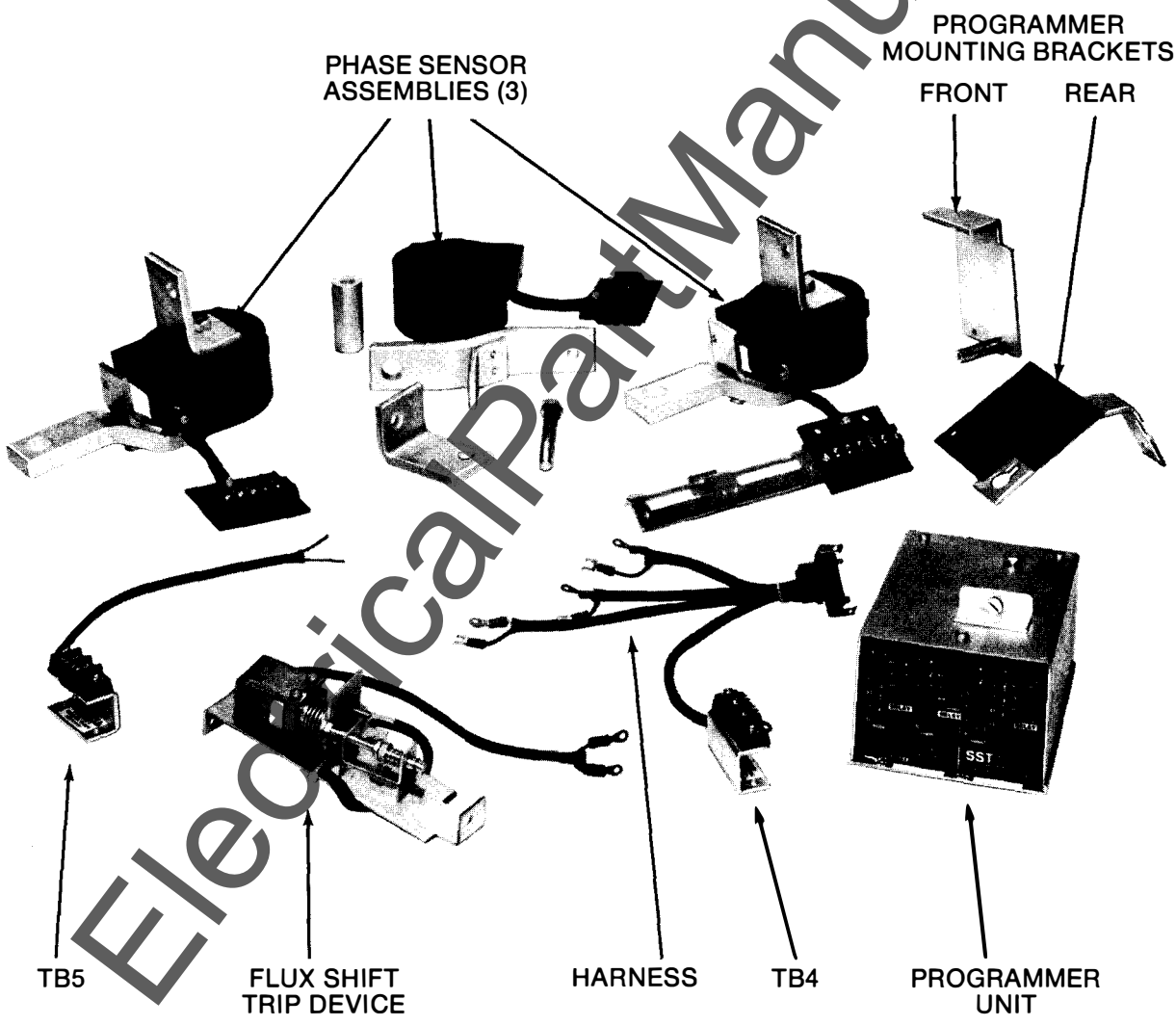
For Installing
the SST Solid State
Overcurrent Trip Device
on Low Voltage
Power Circuit Breaker
Types AK-15 and AK/AKU-25

INSTRUCTIONS

Conversion Kits



Components of SST Conversion Kit for AK-15/25

DISTRIBUTION EQUIPMENT DIVISION
PLAINVILLE, CONNECTICUT 06062 USA

GENERAL ELECTRIC

CONVERTING AK-15/25 BREAKERS TO THE SST TRIP DEVICE

CONTENTS

I. INTRODUCTION

These instructions cover installation of the SST solid state overcurrent trip device conversion kits on AK-15 and AK-25 frame breakers originally equipped with EC or Power Sensor type trip devices. Each kit contains the variety of material necessary to convert either 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 Drawout	AKD-5 Drawout	EC	Power Sensor
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
	—	AKU-2-25	AKU-2A-25	x	
	—	AKU-3-25	AKU-3A-25		x

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 or Power Sensor), then install the SST 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, 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.

TOOLS REQUIRED

Socket Set — ⅜″ drive
Open End Wrenches — Set
Screwdrivers — Assorted
Allen wrenches — Assorted
Tru-arc Pliers — Assorted
Pliers — Assorted
Electric Drill
Drill Bits
6″ Scale
Crimping Tool

Users are reminded that the installation of SST kits provides an excellent opportunity to perform normal maintenance on the breaker proper, 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 SST Kit.

Table 2 — Basic Conversion Kits for AK-15/25, AKU-25

Breaker Mounting Type	Basic Kit Cat. 343L692-(Gp. No.)			
	With 4th-Wire Neutral Sensor		W/O 4th-Wire Neutral Sensor	
	Man.	Elec.	Man.	Elec.
Stationary	G3	G4	G1	G2
AKD & AKD-5 Drawout	G5	G6		

Table 4 — Tapped Current Sensors for Use with SST Conversion Kits

Breaker Type	Sensor Ampere Range	Cat. 343L692-(Gp. No.)	
		Phase Sensors	4th-Wire Neutral Sensor
AK-15	70-225	G37	G67
AK-25, AKU-25	70-225		
	200-600	G38	G68

Table 3 — Programmer Units for AK-15/25, AKU-25 SST Conversion Kits

Trip Elements ①	Cat. 343L692-(Gp. No.)		
	Short-Time Pickup		
	None	1.75L-4L	3L-10L
LS	—	G19	G13
LI	G14	—	—
LSI	—	G20	G15
LSG	—	G21	G16
LIG	G17	—	—
LSIG	—	G22	G18

① Trip Element Abbreviations
L = Long Time
S = Short Time
I = Instantaneous
G = Ground Fault

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 Maintenance Manual GEI-50299 pp. 23, 31.

5. On drawout breakers, remove the primary disconnect fingers from the bottom (loadside) copper studs. Refer to Maintenance Manual GEI-50299 page 7.

6. Remove the three bottom (loadside) 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 SST 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.

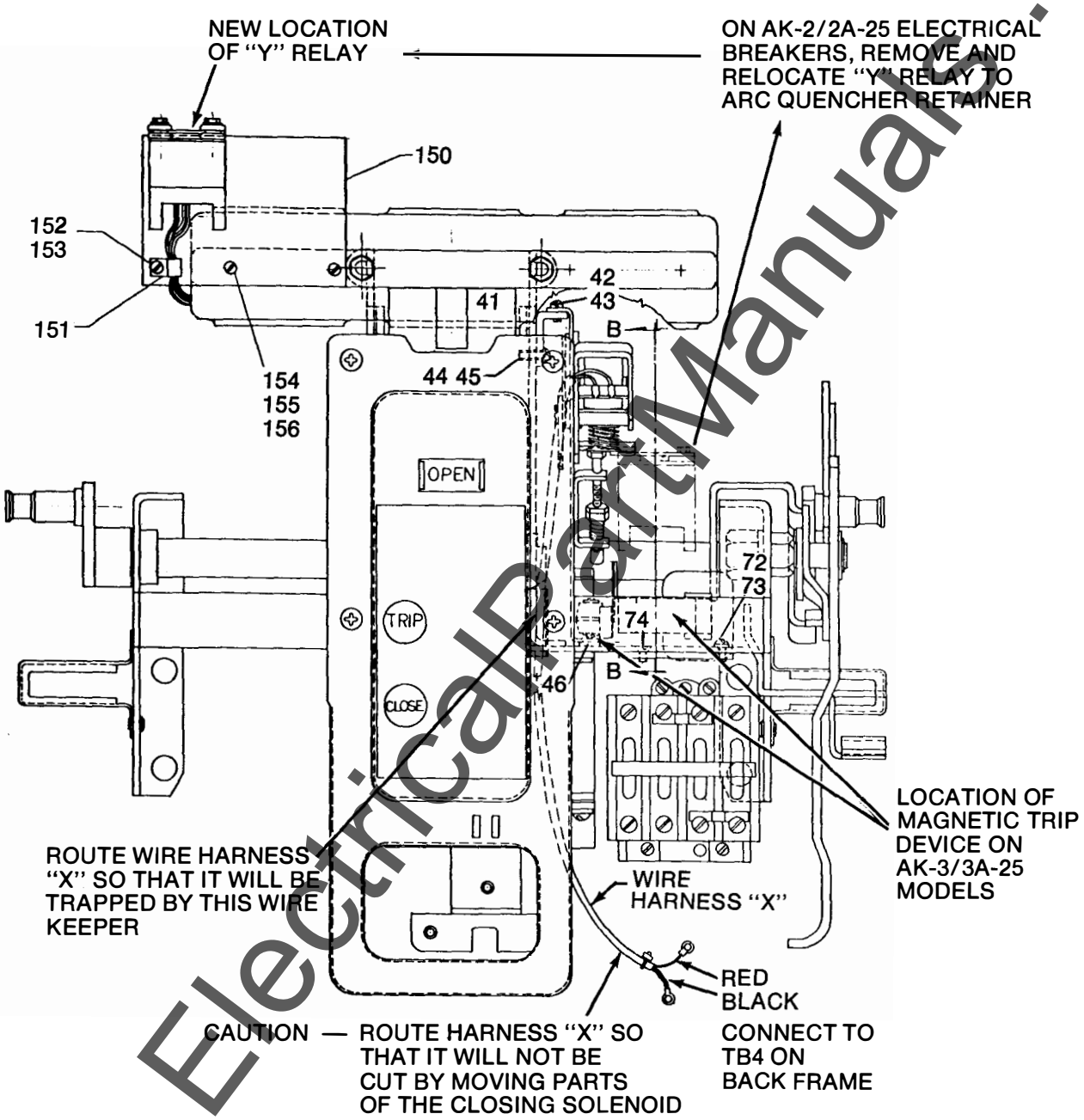


Fig. 1 — Front view of front frame (AKD type drawout shown)

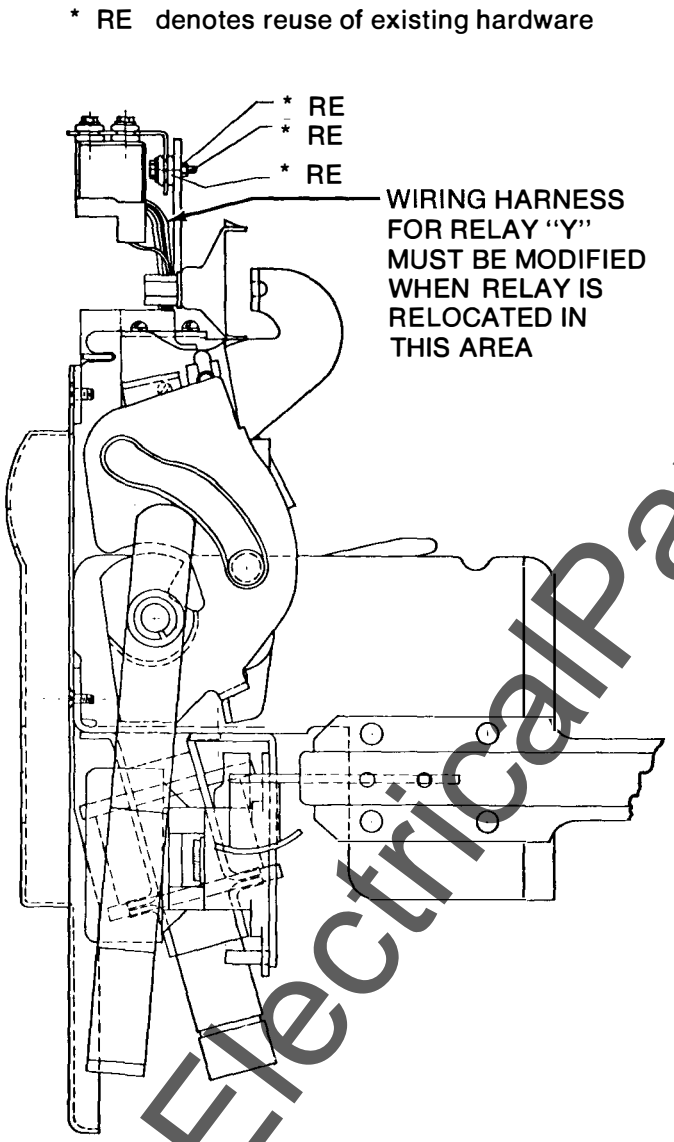


Fig. 2 — Right side view of front frame

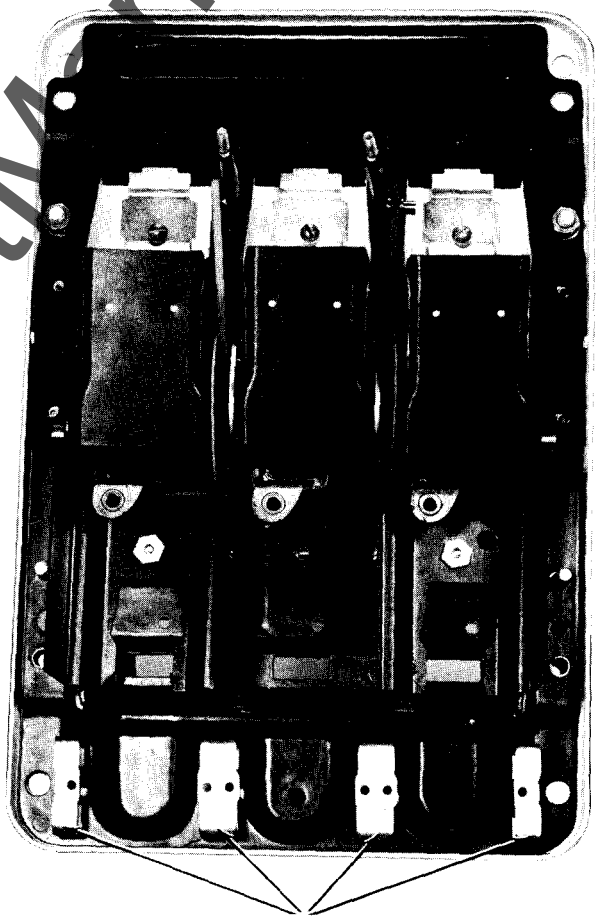


Fig. 3 — Front view of rear frame

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. Proceed with each pole by first inserting lower copper stud 90 through the back plate and attaching 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 ⅜" 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 drawout 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 drawout breakers modify primary disconnects per GEH 4642 included with kit.

CAUTION: Adequate primary contact force is mandatory. Tighten the nuts on the ¼ x 20 mounting bolts to obtain a spring dimension of $^{13}/_{16}$ to $^{27}/_{32}$. The proper dimensions between contact fingers is $^{7}/_{16}$". Proper contact force is 60 to 70 lbs. with the contacts spread to ½".

5. Mount programmer rear mounting bracket 70 together with flux shift trip device terminal board TB4 (part of wire harness 100) to the lower right corner of the back frame utilizing existing holes — See Figs. 5 and 6.

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 next 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. Install programmer front mounting bracket 71 to the underside of the front frame per Fig. 21. On AK-2/2A electrically operated models, this bracket replaces the existing bracket which mounts the "X" contactor. This step is not required on AK-3/3A models; they have the proper bracket already in place.

10. Reference Fig. 6, install flux shifter actuating bushing 49 in the right hand operating link; enlarge 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 terminal block TB4 per Fig. 20. 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. Mount programmer unit 17 to breaker and plug harness connector into programmer. See Fig. 21.

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.

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

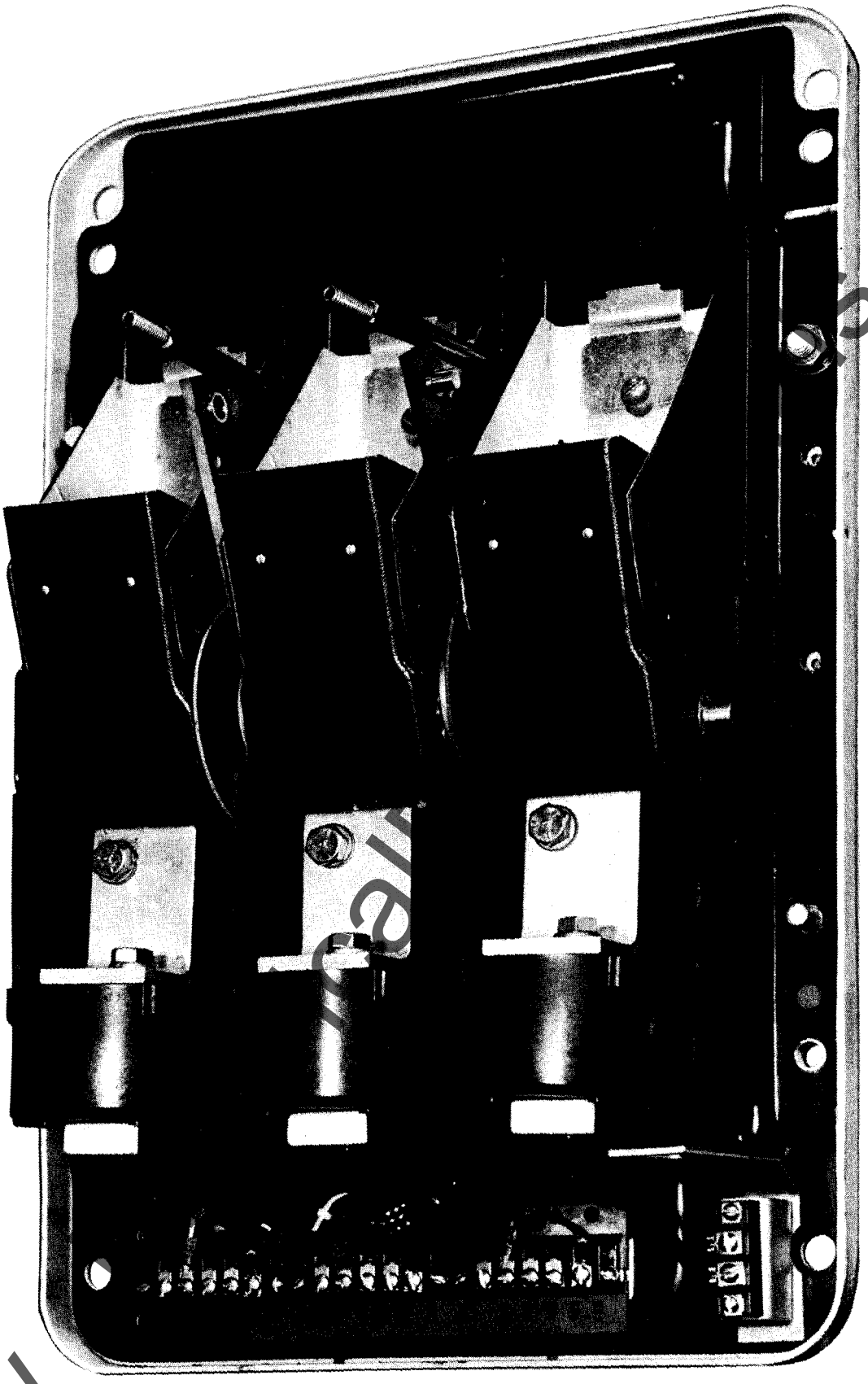


Fig. 4 — AK-25 back frame with SST conversion components installed and ready for reassembly to front frame.

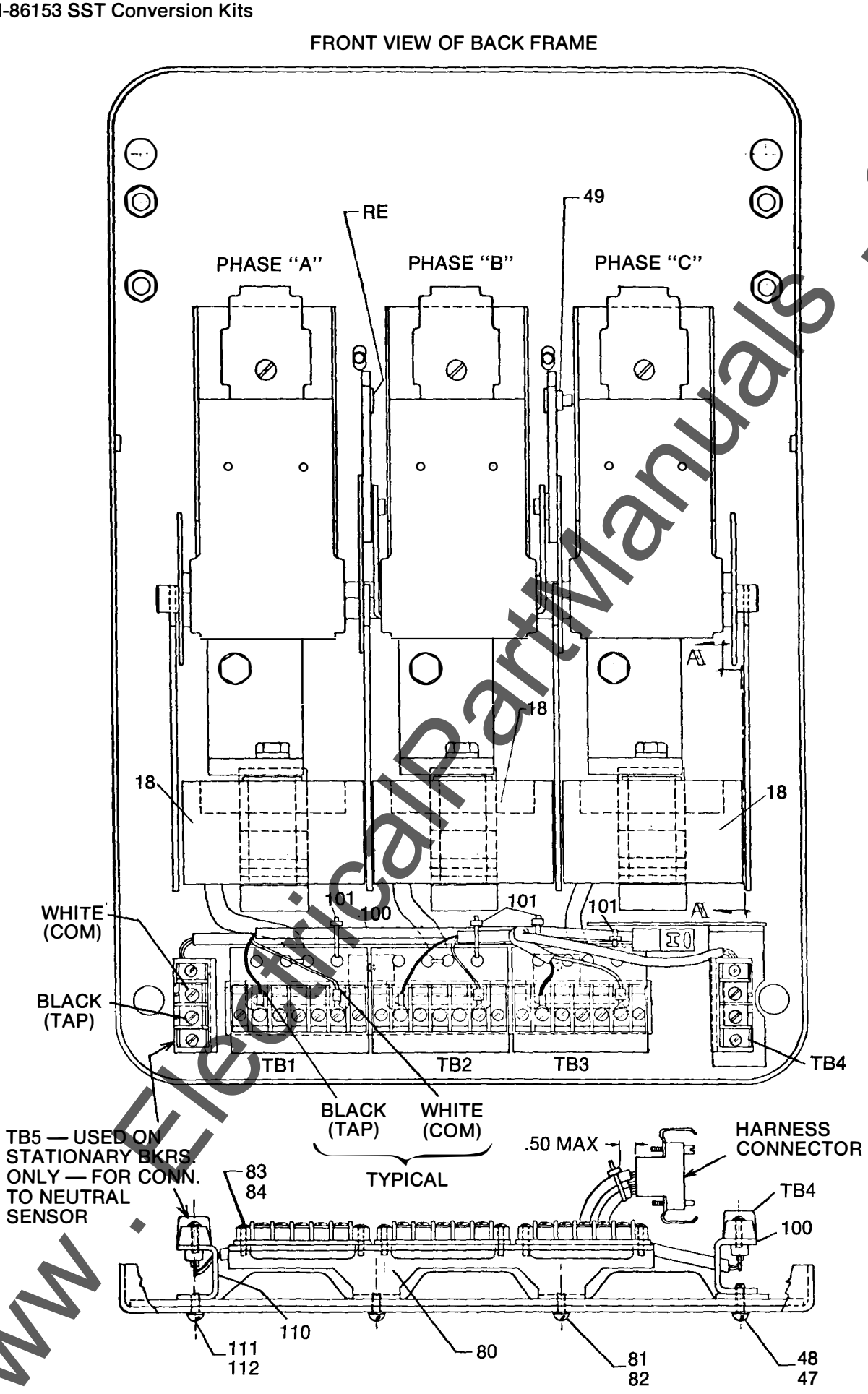


Fig. 5 — Back frame assembly

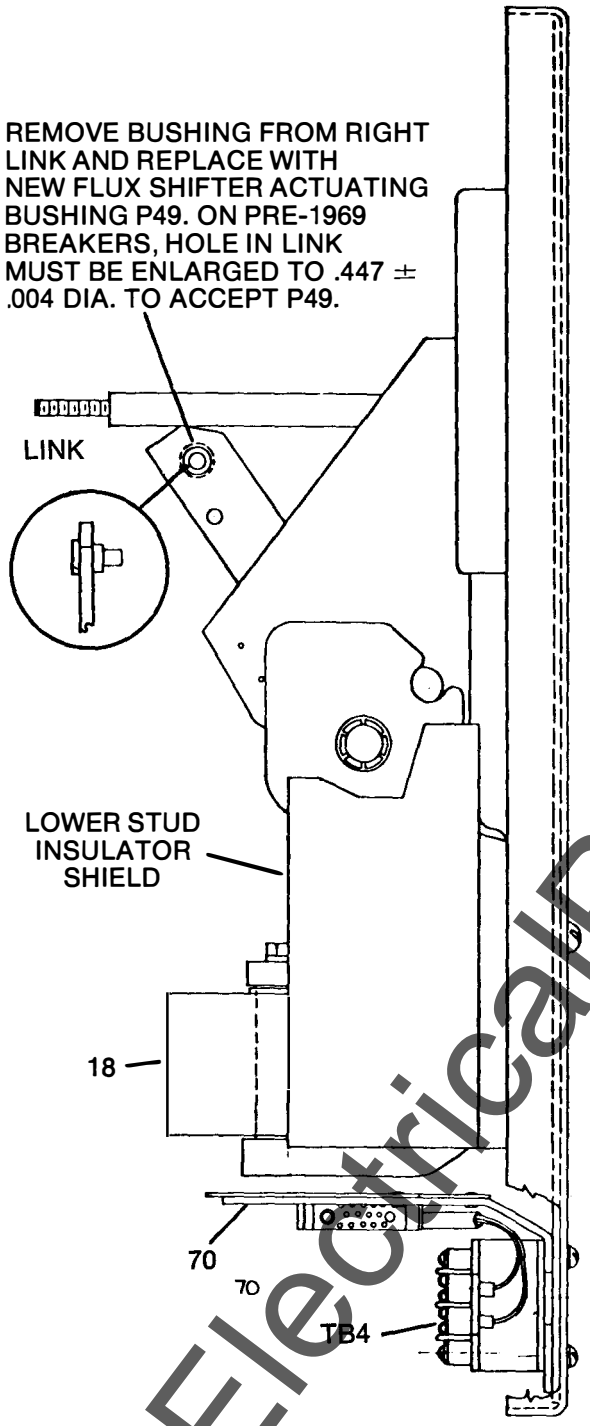


Fig. 6 — Right side view of back frame

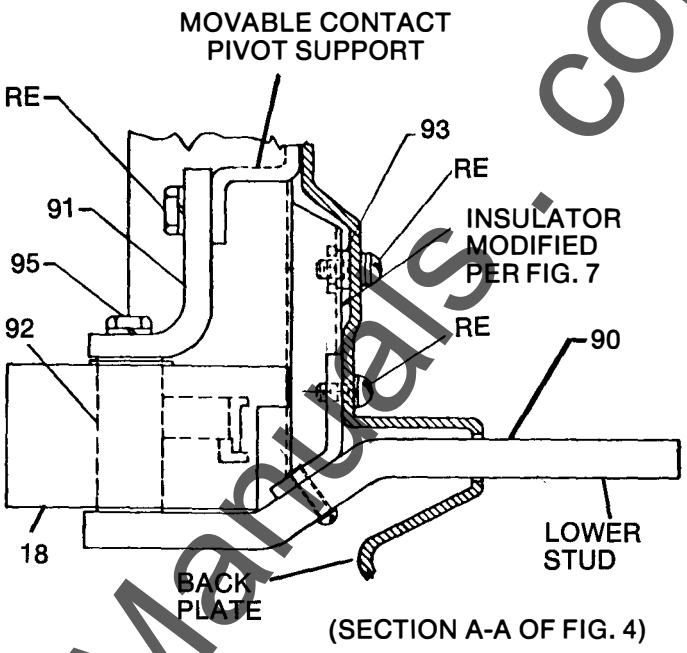


Fig. 7 — Phase sensor assembly, right side view

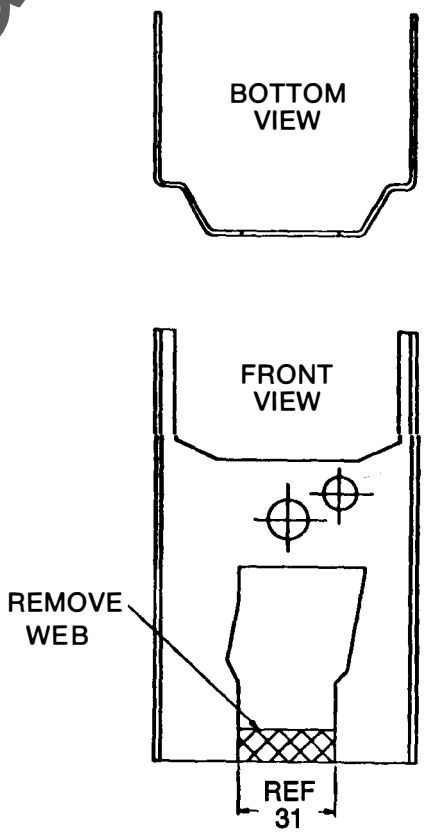


Fig. 8 — Stud insulator modification

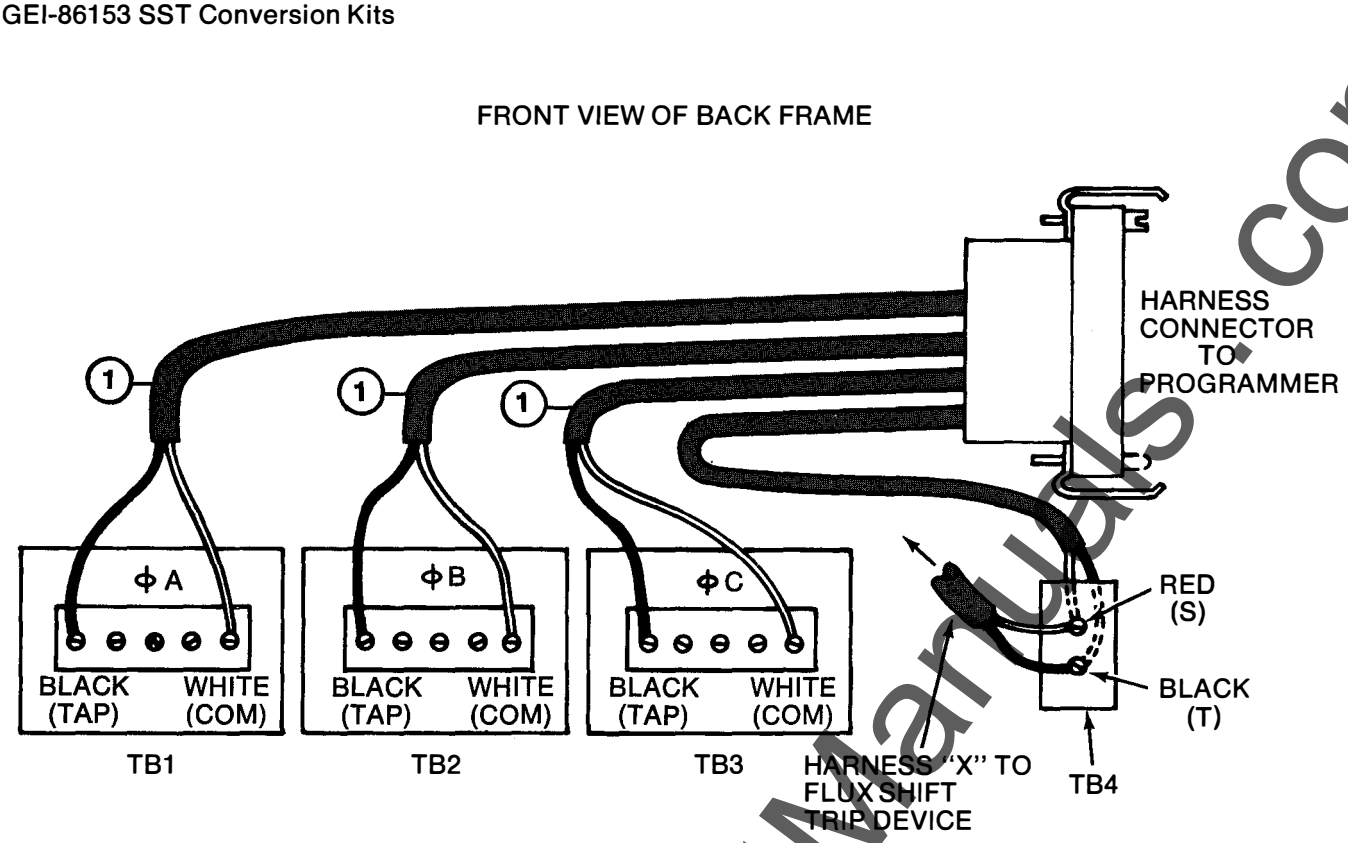


FIG. 9 **Harness connections for all drawout and stationary breakers used on 3-wire systems — with and without ground fault. For elementary diagram see Figs. 10 & 11.**

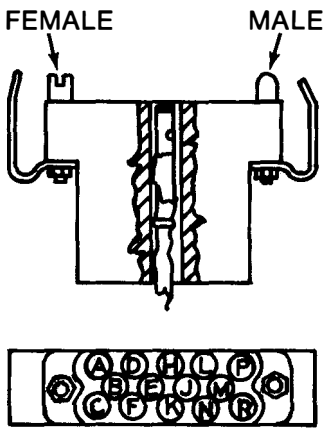
INSTALLATION STEPS

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 Socket Number
Phase A Sensor	TB1	White Black	A C
Phase B Sensor	TB2	White Black	D F
Phase C Sensor	TB3	White Black	H K
Flux Shift Trip Device	TB4	Red Black	B E
4th-Wire Neutral* Sensor	TB5 or Secondary Disconnect	White Black	L N

*Used only with 4-wire Ground Fault.



HARNESS CONNECTOR

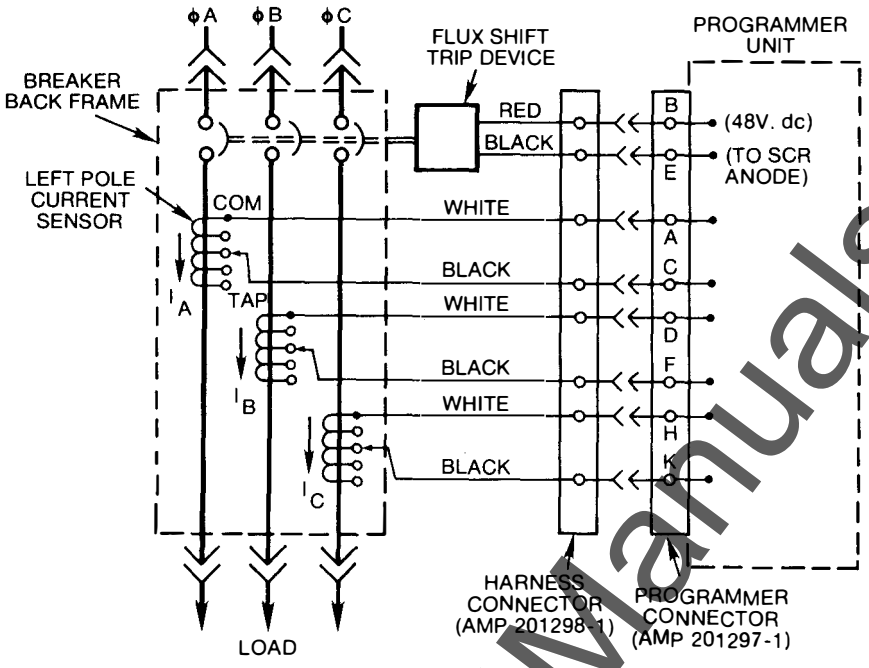


Fig. 10 — Cabling Diagram — SST without ground fault.

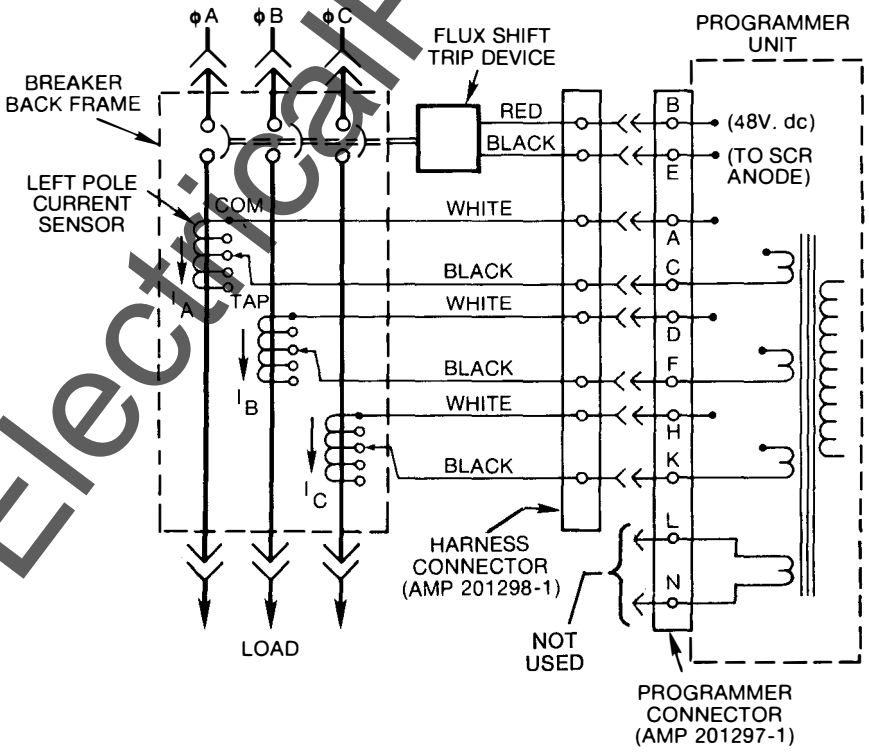


Fig. 11 — Cabling Diagram — SST with ground fault on 3-wire load.

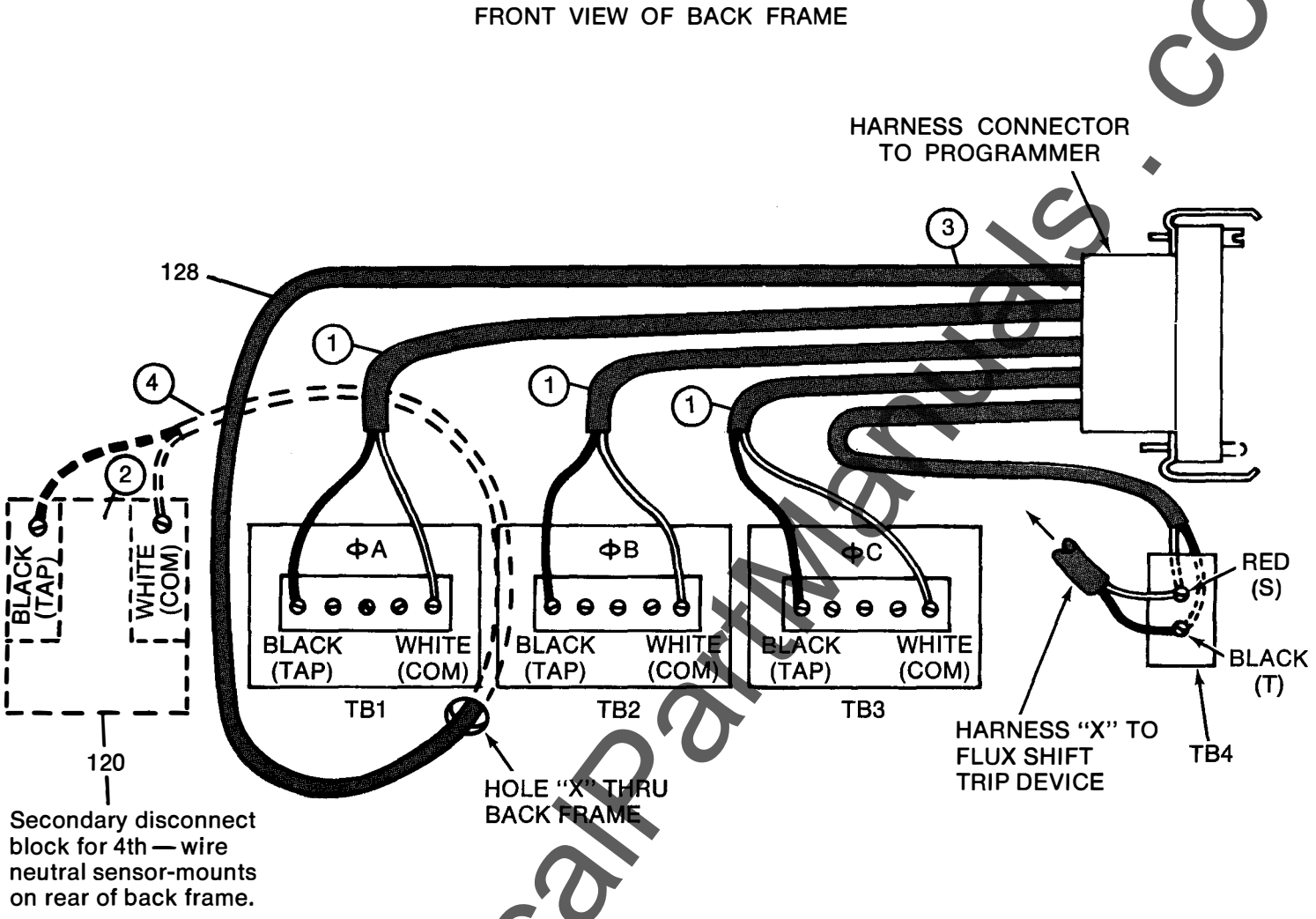
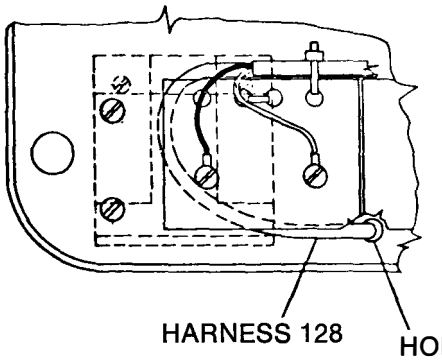


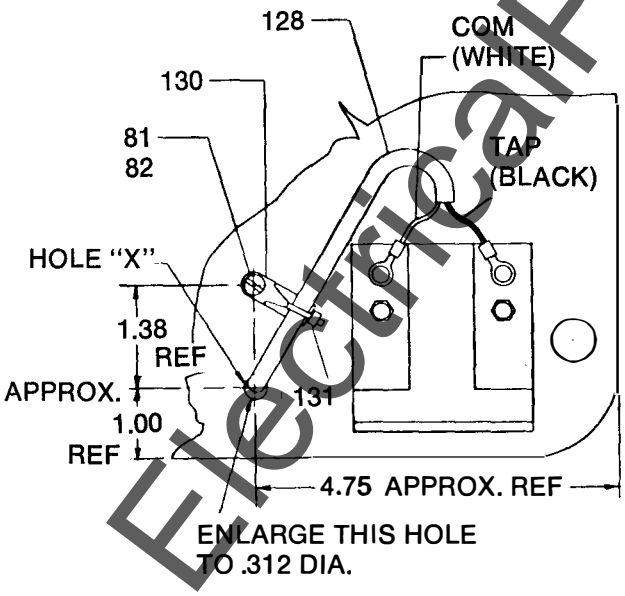
FIG. 12 Harness connections for all drawout breakers equipped with 4-wire ground fault. For elementary diagram see Fig. 14.

INSTALLATION STEPS

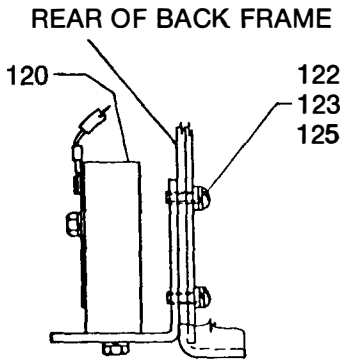
1. Connect the A, B, and C phase sensor leads respectively to TB1, TB2 & TB3. Identify per Table 5.
2. Mount the neutral sensor disconnect block 120 to the rear of the back frame per Fig. 13. Use existing mounting holes.
3. Insert the two prepared leads of harness 128 into the harness connector: Black to socket N, white to socket L.
4. Feed the opposite end of harness 128 thru 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 (drawout breakers only).

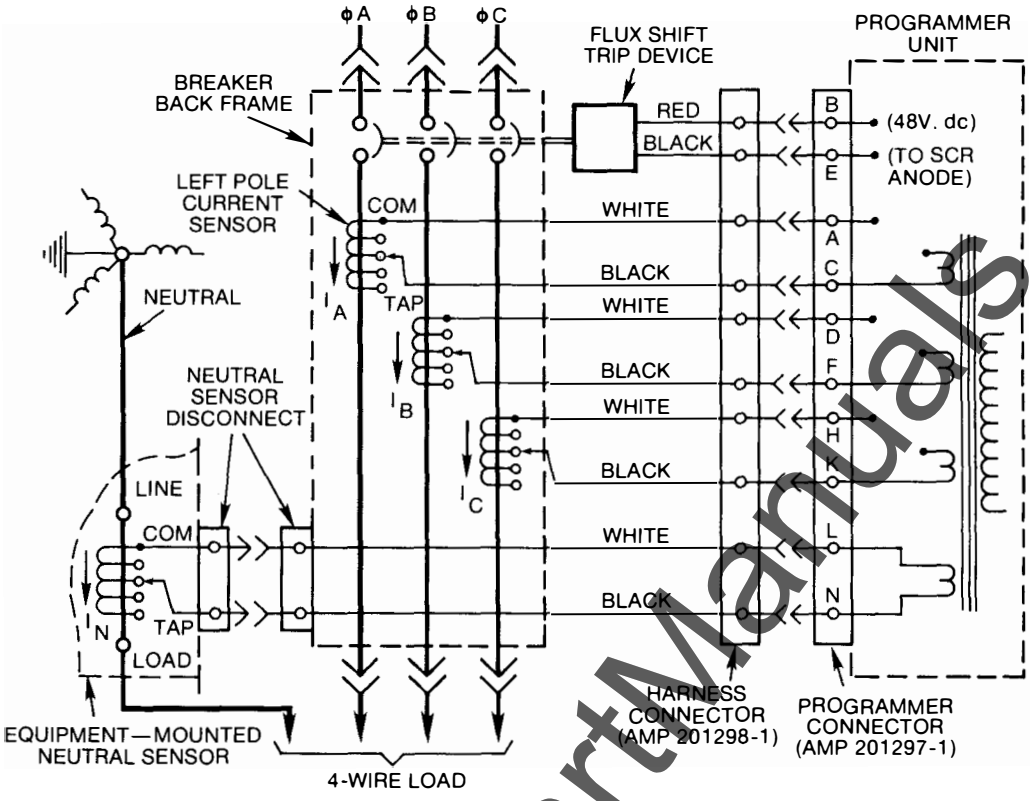


Fig. 14 — Cabling Diagram — SST with ground fault on 4-wire load — drawout breaker.

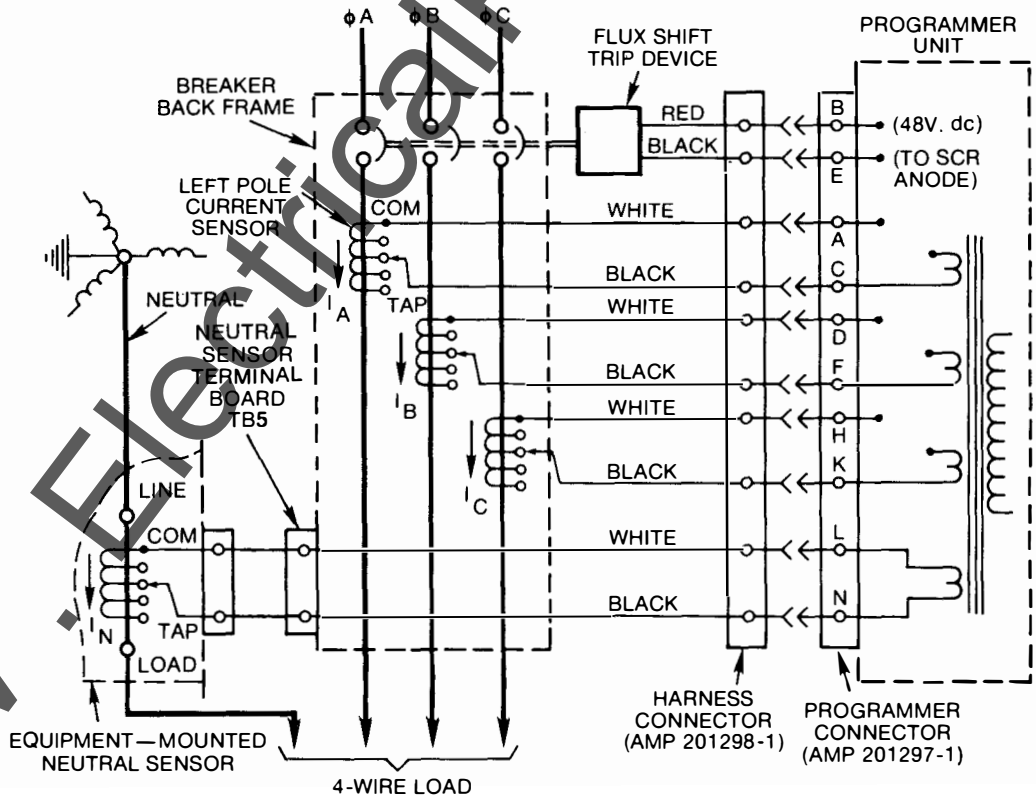


Fig. 15 — Cabling Diagram — SST with ground fault on 4-wire load — stationary breaker.

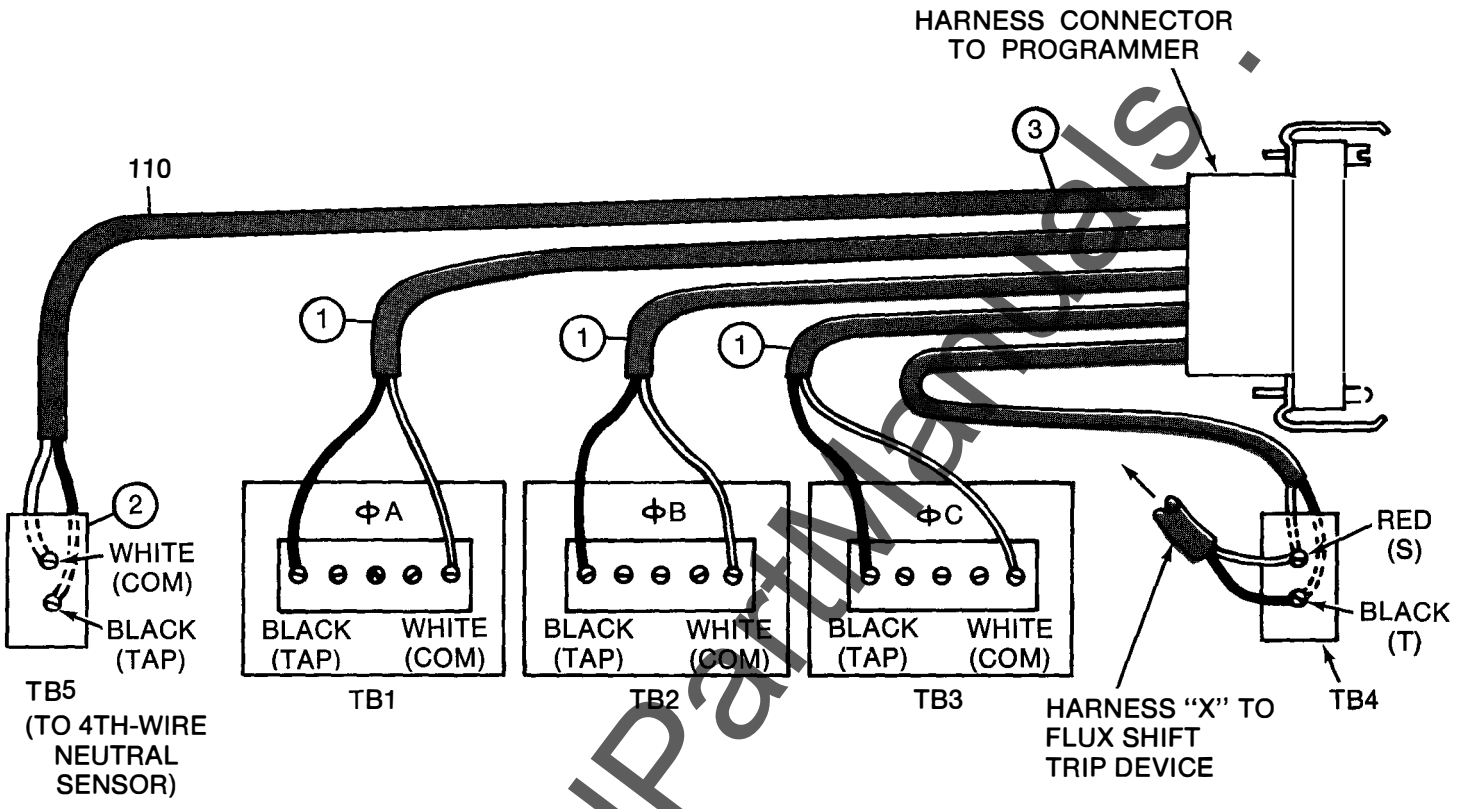


Fig. 16 **Harness connections for stationary breakers equipped with 4-wire ground fault. For elementary diagram see Fig. 15.**

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 socket N, white to socket L.

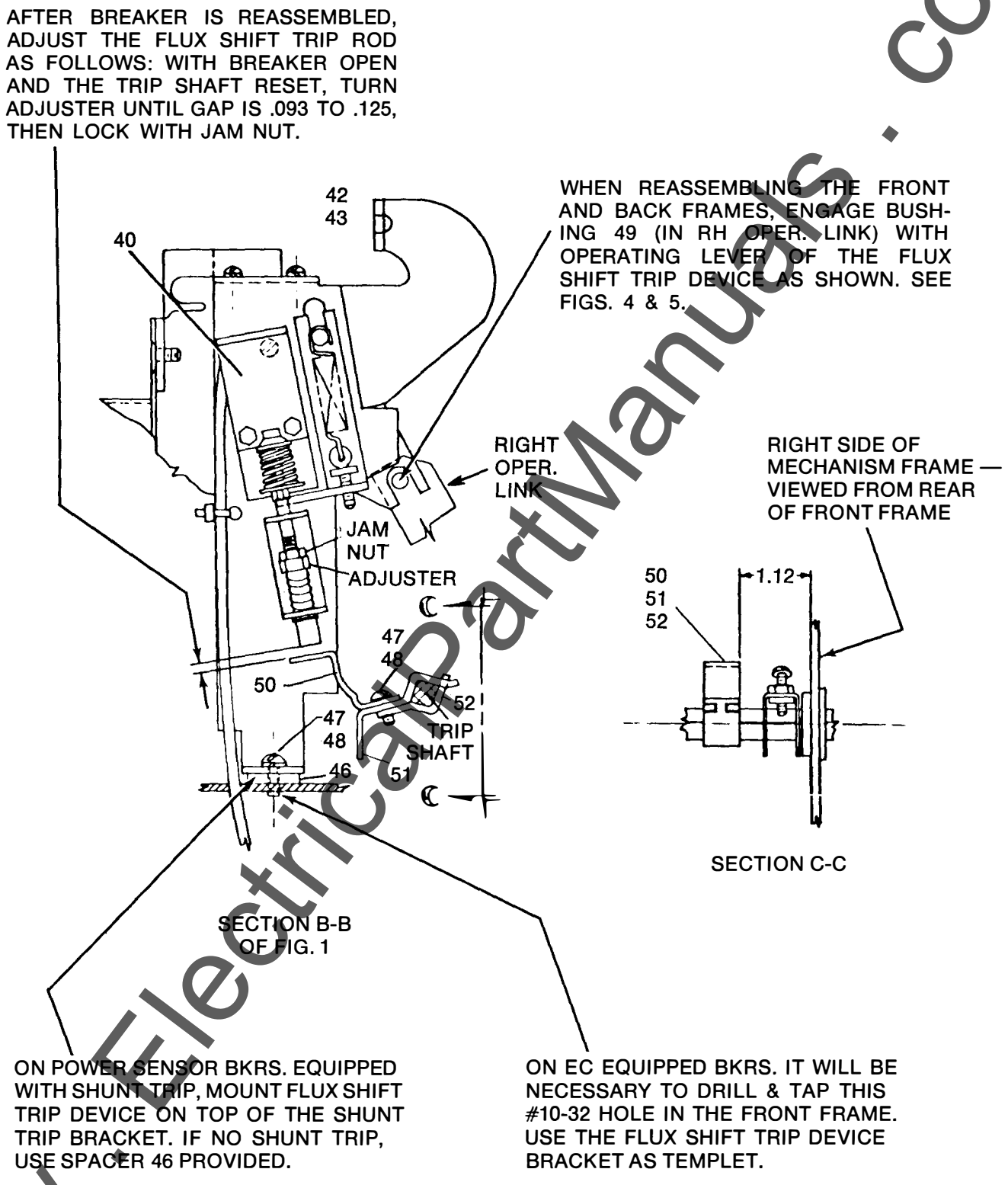


Fig. 17 — Right side view of mechanism frame showing mounting of flux shift trip device 40.

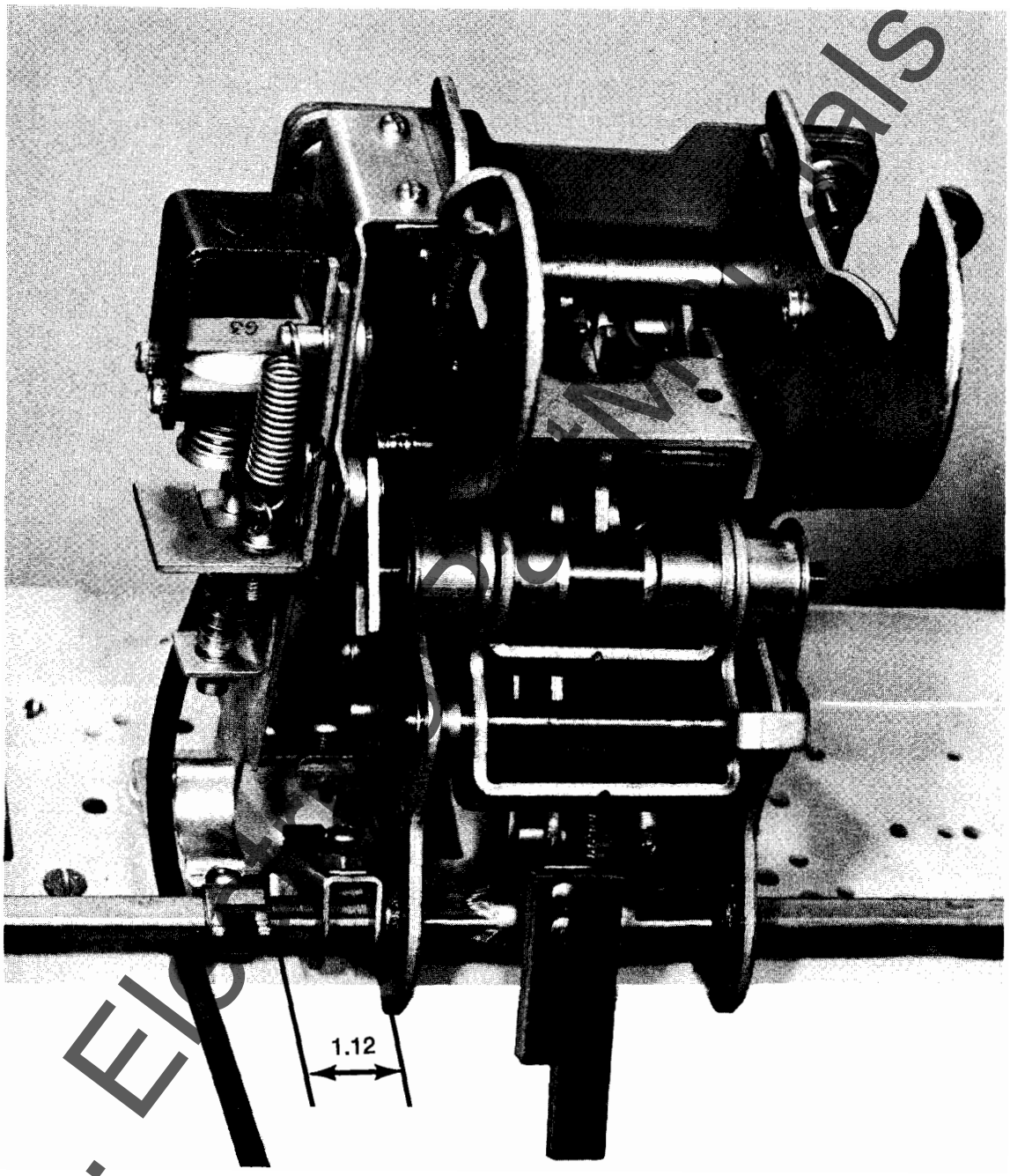


Fig. 18 — Rear view of front frame showing location of trip paddle for flux shift trip device.

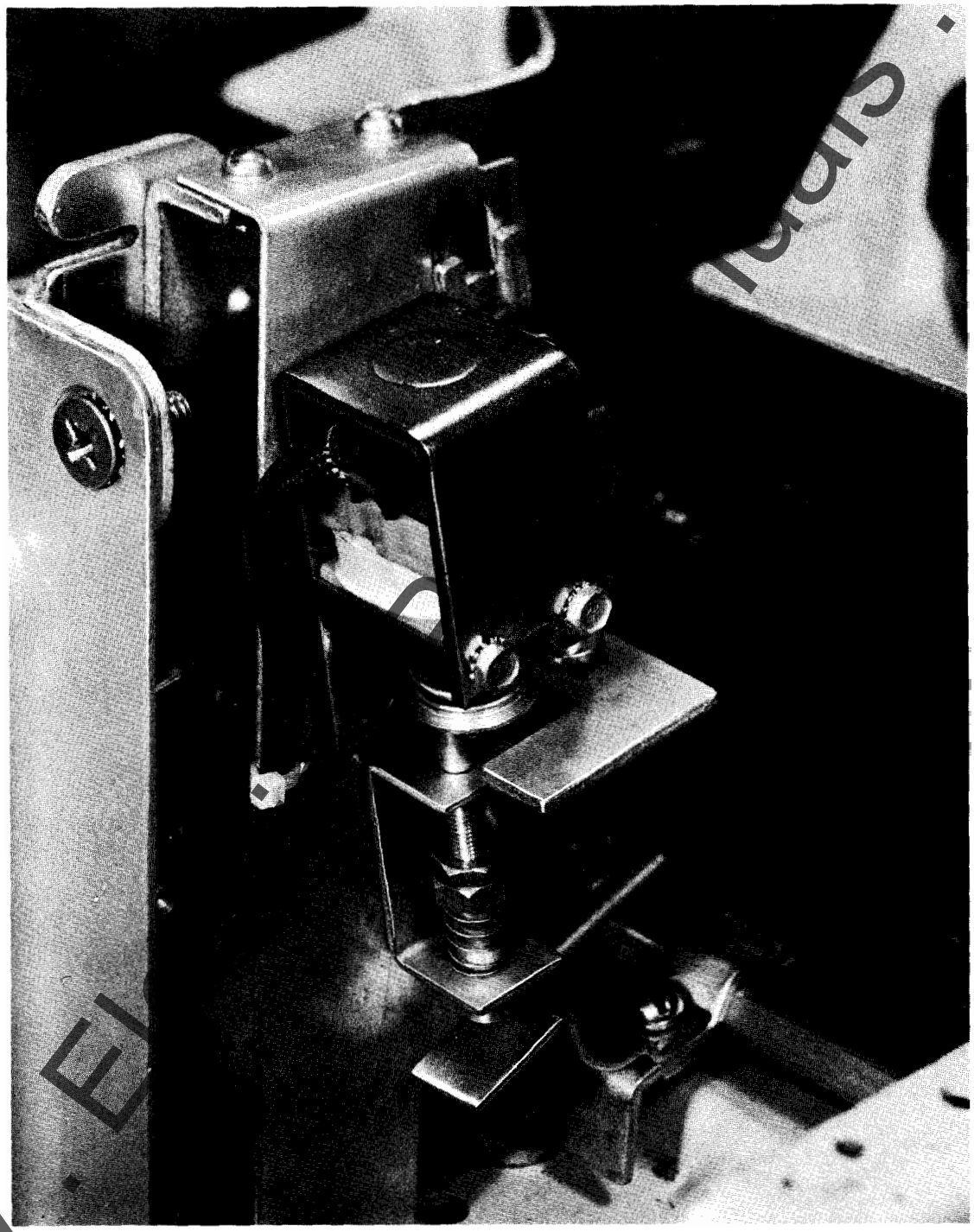


Fig. 19 — Right side view of operating mechanism showing mounting of flux shift trip device.

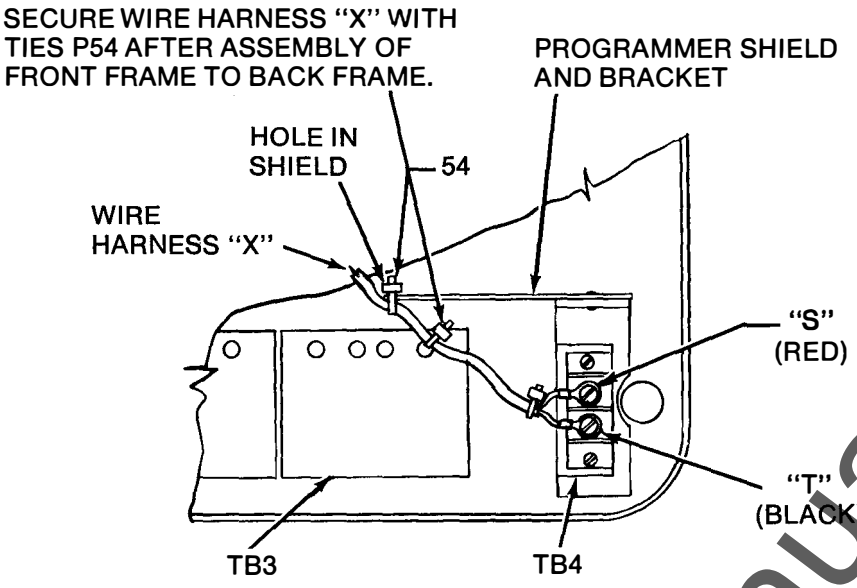


Fig. 20 — Connection of Harness "X" from flux shift trip device to terminal board TB4 on back frame.

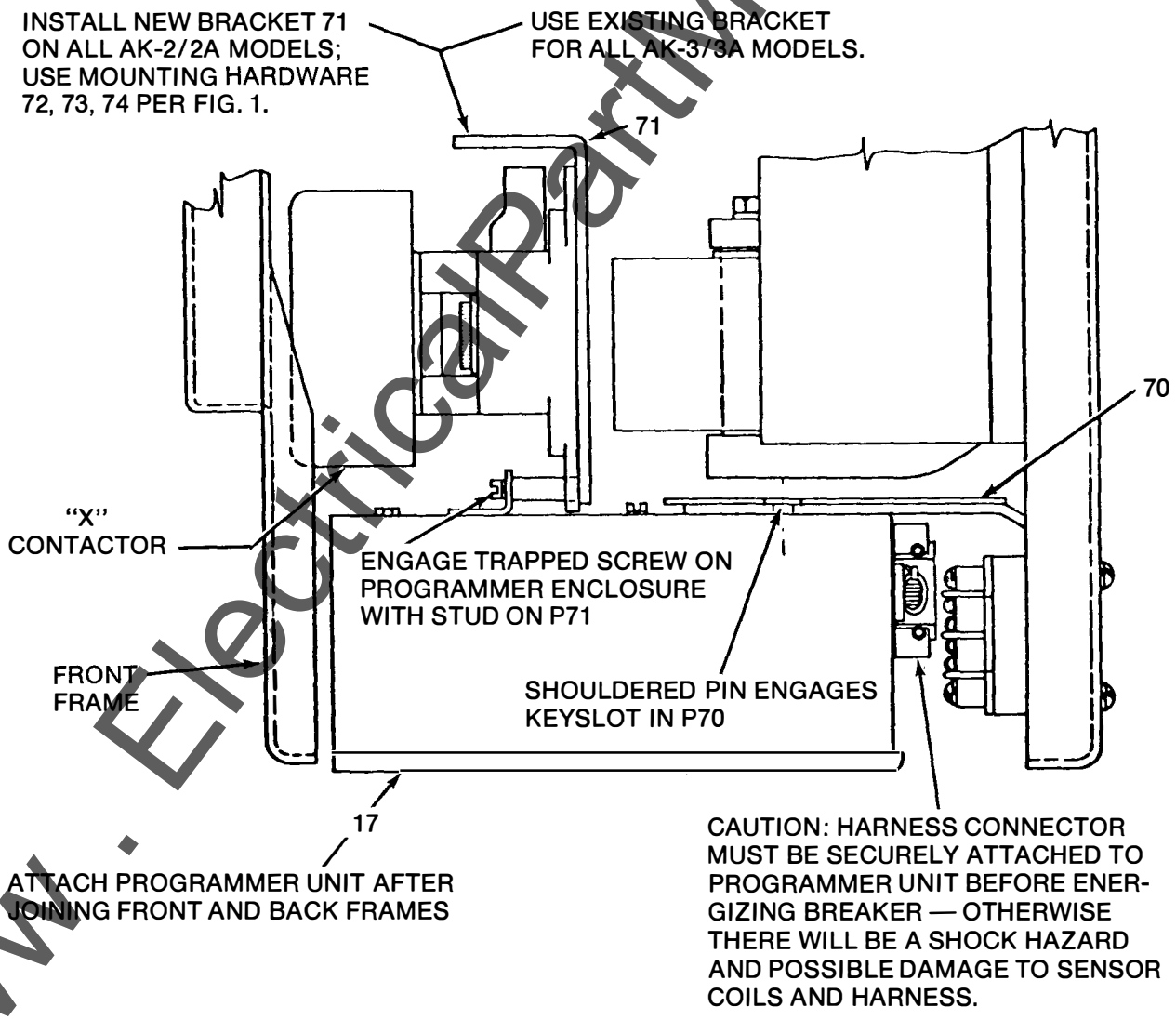


Fig. 21 — Right side view of breaker showing mounting of programmer unit.

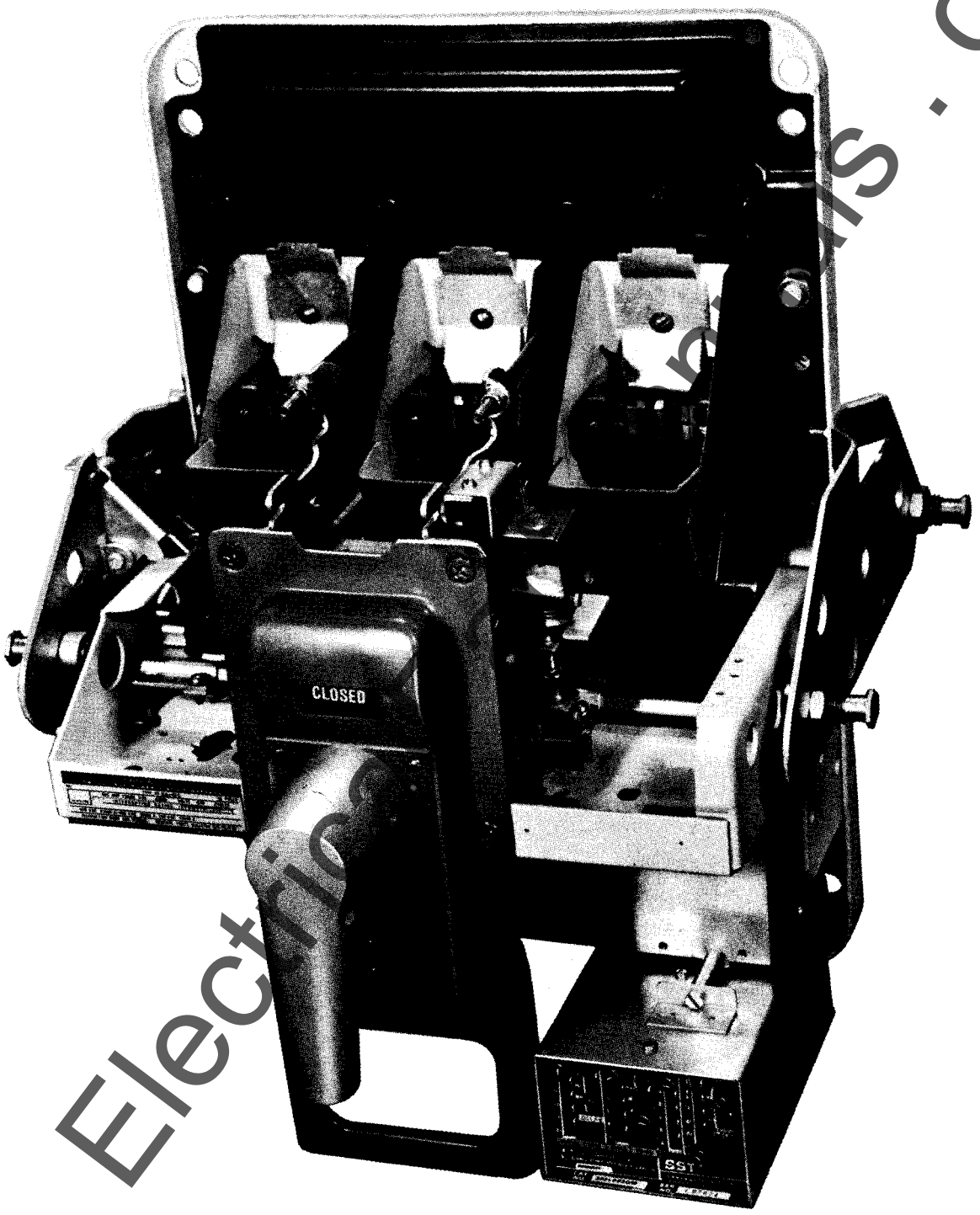


Fig. 22 — AK-25 breaker with SST conversion completed. (AKD-5 type drawout shown)

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. 23 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 drawout type breakers, mount the 4th-wire neutral sensor stationary disconnect block 121 inside the breaker compartment at the lower rear as shown in Figs. 24 or 25, 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. 26. For stationary breakers, the neutral sensor is connected to TB5.

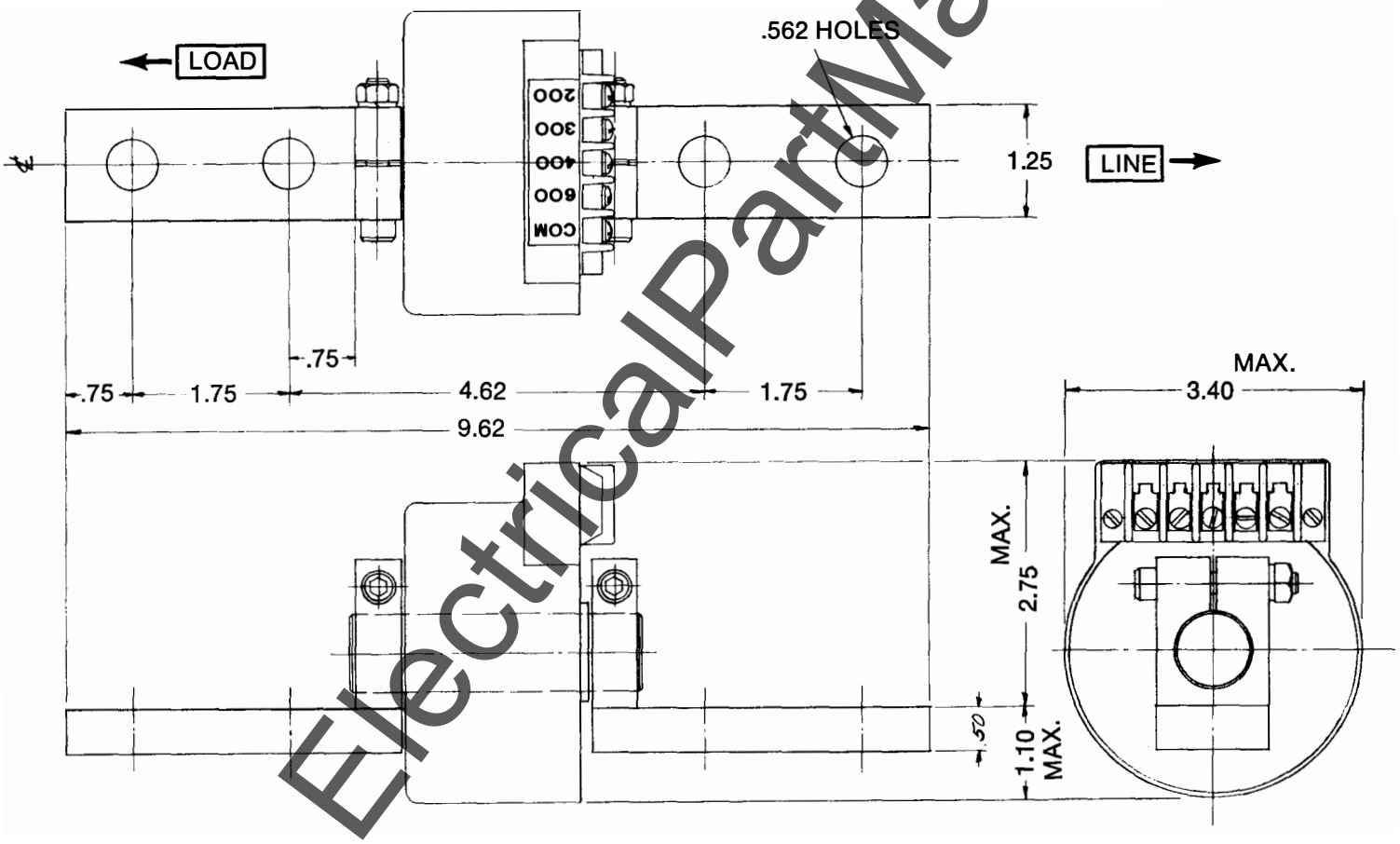


Fig. 23 — Outline of SST Neutral Sensors:
Cat. 139C4475G1 70-225 amp
Cat. 139C4475G2 200-600 amp
(from outline dwg. 139C4476)

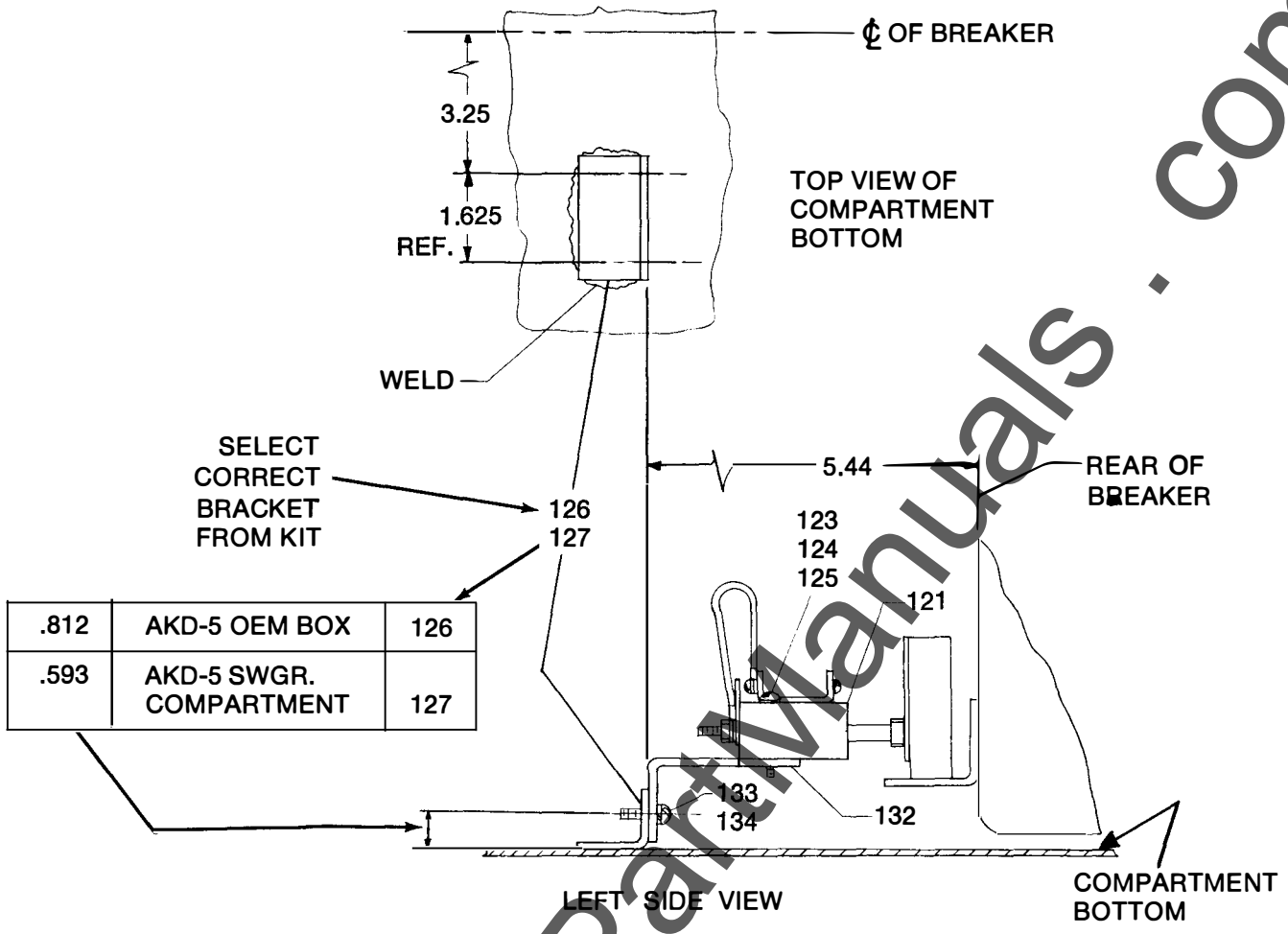


Fig. 24 — Mounting of 4th-wire neutral sensor disconnect block in AKD-5 switchgear compartments and AKD-5 type OEM boxes.

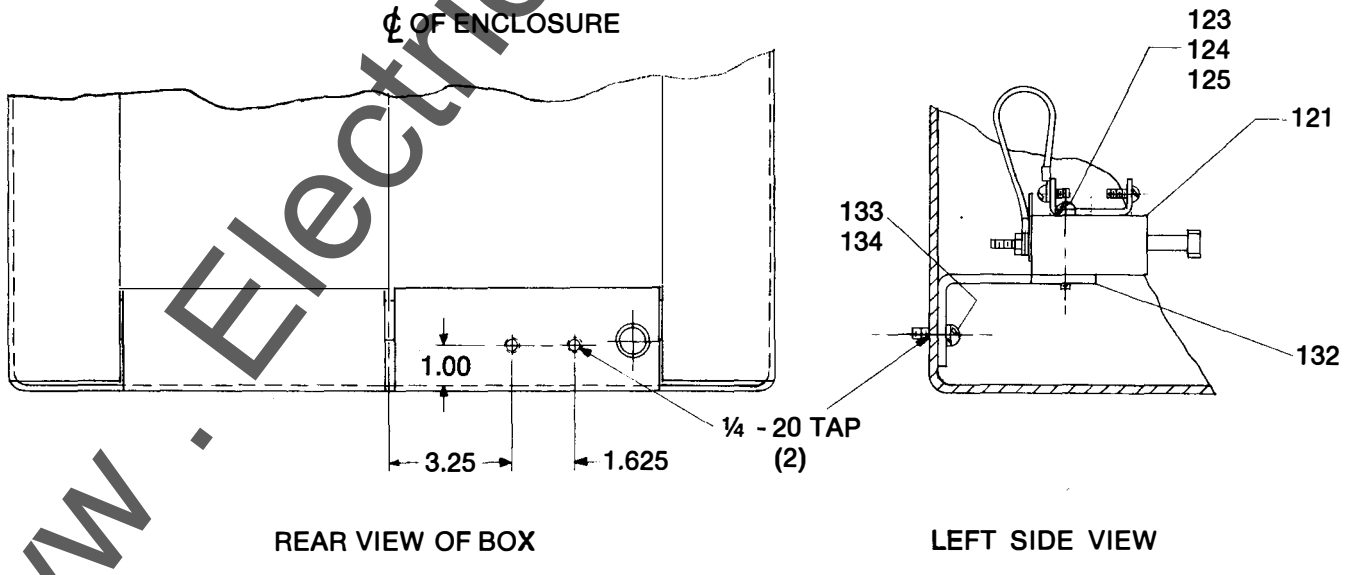


Fig. 25 — Mounting of 4th-wire neutral sensor disconnect block in AKD type OEM box.

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.

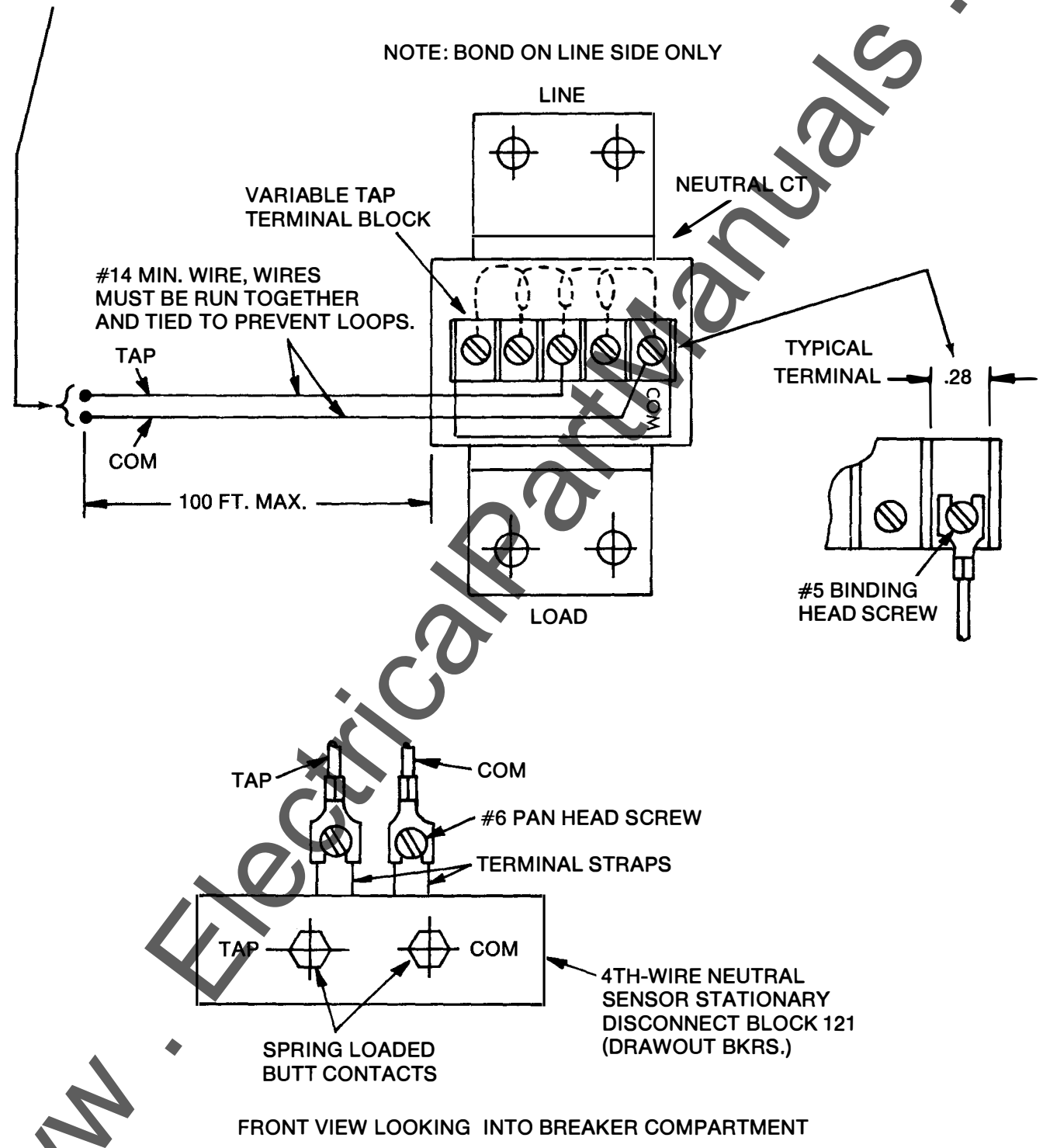


Fig. 26 — Connecting the 4th-wire neutral sensor.

V. FUNCTIONAL TESTING

Before the breaker is reinstalled to service:

1. Megger breaker primary circuit using a 1000V megger.

Perform either of the following tests:

A — Using ECS/SST test set Catalog #TAK-TS1, test per Instructions GEK-64454 to assure proper operation of the breaker and its trip deviceOr,

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 26 & 27.

NOTE:

When testing units equipped with a ground fault trip element, the latter must be deactivated by using Ground Fault Defeat Cable Catalog #TGFD as shown in Fig. 27 below. If this defeat cable is not available, the breaker can be tested by connecting two poles in series.

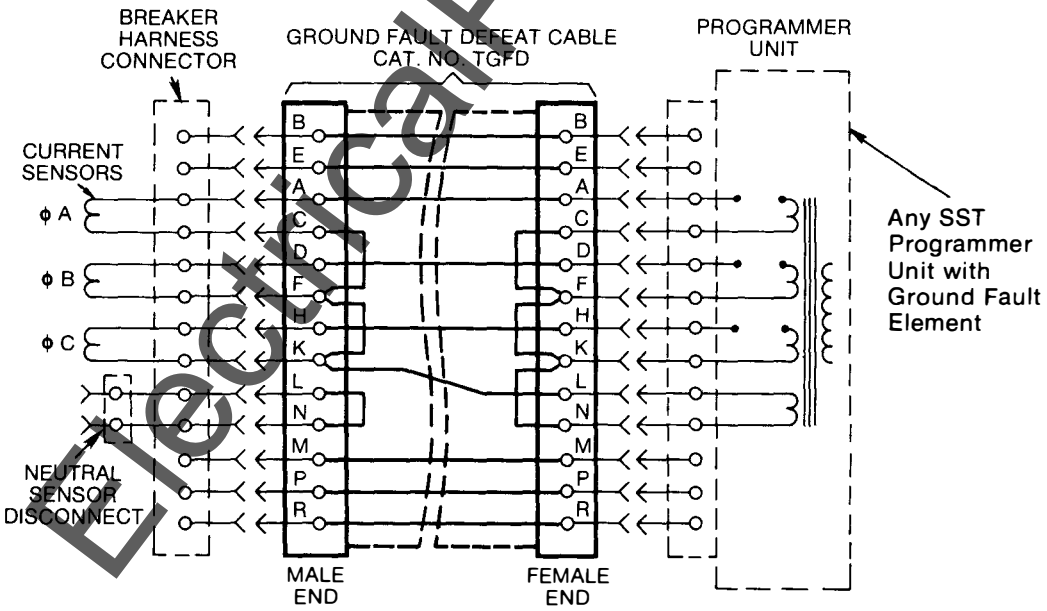


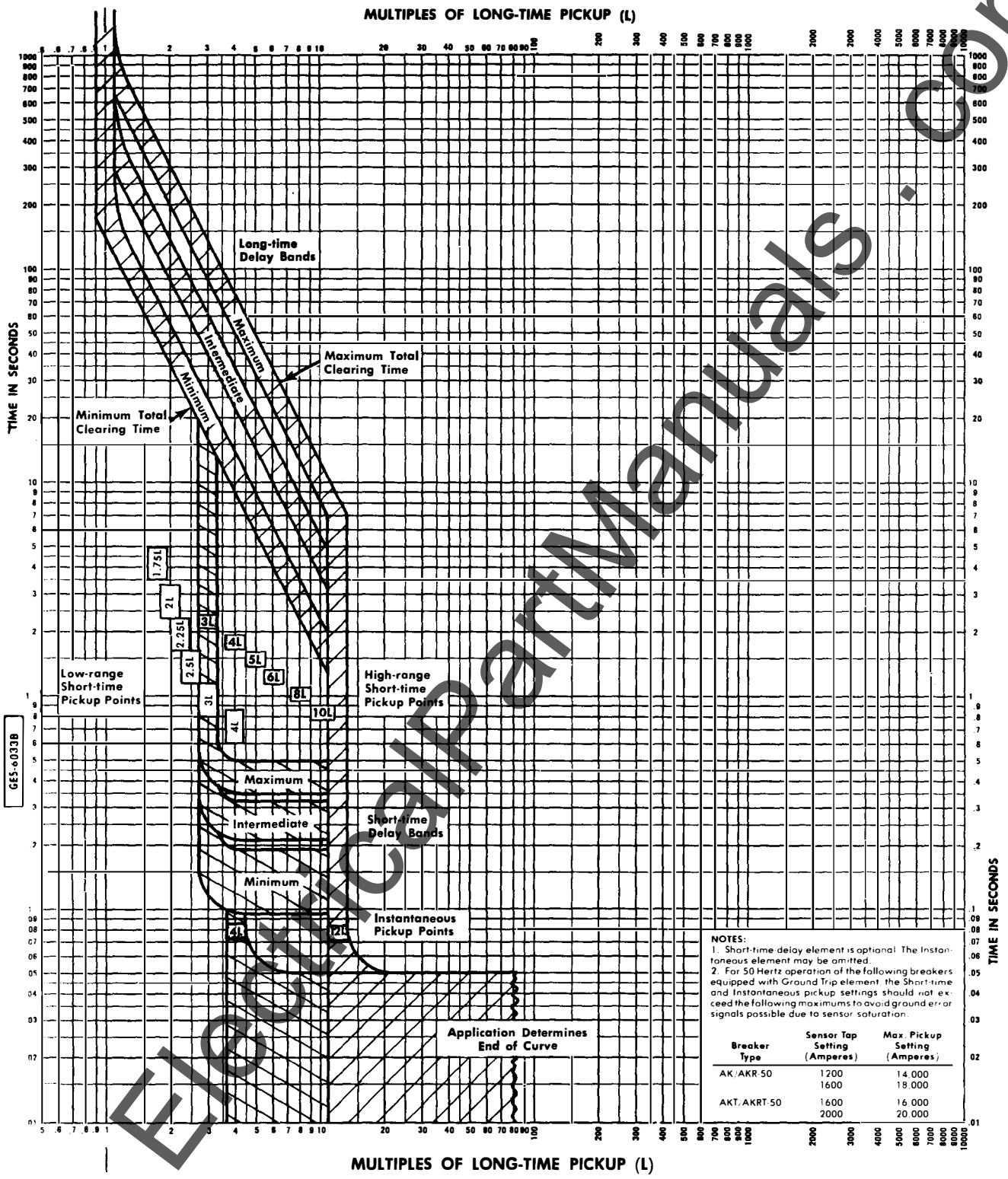
Fig. 27 — Cabling diagram with Ground Fault Defeat Cable inserted between breaker harness and SST Programmer Unit — for use during single-phase, high current — low voltage testing.

TABLE 6 — TRIP CHARACTERISTICS — SST CONVERSION KITS

Applicable time-current Curves: GES-6033B, 6034A, 6035B

Breaker Frame Type	Frame Size (Amperes)	Sensor Taps (X) (Amperes)	SST Programmer Adjustment Range (Set Points)						
			Ground Fault		Long Time		Short Time		Instantaneous Pickup (Multiple of L)
			Pickup (Multiple of X)	Delay Band (Seconds)	Pickup (L) (Multiple of X)	Delay Band (Seconds)	Pickup (Multiple of L)	Delay Band (Seconds)	
AK-15	225	70, 100, 150, 225	.5, .6, .8, 1, 1.5, 2 (X)	Maximum 0.30	.6, .7, .8, .9, 1, 1.1 (X)	Maximum 22	1.75, 2, 2.25, 2.5, 3, 4 (L)	Maximum 0.35	4, 5, 6, 8, 10, 12 (L)
AK-25	600	70, 100, 150, 225 or 200, 300, 400, 600							
AK-50	1600	300, 400, 600, 800 or 600, 800, 1200, 1600	.25, .3, .4, .5, .6, .7 (X)	Intermed. 0.165		Intermed. 10	or	Intermed. 0.21	
AKT-50	2000	800, 1200, 1600, 2000	.2, .25, .3, .4, .5, .6 (X)	Minimum 0.065		Minimum 4	3, 4, 5, 6, 8, 10 (L)	Minimum 0.095	
AK-75	3000	1200, 1600, 2000, 3000	.2, .22, .25, .3, .35, .37 (X)						
AK-100	4000	1600, 2000, 3000, 4000	.18, .2, .22, .25, .27, .3 (X)						
NOTES		①	②	④	②	③	②	④	②

① × = Sensor ampere tap = trip rating
② Pickup tolerance = ± 10%
③ Time delay at lower limit of band @ 6L
④ Time delay at lower limit of band



NOTES:
1. Short-time delay element is optional. The Instantaneous element may be omitted.
2. For 50 Hertz operation of the following breakers equipped with Ground Trip element, the Short-time and Instantaneous pickup settings should not exceed the following maximums to avoid ground error signals possible due to sensor saturation.

Breaker Type	Sensor Tap Setting (Amperes)	Max. Pickup Setting (Amperes)
AK/AKR-50	1200	14,000
	1600	18,000
AKT/AKRT-50	1600	16,000
	2000	20,000

GENERAL ELECTRIC

AK/AKR LOW-VOLTAGE POWER CIRCUIT BREAKERS

SST™ SOLID-STATE OVERCURRENT TRIP DEVICE

GES-6033B

Long-time-delay, Short-time-delay and Instantaneous Time-current Curves

Curves apply at 50/60 Hertz
From − 20C to + 70C Programmer Ambient

X = Current Sensor Taps (Amperes)

AK-15	70, 100, 150, 225
AK-25	70, 100, 150, 225 or 200, 300, 400, 600
AKR-30	100, 150, 225, 300 or 300, 400, 600, 800
AK/AKR-50	300, 400, 600, 800 or 600, 800, 1200, 1600
AKT/AKRT-50	800, 1200, 1600, 2000
AK-75	1200, 1600, 2000, 3000
AKR-75	1200, 1600, 2000, 3200
AK/AKR-100	1600, 2000, 3000, 4000

Programmer Set Points

PICKUP

Long-time: 6, 7, 8, 9, 10 & 11 multiples of current sensor tap setting (X). (Settings higher than 100% of the frame size do not increase the continuous current rating).

Short-time: 1.75, 2, 2.25, 2.5, 3 & 4 or 3, 4, 5, 6, 8 & 10 multiples of Long-time pickup setting (L). For 50 Hz. operation see Note 2.

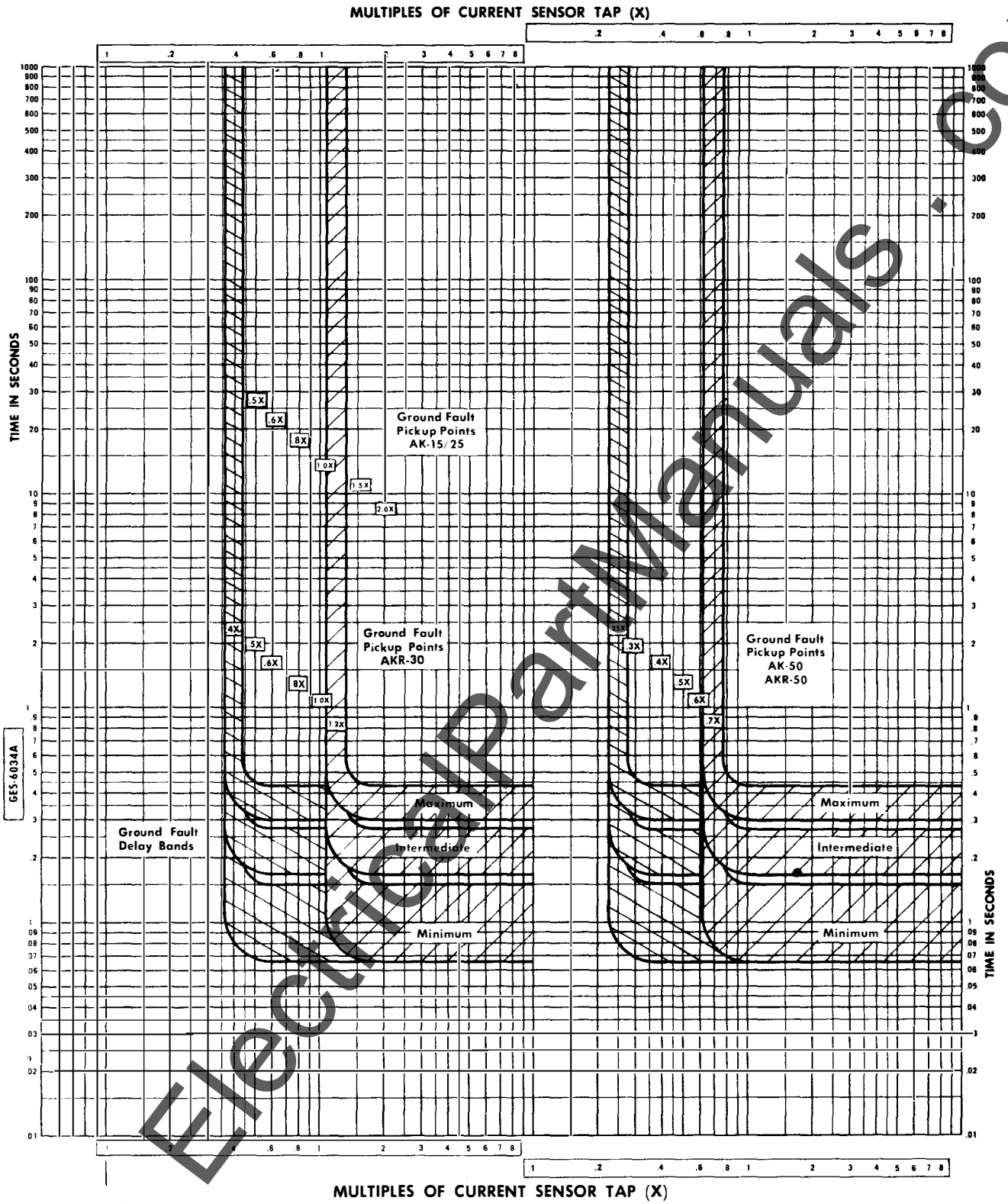
Instantaneous: 4, 5, 6, 8, 10 & 12 multiples of Long-time pickup setting (L). For 50 Hz. operation, see Note 2.

TIME DELAY BANDS

Long-time and Short-time: Max., Int. & Min.

2-78 (3M)

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062



NOTE: 4th wire Ground sensor tap must be set same as phase sensor tap.

GENERAL ELECTRIC

TYPE AKR LOW-VOLTAGE POWER CIRCUIT BREAKERS

SST™ SOLID-STATE OVERCURRENT TRIP DEVICE

Ground Trip Time-current Curves

GES-6034A

Current Sensor Taps (Amperes)	
AK-15	70, 100, 150, 225
AK-25	70, 100, 150, 225 or 200, 300, 400, 600
AKR-30	100, 150, 225, 300 or 300, 400, 600, 800
AK-AKR-50	300, 400, 600, 800 or 600, 800, 1200, 1600

Curves apply at 50/60 Hertz
From − 20C to + 70C Programmer Ambient

Programmer Set Points

Ground Fault Pickup:

AK-15/25	.5x, .6x, .8x, 1.0x, 1.5x, & 2.0x
AKR-30	.4x, .5x, .6x, .8x, 1.0x, & 1.2x
AK/AKR-50	.25x, .3x, .4x, .5x, .6x, & .7x

Where X = sensor tap setting

Ground Fault Delay Bands:
Maximum, Intermediate & Minimum

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

GENERAL ELECTRIC COMPANY
DISTRIBUTION EQUIPMENT DIVISION
PLAINVILLE, CONNECTICUT 06062

GENERAL ELECTRIC