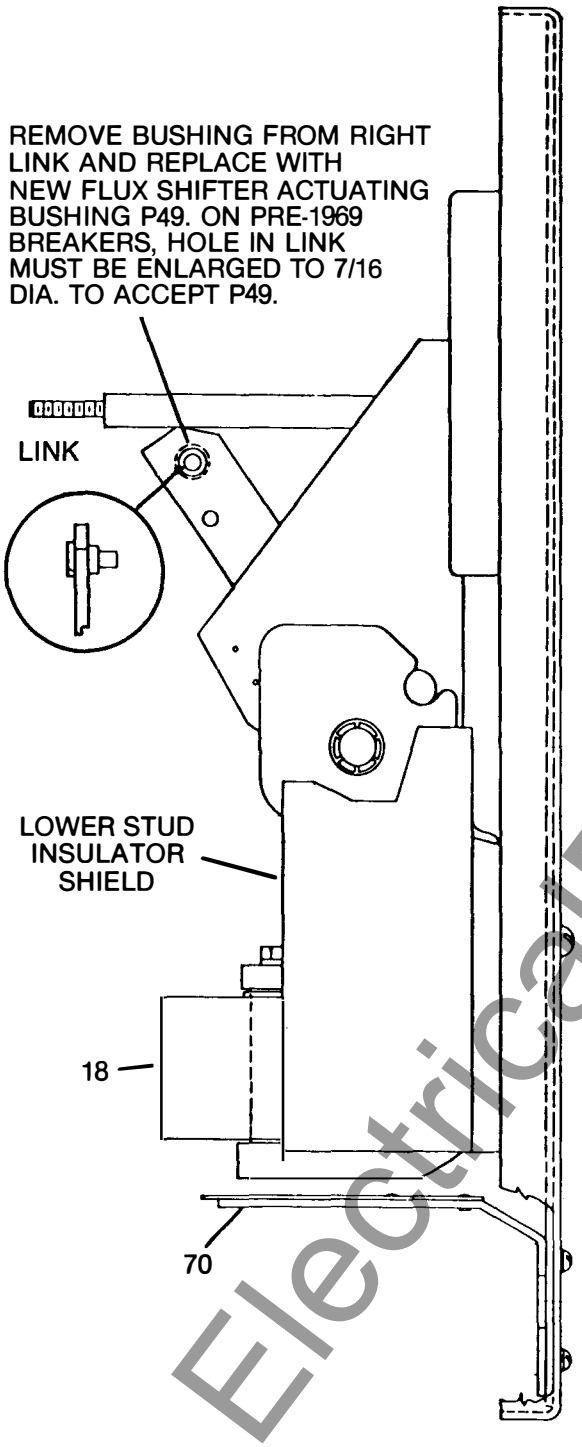


Fig. 6 — Right side view of back frame

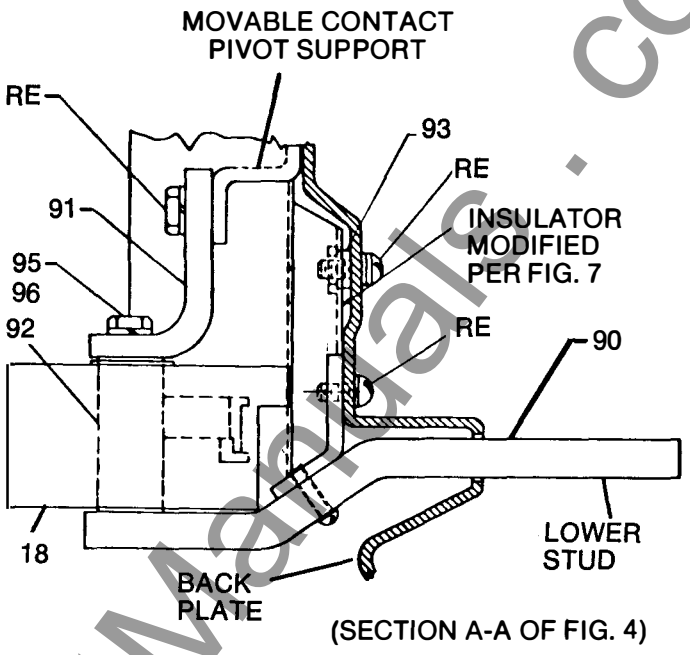


Fig. 7 — Phase sensor assembly, right side view

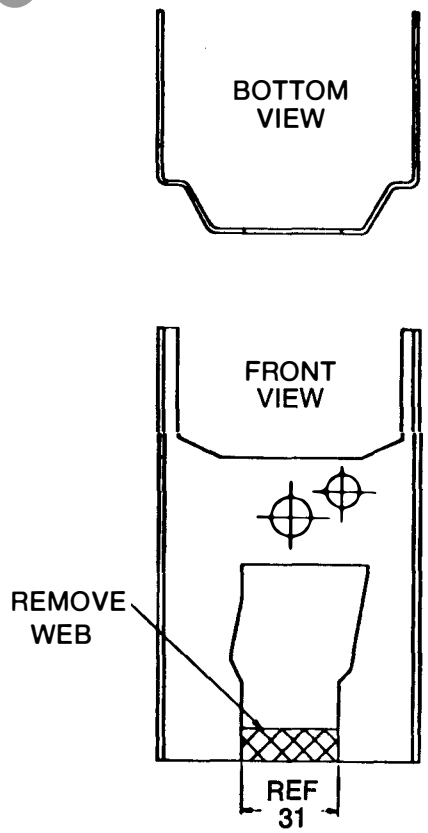


Fig. 8 — Stud insulator modification

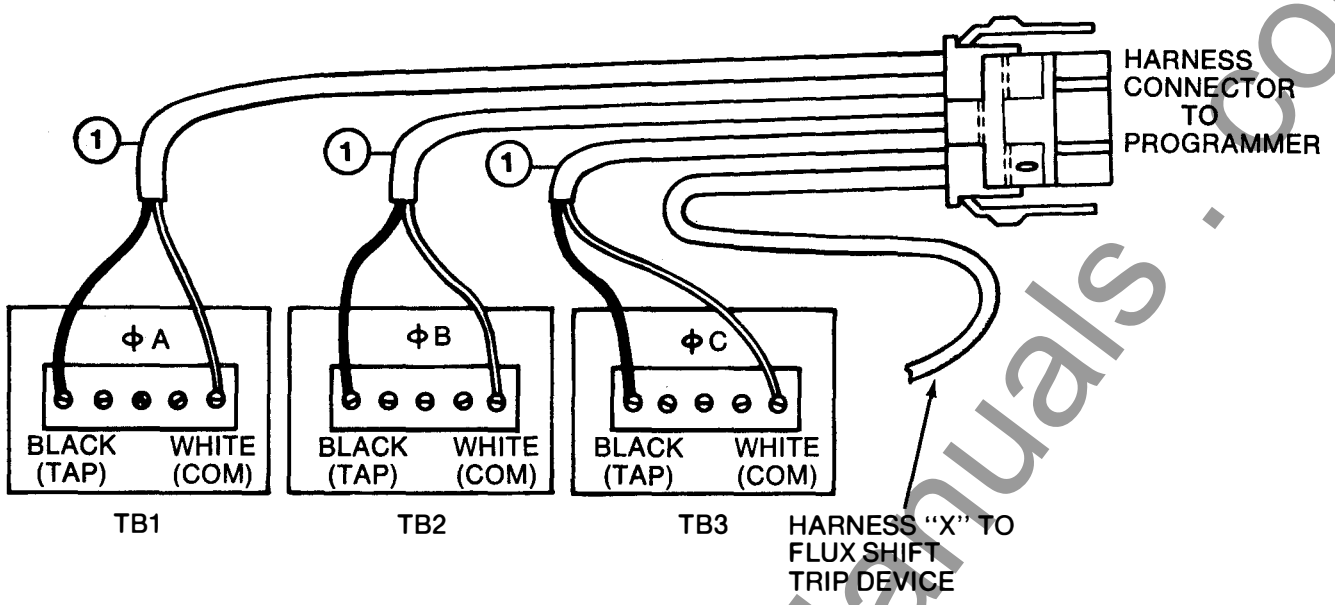


FIG. 9 Harness connections for all drawout and stationary breakers used on 3-wire systems — with and without ground fault. For elementary diagram see Figs. 10 & 11.

INSTALLATION STEPS

1. Connect the A, B and C Phase Sensor Leads respectively to TB1, TB2 and TB3. Identify per Table 5.

TABLE 5 — Harness Connections

Component	From Terminal Board	Wire Color	To Harness Connector Pin Number
Phase A Sensor	TB1	White Black	18 22
Phase B Sensor	TB2	White Black	19 23
Phase C Sensor	TB3	White Black	20 24
Flux Shift Trip Device	Trip Device	Red White	32 28
4th-Wire Neutral* Sensor	TB5 or Secondary Disconnect	White Black	21 17

*Used only with 4-wire Ground Fault.

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

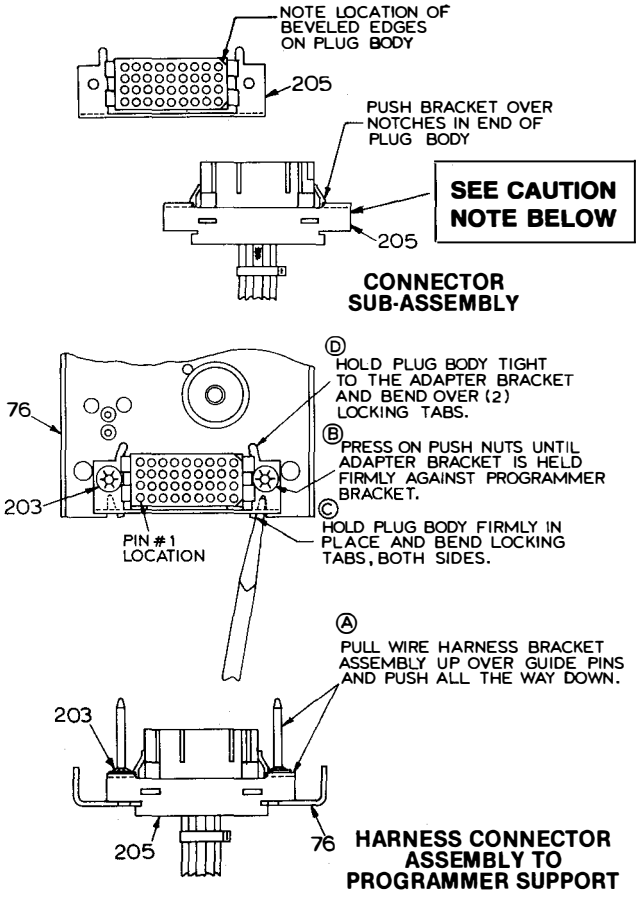


Fig. 9A

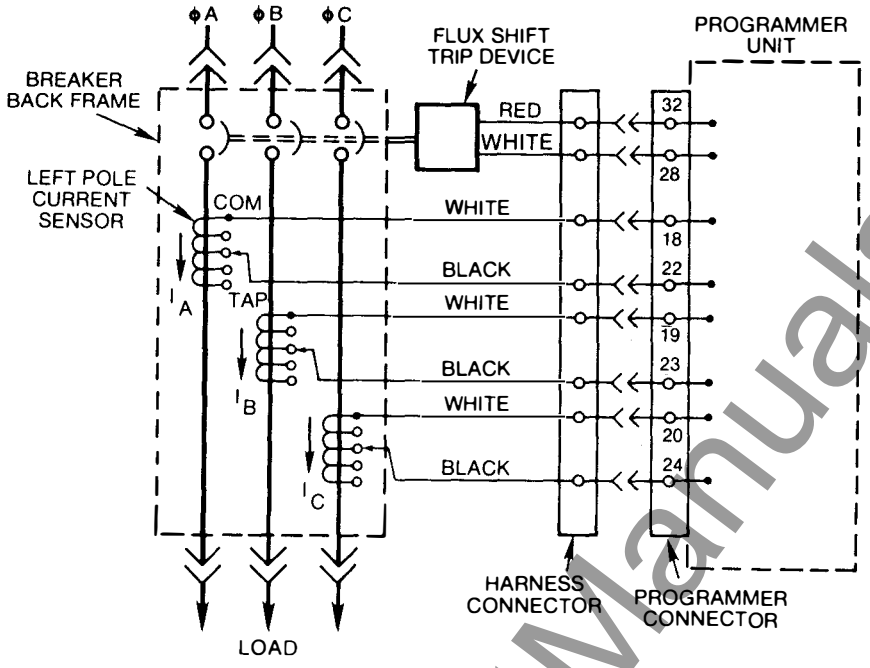


Fig. 10 — Cabling Diagram — MicroVersaTrip® RMS-9 without ground fault.

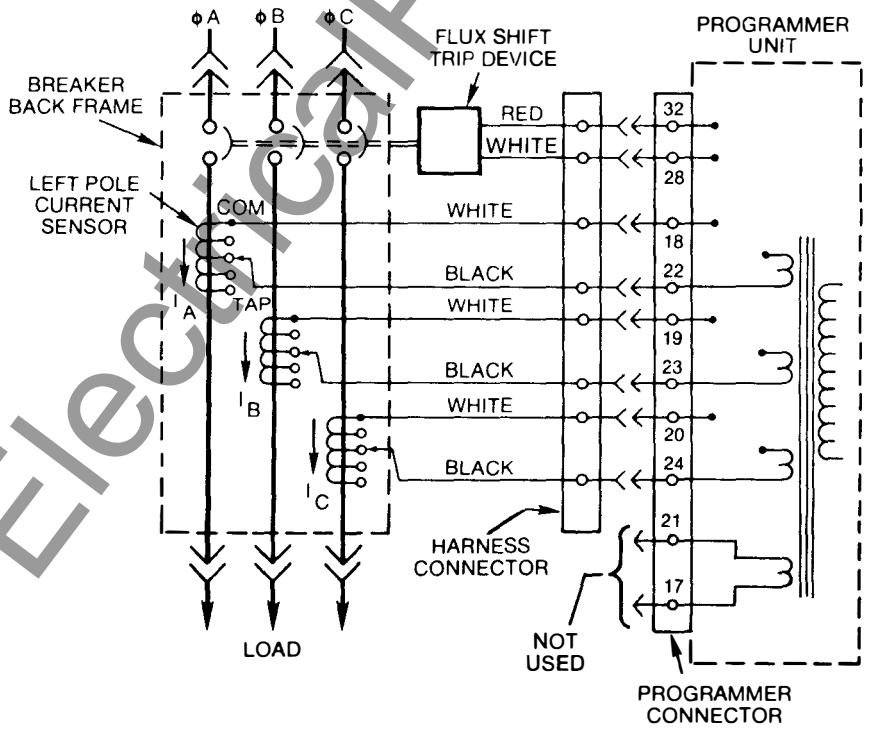


Fig. 11 — Cabling Diagram — MicroVersaTrip® RMS-9 with ground fault on 3-wire load.

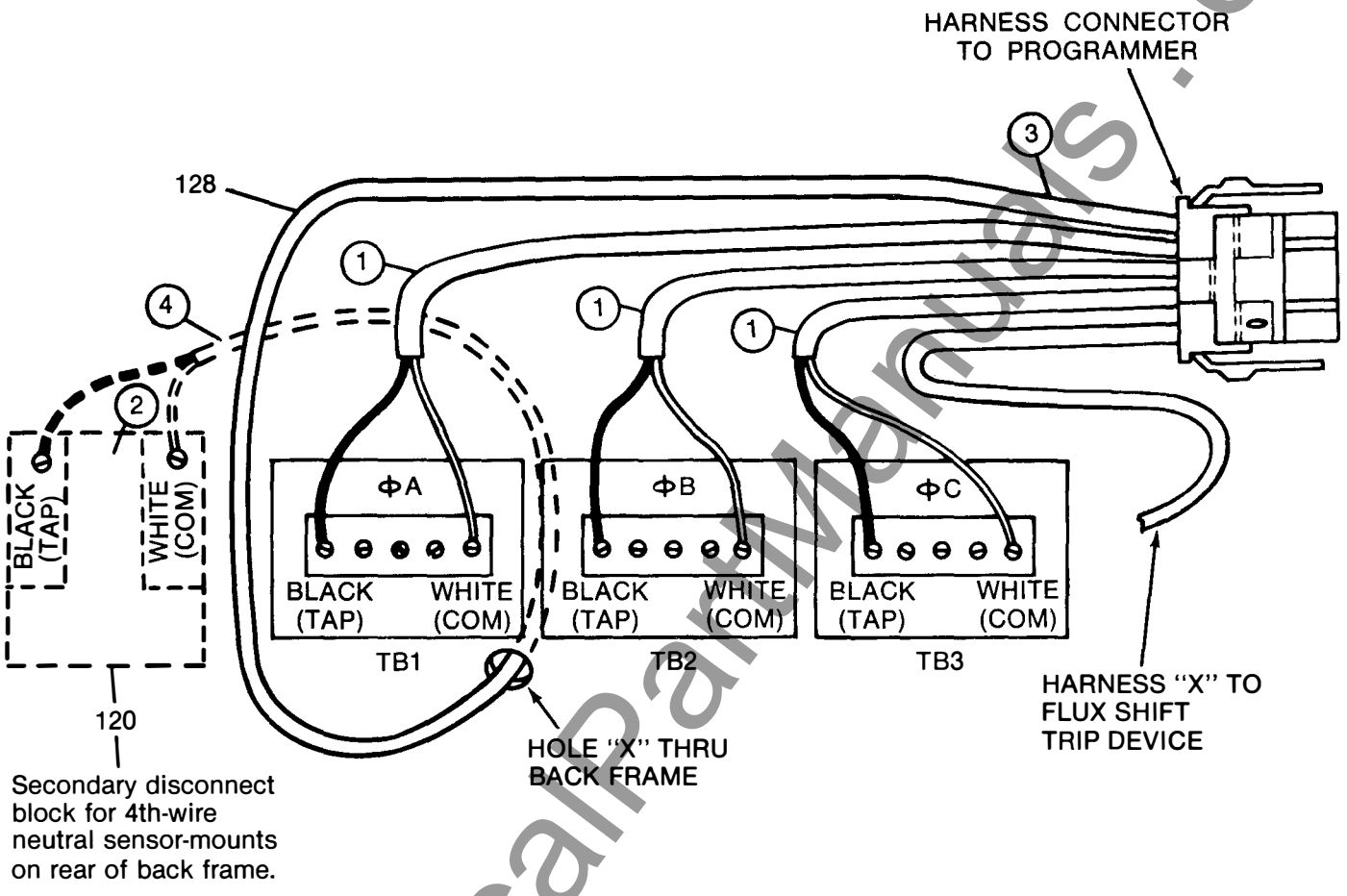


FIG. 12 Harness connections for all drawout breakers equipped with 4-wire ground fault. For elementary diagram see Fig. 14.

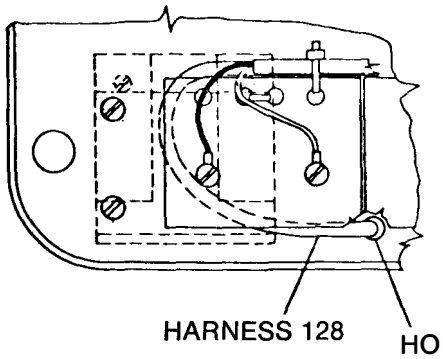
INSTALLATION STEPS

1. Connect the A, B, and C phase sensor leads respectively to TB1, TB2 and TB3. Identify per Table 5.

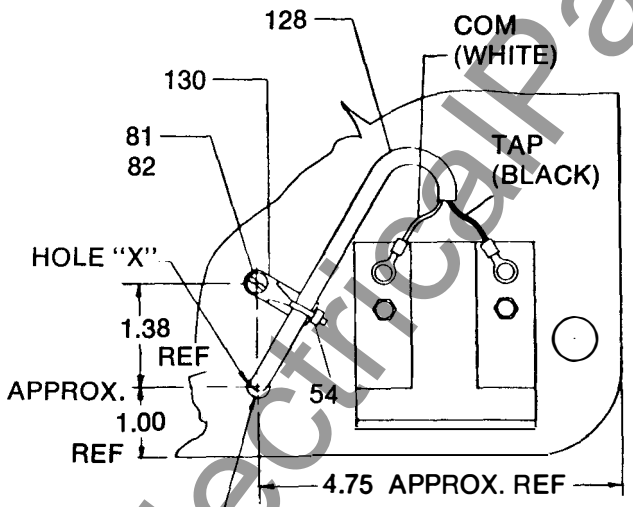
2. Mount the neutral sensor disconnect block 120 to the rear of the back frame per Fig. 13. Use existing mounting holes.

3. Insert the two prepared leads of harness 128 into the harness connector: Black to Pin 17, white to Pin 21.

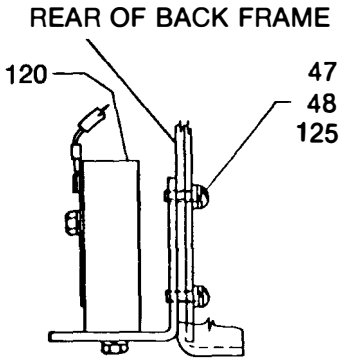
4. Feed the opposite end of harness 128 through hole "X" in the back frame and connect leads to block 120 as shown in Fig. 13.



FRONT VIEW OF BACK FRAME



REAR VIEW OF BACK FRAME



SIDE VIEW

Fig. 13 — Mounting detail for secondary disconnect block 120 for 4th-wire neutral sensor (draw-out breakers only).

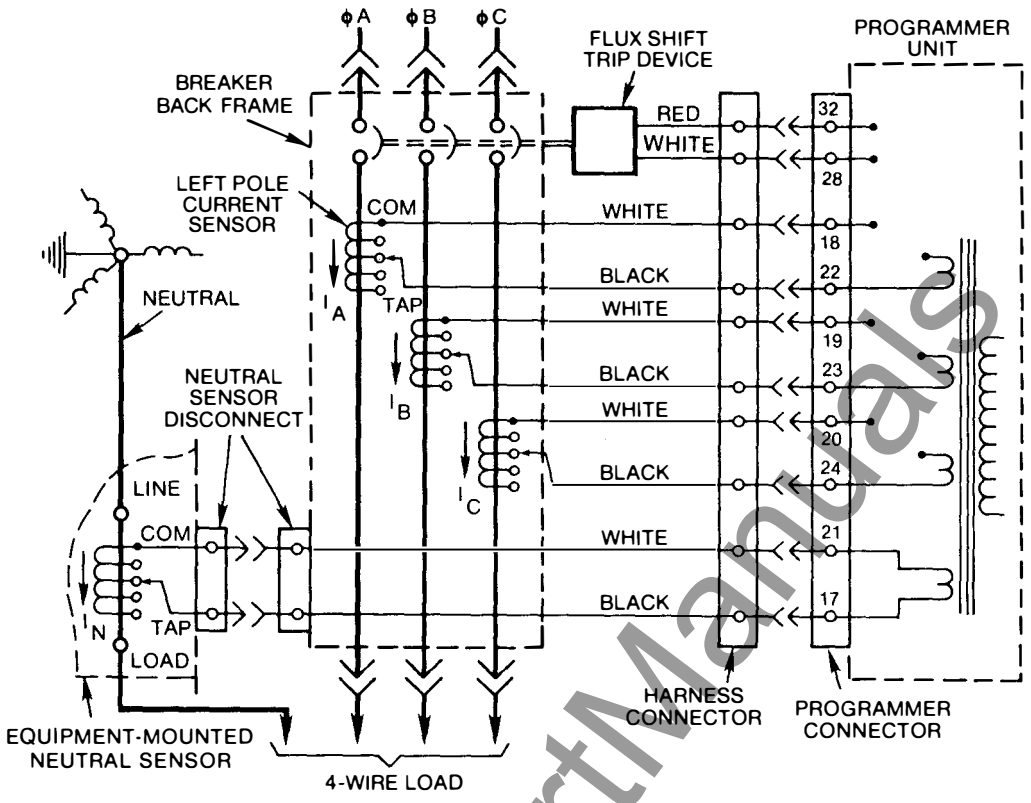


Fig. 14 — Cabling Diagram — MicroVersaTrip® RMS-9 with ground fault on 4-wire load — draw-out breaker.

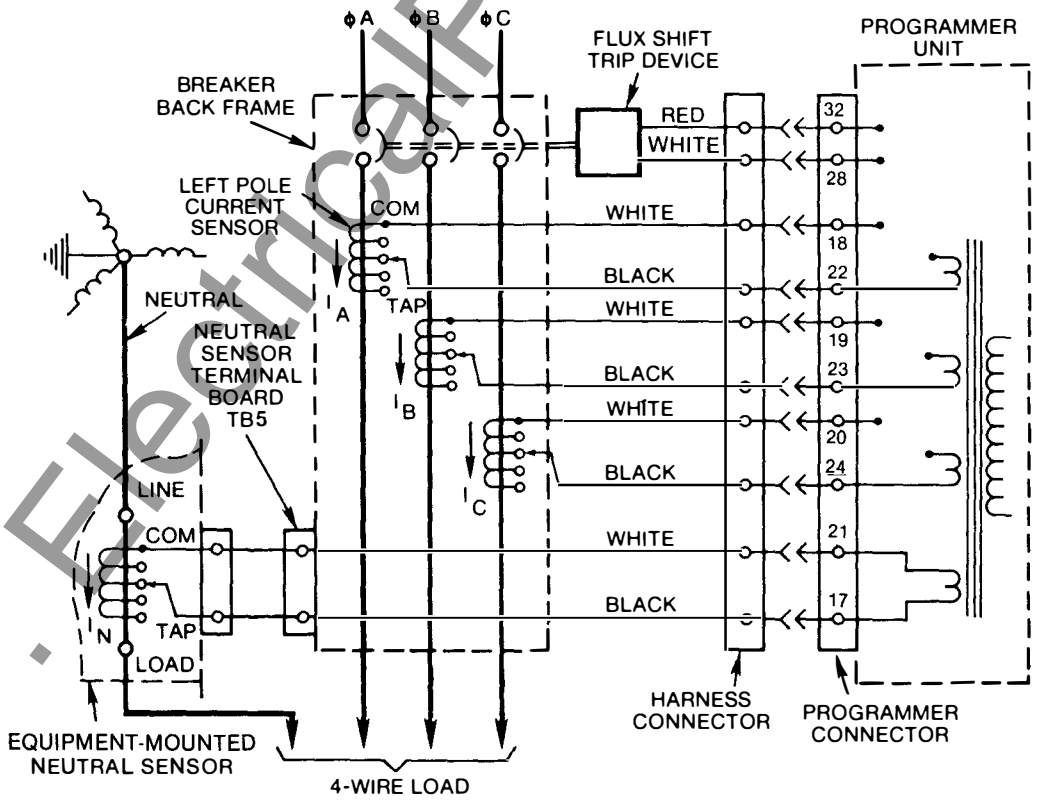


Fig. 15 — Cabling Diagram — MicroVersaTrip® RMS-9 with ground fault on 4-wire load — stationary breaker.

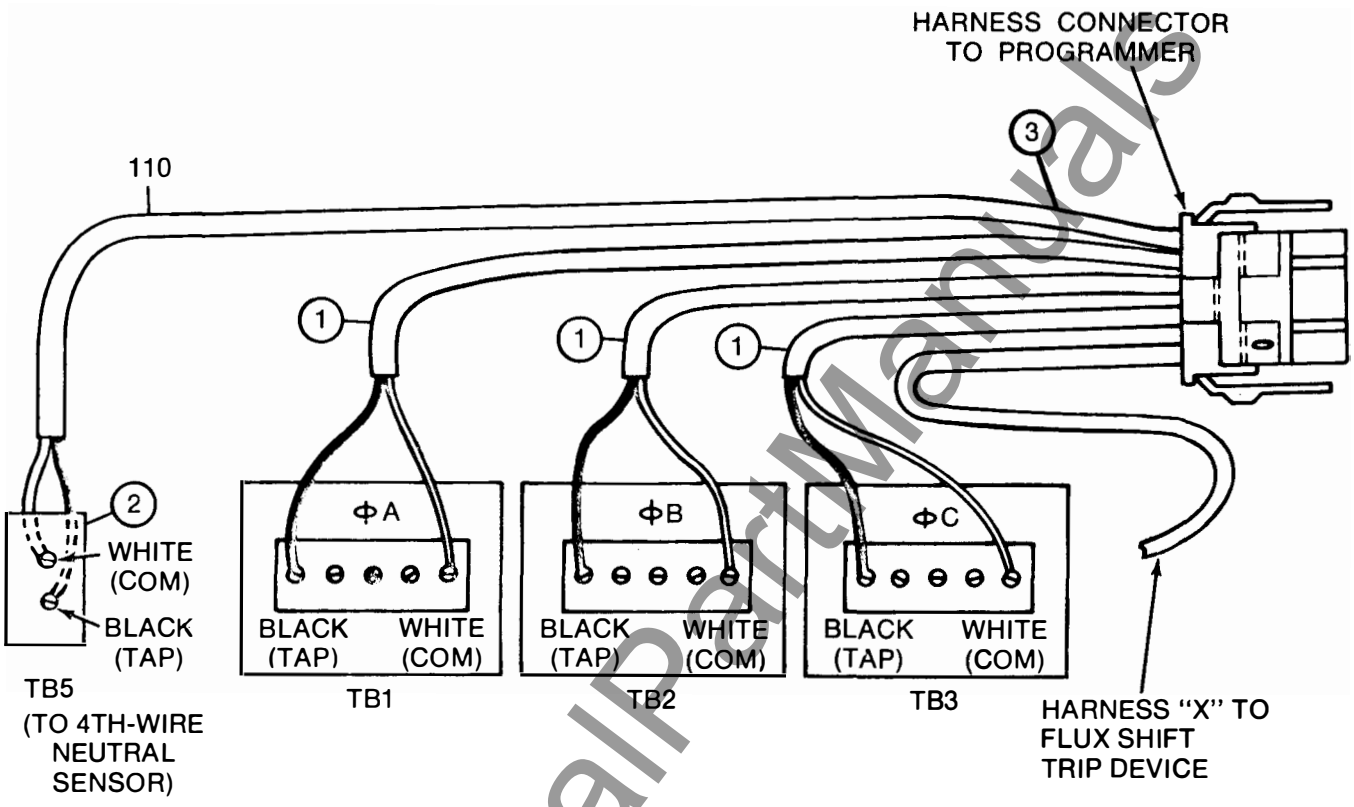


Fig. 16 **Harness connections for stationary breakers equipped with 4-wire ground fault. For elementary diagram, see Fig. 15.**

INSTALLATION STEPS

1. Connect the A, B and C phase sensor leads respectively to TB1, TB2 & TB3. Identify per Table 5.

2. Mount neutral sensor terminal board TB5 (part of harness 110) to the back frame.

3. Insert the prepared leads on the opposite end of harness 110 into the harness connector: Black to Pin 17, white to Pin 21.

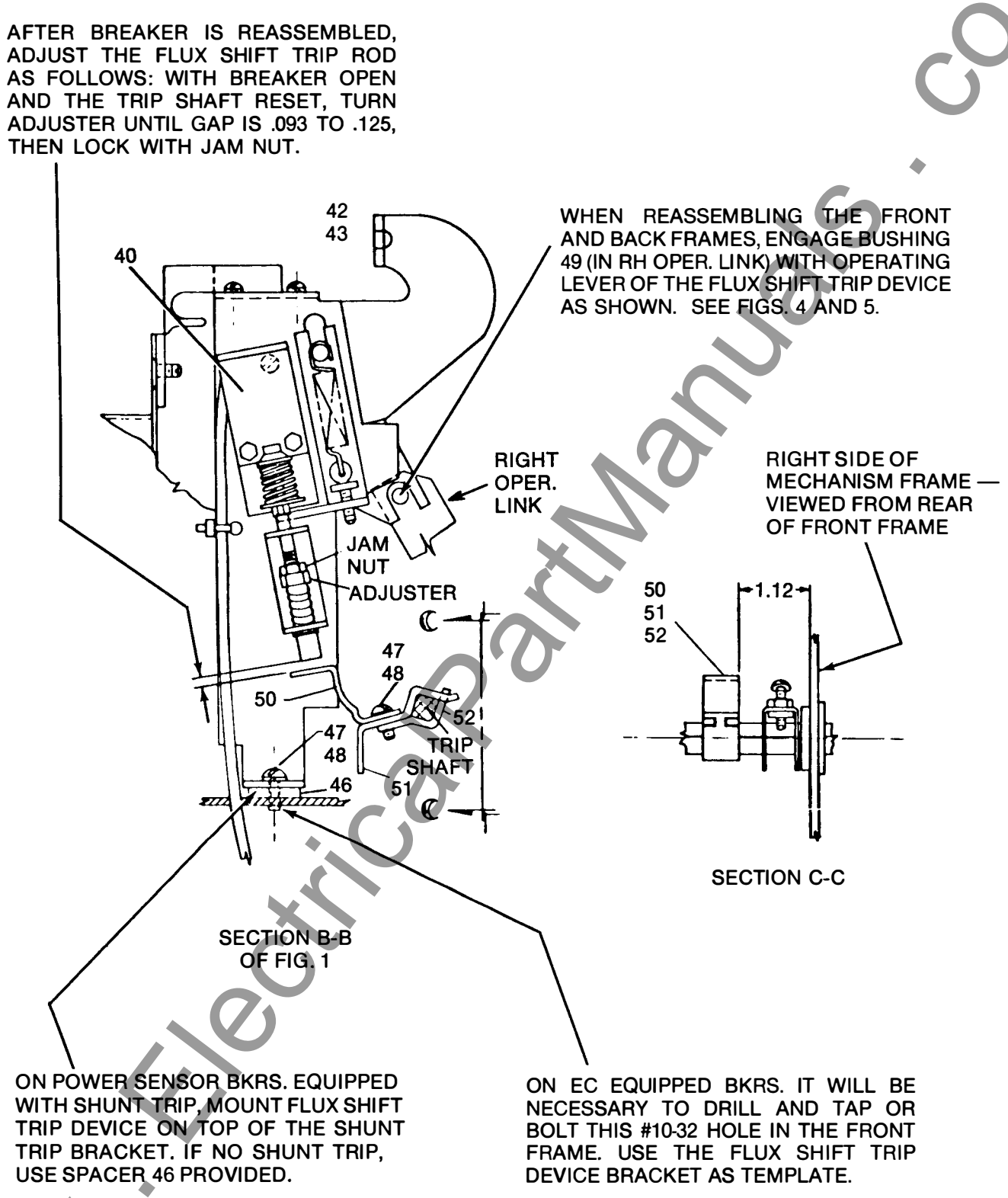


Fig. 17 — Right side view of mechanism frame showing mounting of flux shift trip device 40.

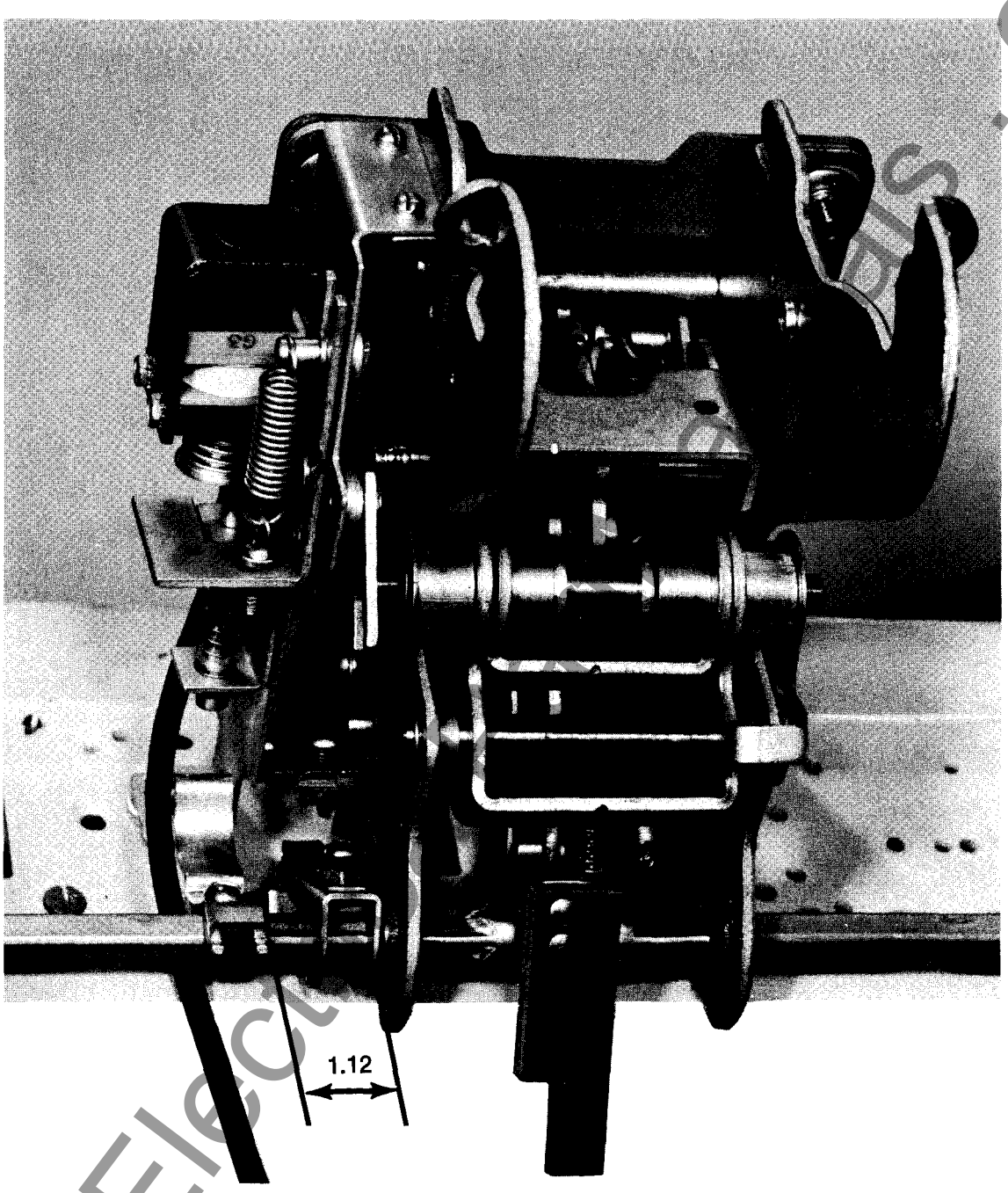


Fig. 18 — Rear view of front frame showing location of trip paddle for flux shift trip device.

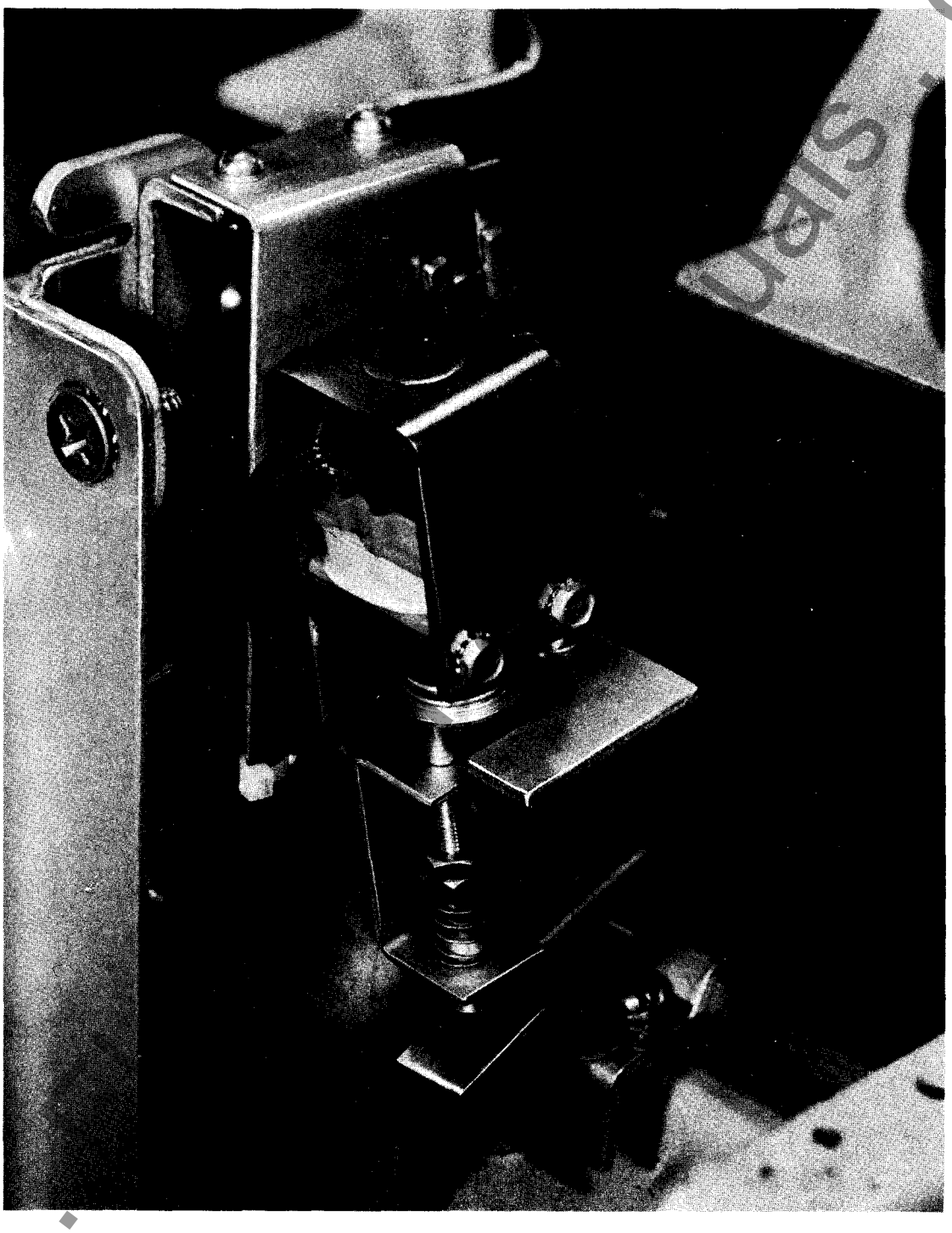


Fig. 19 — Right side view of operating mechanism showing mounting of flux shift trip device.

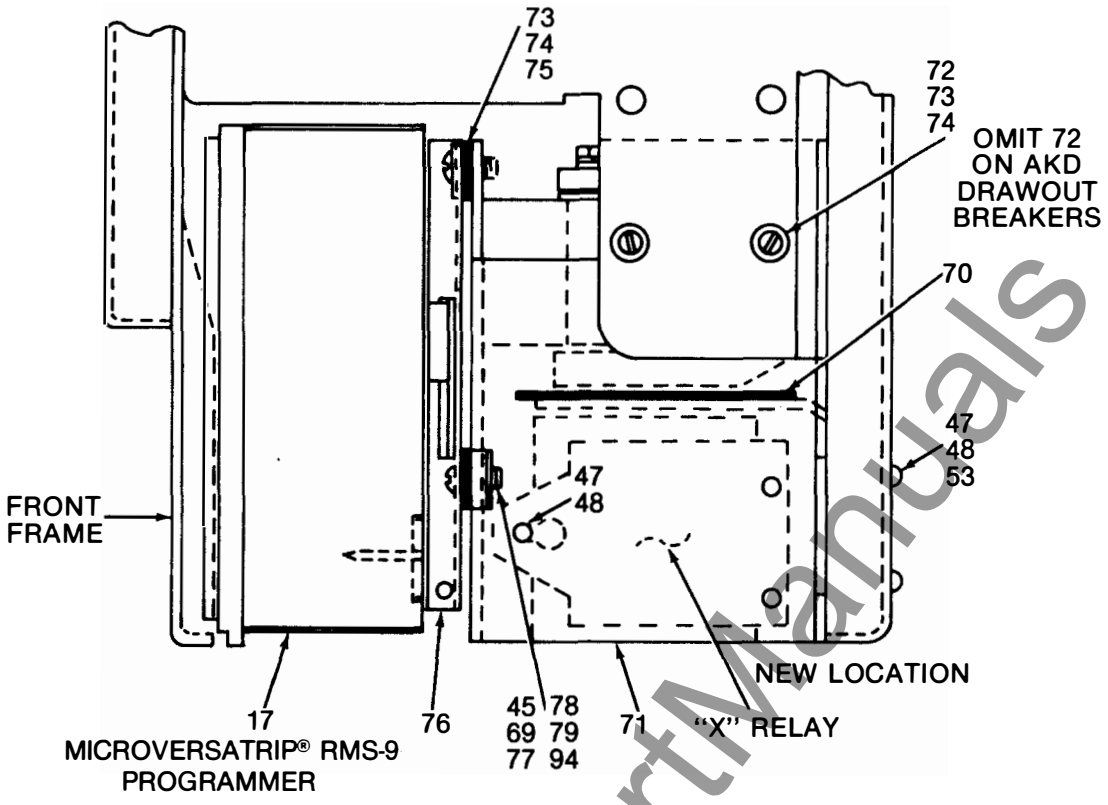


Fig. 20 — Right side view of breaker showing mounting of programmer unit.

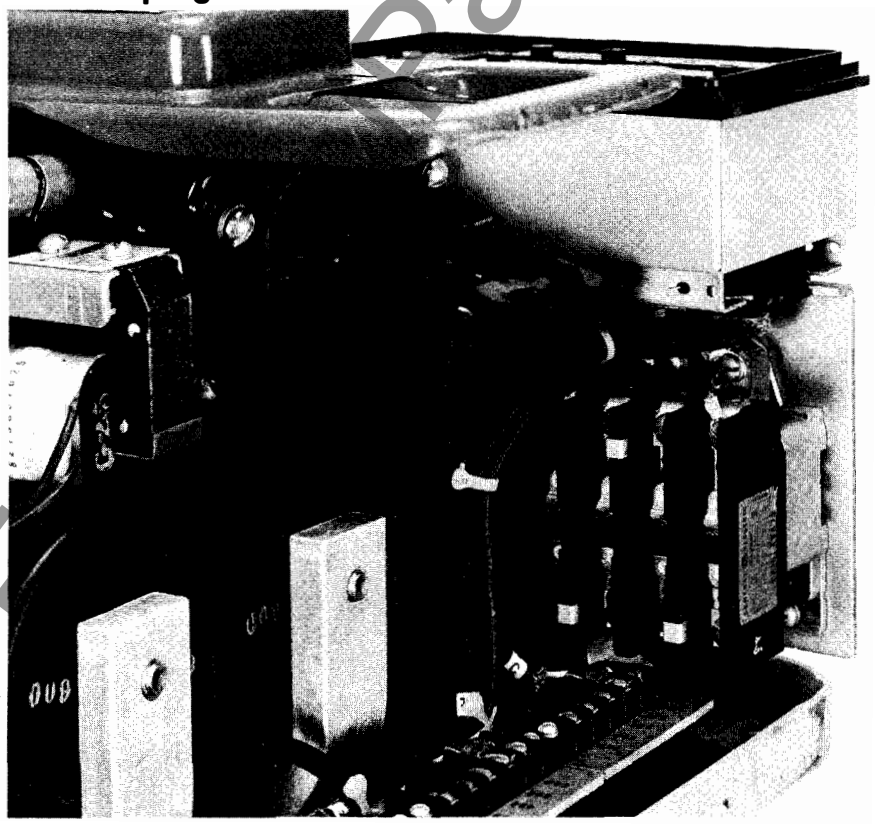


Fig. 21 — X Relay location with harness routing.

IV. EQUIPMENT MODIFICATIONS

NOTE:

The following modifications are required ONLY in conjunction with breakers being equipped with 4-wire Ground Fault trip elements.

1. Mount the neutral sensor (CT) in the outgoing neutral lead, normally in the equipment's bus or cable compartment. See Fig. 22 for the sensor's bar drilling plan. Check to insure that the neutral and phase sensors match, i.e., have the same ampere range.

2. On draw-out-type breakers, mount the 4th-wire neutral sensor stationary disconnect block 121 inside the breaker compartment at the lower rear as shown in Figs. 23 or 24, whichever applies. For the AKD-5-type equipments of Fig. 24, be careful to select the correct mounting bracket (Part 126 or 127).

3. Connect the neutral sensor to disconnect block 121 per wiring instructions of Fig. 25. For stationary breakers, the neutral sensor is connected to TB5.

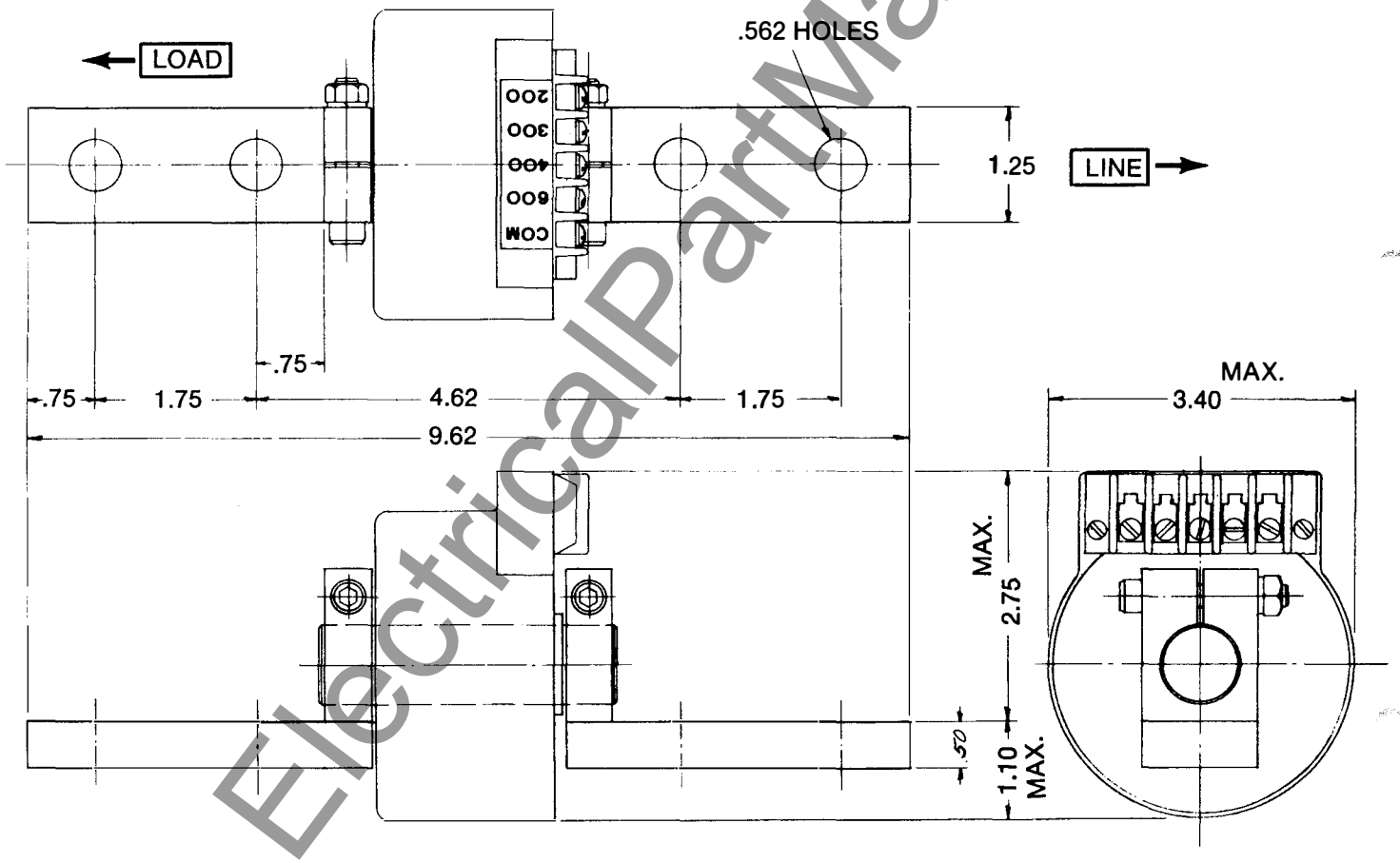


Fig. 22 — Outline of MicroVersaTrip® RMS-9 Neutral Sensors:
Cat. TSVG225BK — 70-225 amp
Cat. TSVG206BK — 200-600 amp

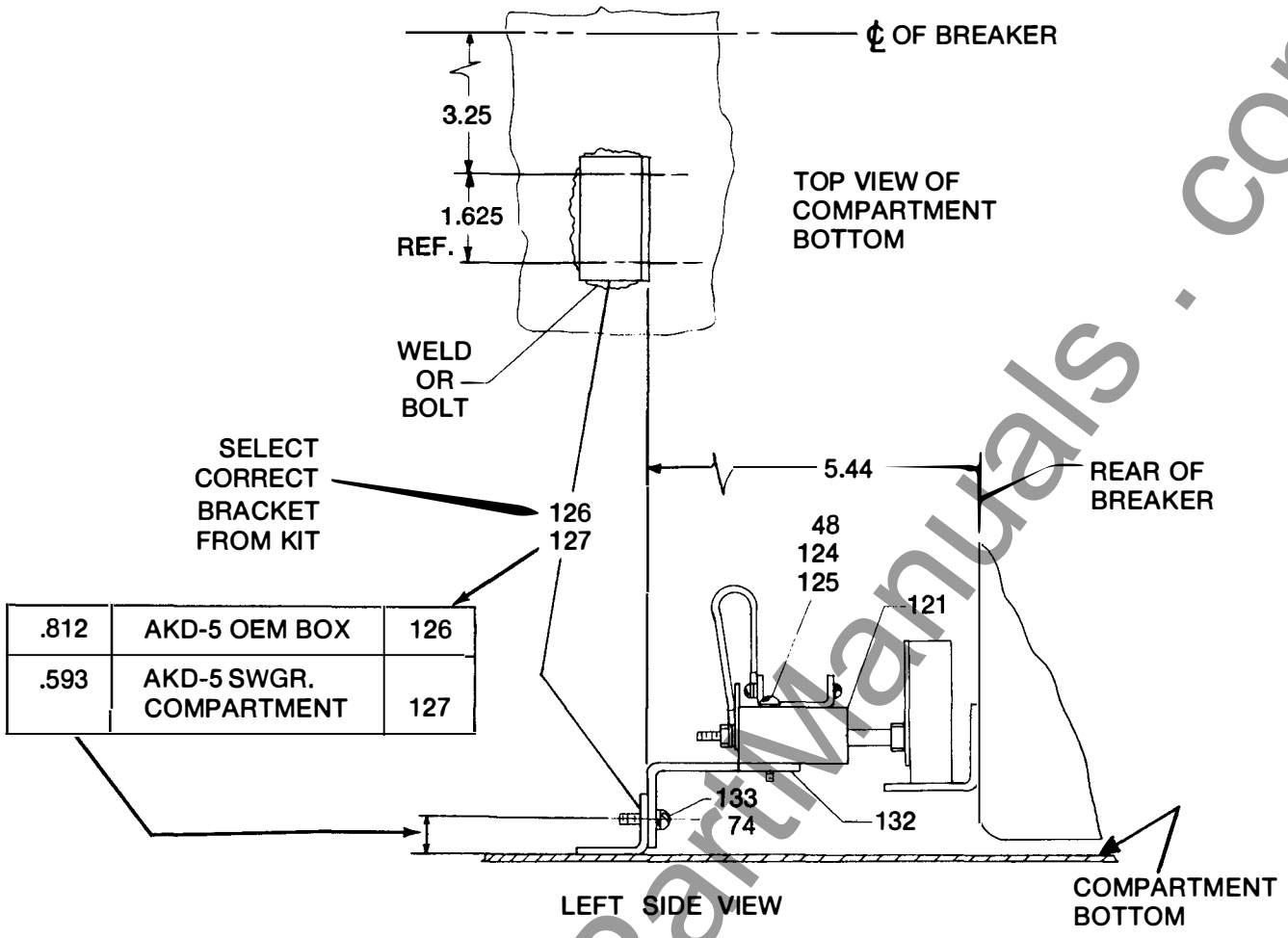


Fig. 23 — Mounting of 4th-wire neutral sensor disconnect block in AKD-5 switchgear compartments and AKD-5 type OEM boxes.

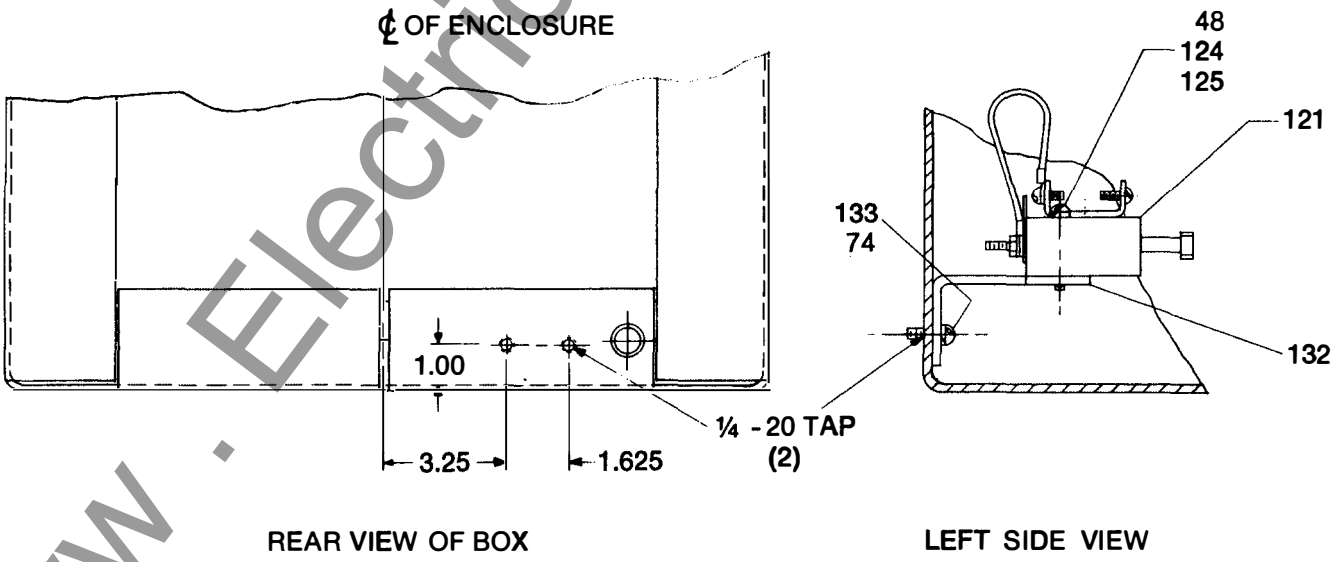


Fig. 24 — Mounting of 4th-wire neutral sensor disconnect block in AKD type OEM box.

NOTE:
Neutral CT markings of LINE and LOAD must be respected when making bus or cable connections.

Polarity of connecting wires from Secondary of Neutral CT to Terminal Block or CT Disconnect Block must also be respected: Tap to Tap, Com. to Com.

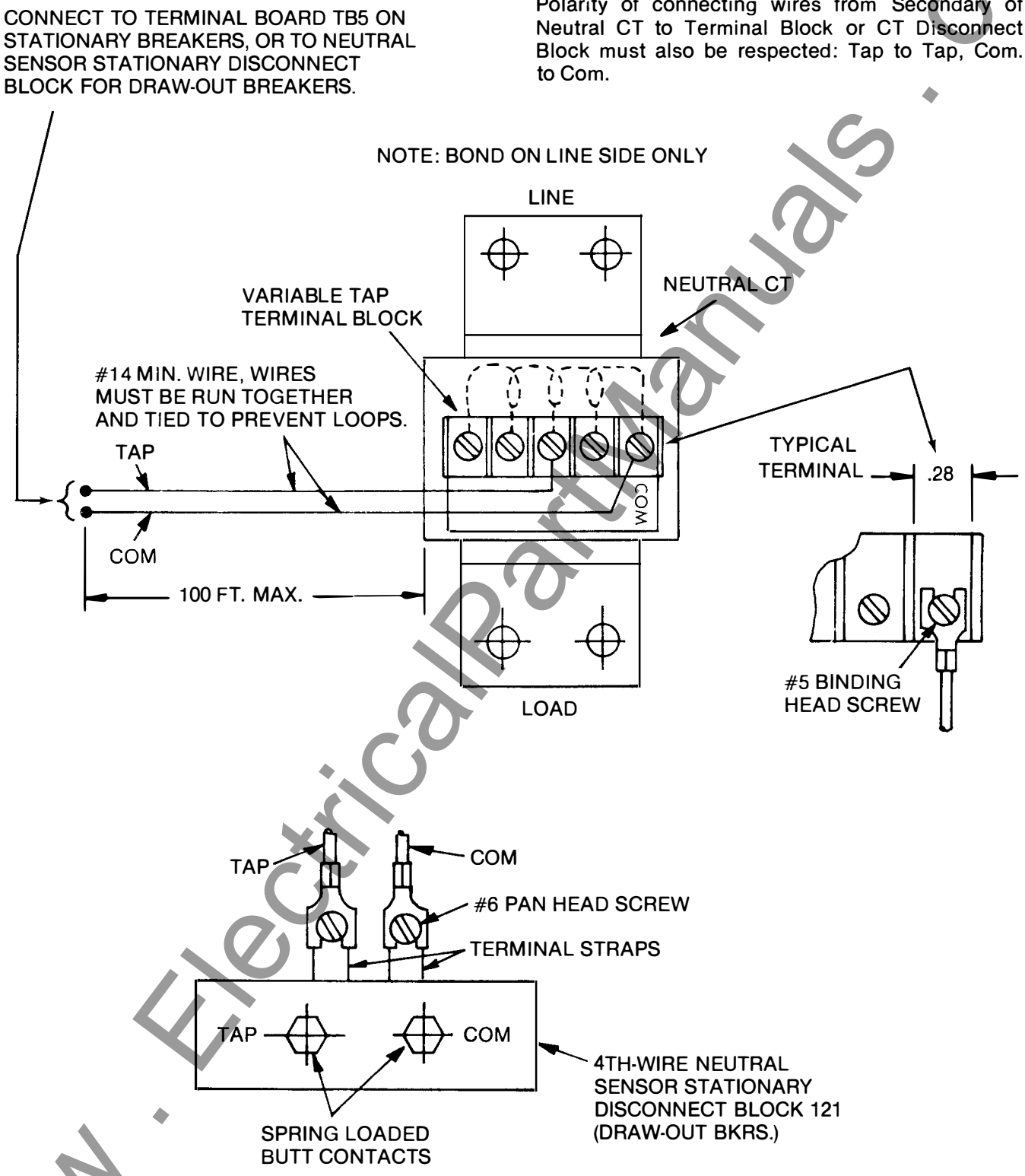


Fig. 25 — Connecting the 4th-wire neutral sensor.

V. FUNCTIONAL TESTING

Before the breaker is reinstalled to service:

1. Megger breaker primary circuit using a 1000V megger. Any value exceeding 500 megohm is acceptable.

Perform either of the following tests:

A — Using MicroVersaTrip® RMS-9 portable test set Catalog TVRMS, test per instructions GEK-97367 to assure proper operation of the breaker and its trip device. Or,

B — Using a single-phase, high current-low voltage test set, test each trip element (L, S, I, G) to assure proper protective device operation. Compare results with applicable time-current characteristic curves reproduced on pages 25 and 26.

NOTE:

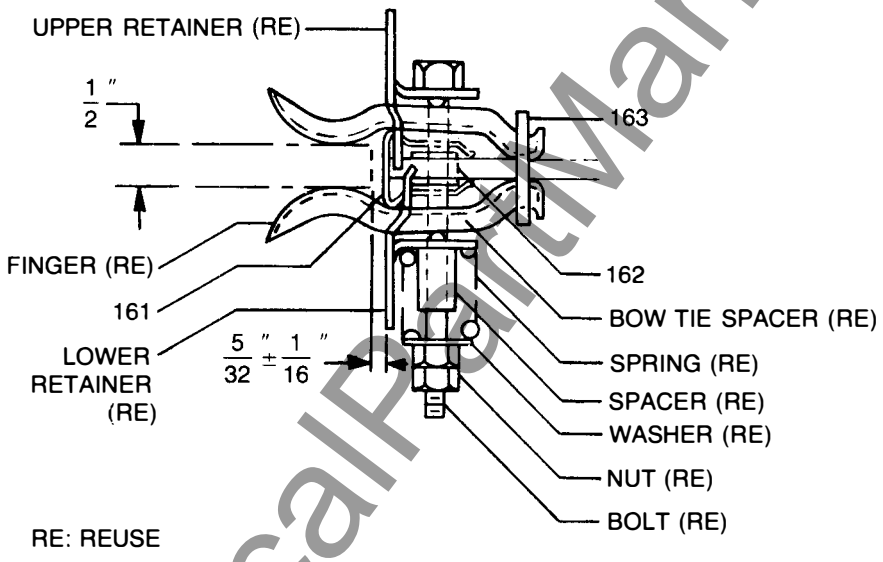
When testing units equipped with a ground fault trip element, the latter must be deactivated by using test set Cat. No. TVRMS. If a high current test set (primary injection) is being used, and portable test set TVRMS is not available, connect two poles in series.

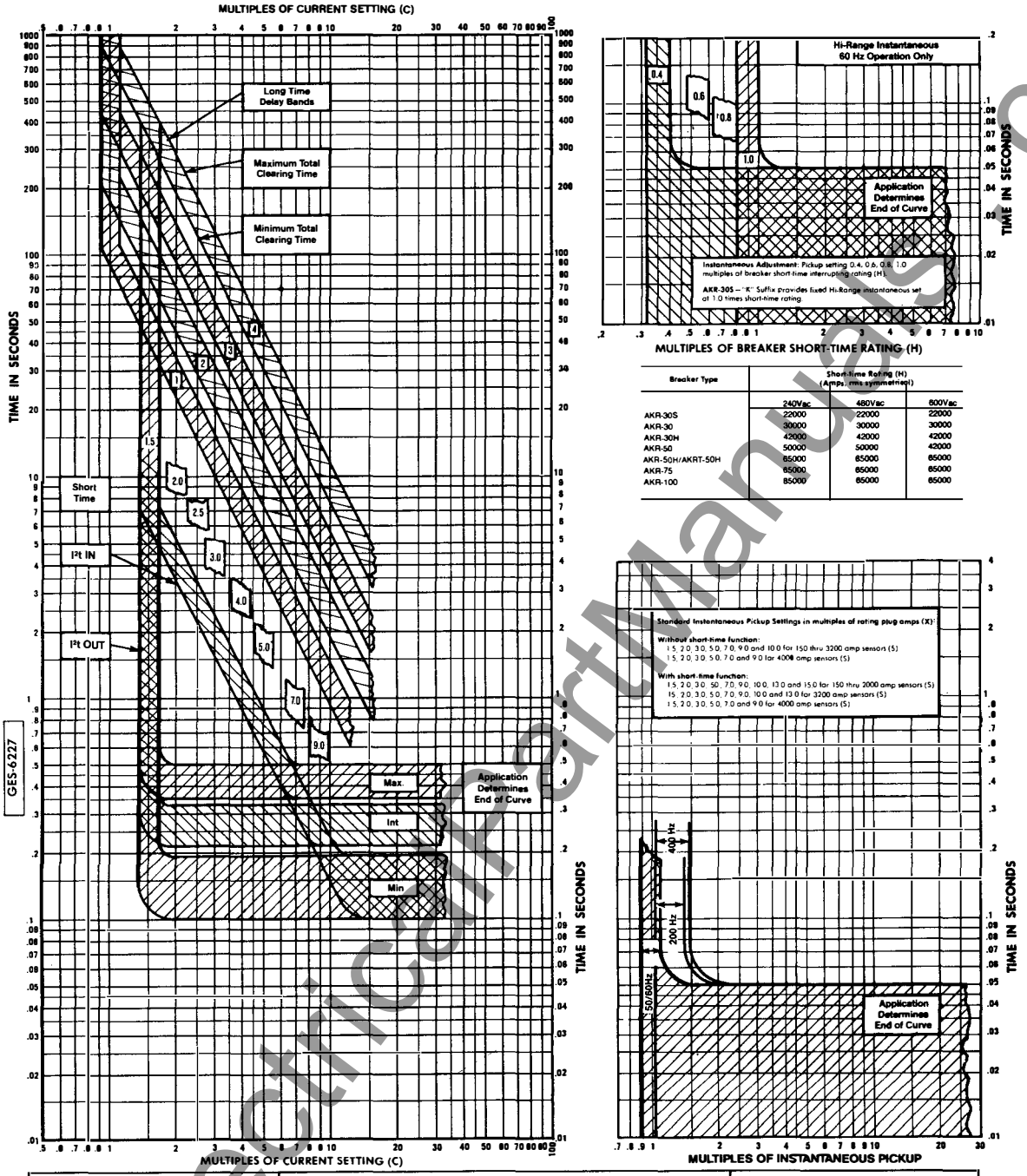
MicroVersaTrip ground fault defeat cable Cat. No. TVTGD9 **CANNOT** and **MUST NOT** be used to temporarily defeat the MicroVersaTrip® RMS-9 programmer ground fault function. Programmer damage may result.

AK-2/3-15 REASSEMBLY OF PRIMARY DISCONNECTS FOR NEW LOWER STUD - DRAW-OUT BREAKERS

1. Place spacer with off-center hole (162) in hole of stud while sliding new retainer (161) completely on stud.
2. Place new retaining ring (163) on stud. Insert lip of upper fingers under retaining ring and place bow tie spacers in fingers.
3. Place retainer over upper fingers and insert bolt.
4. Insert lip of lower fingers under retaining ring (163) and place bow tie-shaped spacers in fingers. Locate lower retainer to hold bow tie-shaped spacers in place.
5. Place cylindrical spacer and spring on bolt and secure with washer and nut.
6. Tighten nut to obtain 60-70 lbs. pressure per set of four fingers when spread ½″ apart, as shown, and lock with second nut.

Note: If pressure gage not available, compress spring to a 13/16″ dimension for proper pressure.





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	85000	85000	85000
AKR-75	85000	85000	85000
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 Sensor (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	300 600 500 600 700 800 600 800 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

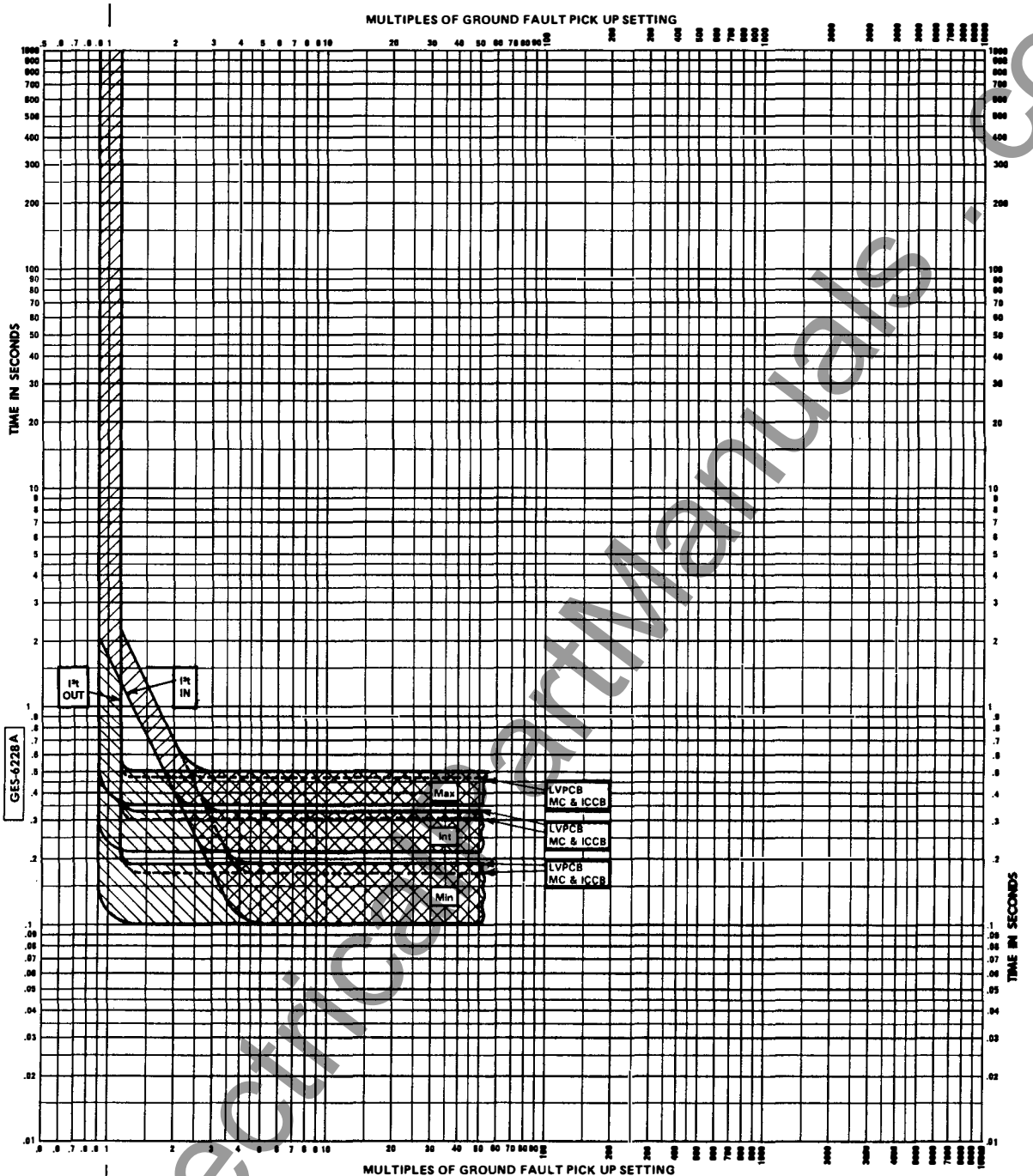
Instantaneous Adjustments: See Curves above.

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

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-6228A

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 amp 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: I^2t 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.

10/86 (3M)

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

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:
GE Construction Equipment
41 Woodford Avenue
Plainville, Connecticut 06062

Outside the US and Canada, write:
GE Construction Equipment Export Operation
411 Theodore Fremd Avenue
Rye, New York 10580 USA

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