INSTRUCTIONS

GEI-86155

CONVERSION KITS

For Installing the SST Solid State Overcurrent Trip Device on Low Voltage Power Circuit Breaker Types AK-75 and AK-100

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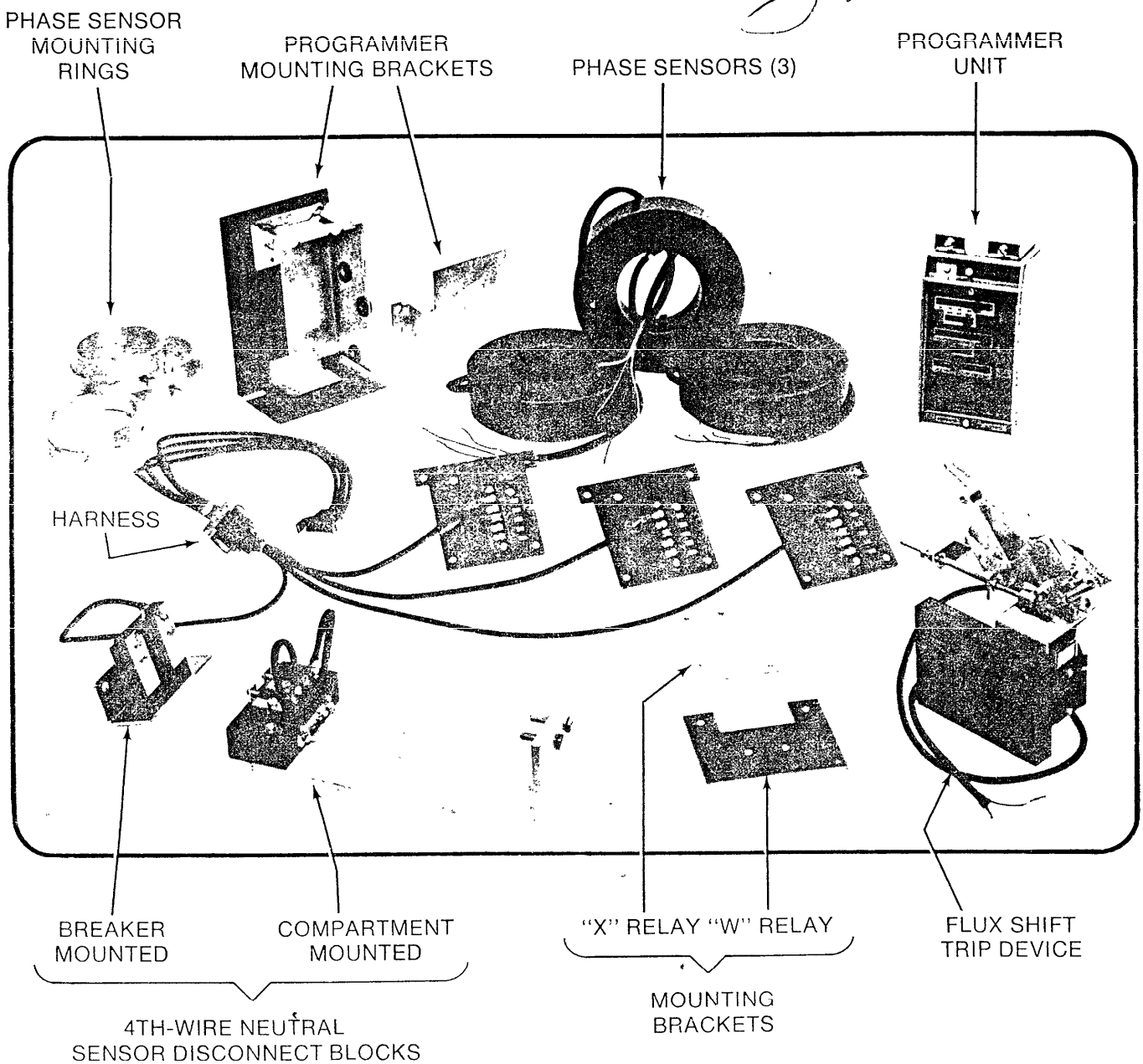


Components of SST Conversion Kit for Drawout AK-75 and AK-100

DISTRIBUTION EQUIPMENT DIVISION
PLAINVILLE, CONNECTICUT USA

GENERAL ELECTRIC

CONVERTING AK-75/100 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-75 and AK-100 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 breakers listed in Table 1.

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 (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) is required for separate mounting in the equipment. Insure also that retrofitted breakers are applied within their short circuit ratings; for example, assuming that as part of a conversion the breaker's trip elements are to be changed from LI to LS, then the short time rating would govern the application.

For identification purposes, all kit materials are itemized on the parts lists included with each kit. The item numbers on those parts lists correspond to the part numbers used on the illustrations herein. Any original breaker parts that are to be reused bear the designation RE.

As a service related consideration, 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. Such procedures are covered in Maintenance Manual GEK-7303; renewal parts are available as listed in Bulletin GEF-4395 (AK-75) and GEF-4396 (AK-100). Copies of these publications are included in each kit.

TOOLS REQUIRED

Socket Set	Pliers
Open End Wrenches	Electric Drill
Screwdrivers	6″ Scale
Allen Wrenches	Crimping Tool
Tru-arc Pliers	

NOTE

Although designed specifically for the breaker models in Table 1, these kits in many instances can be employed for conversion of the earlier AK-1-75/100 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 — Convertible Breaker Models

A-C Frame Size (Amp)	Breaker Type			Trip Device	
	Stationary	Drawout		EC	Power Sensor
		AKD	AKD-5		
3000	NA	AK-2-75	AK-2A-75	X	
	NA	AK-3-75	AK-3A-75		X
4000	NA	AK-2-100	AK-2A-100	X	
	NA	AK-3-100	AK-3A-100		X

NA = No Kit Available

Table 2 — Basic Conversion Kits for Breakers in Table 1

Drawout Breaker Type	Basic Kit Cat. 343L697 — (Gp. No.)	
	With 4th-Wire Neutral Sensor	W O 4th-Wire Neutral Sensor
	Man. or Elec.	Man. or Elec
AK-75	G2	G1
AK-100	G4	G3

Table 3 — Tapped Current Sensors

Drawout Breaker Type	Sensor Ampere Range	Cat. No.	
		Phase Sensors	4th-Wire Neutral Sensor
AK-75	1200-3000	343L697G37	343L671G61
AK-100	1600-4000	343L697G38	343L671G62

TABLE 4 — Programmer Units

Breaker Frame	Programmer Cat No.	Trip Elements ①	Group No. Short-time Pickup		
			None	1 75L-4L	3L-10L
UNITS WITHOUT GROUND FAULT					
AK-75 AK-100	343L696G	LS	—	37	13
		LST	—	39	16
		LI	14	—	—
		LIT	17	—	—
		LSI	—	38	15
		LSIT	—	40	18
UNITS WITH GROUND FAULT					
AK-75	343L697G	LSG	—	19	7
		LSGT	—	21	10
		LIG	8	—	—
		LIGT	11	—	—
		LSIG	—	20	9
		LSIGT	—	22	12
AK-100		LSG	—	23	13
		LSGT	—	25	16
		LIG	14	—	—
		LIGT	17	—	—
		LSIG	—	24	15
		LSIGT	—	26	18

① Trip Element Abbreviations

L = Long Time
S = Short Time
I = Instantaneous
G = Ground Fault

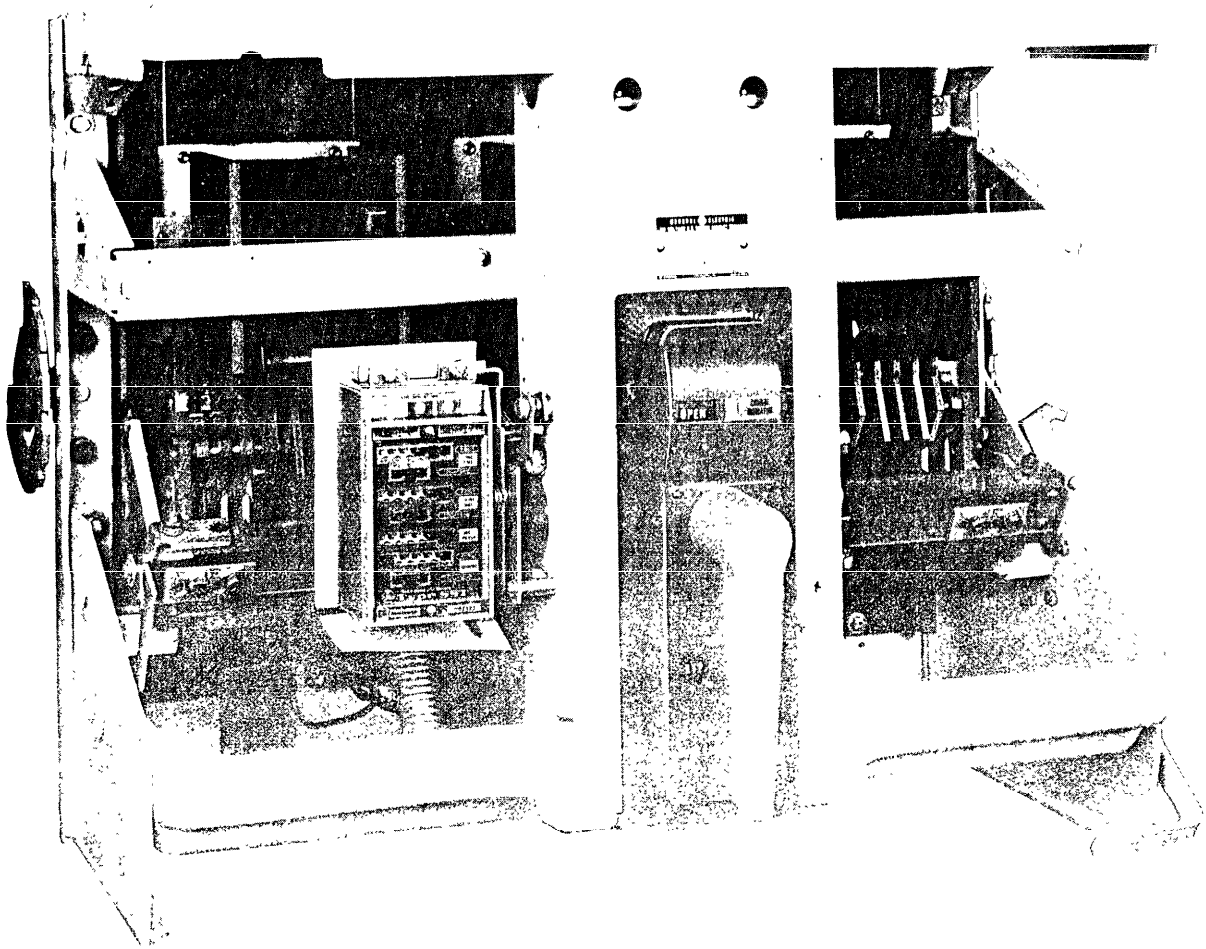


Fig. 1 — SST programmer unit mounted on AK-100 breaker.

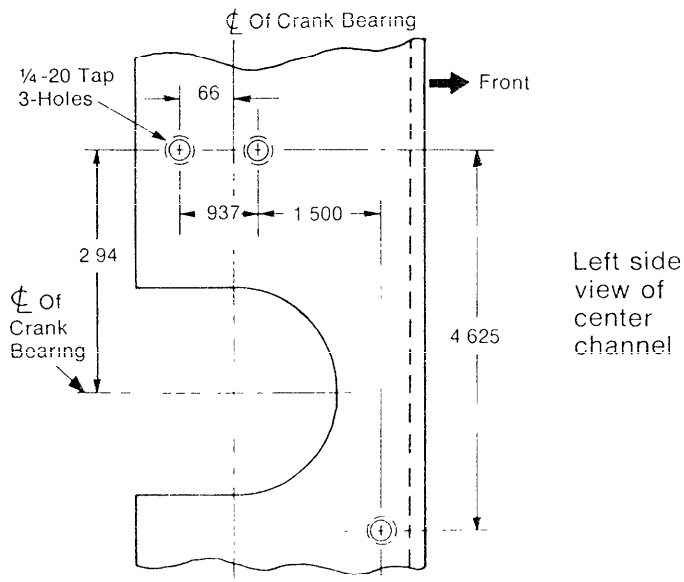


Fig. 2 — Drilling plan for programmer mounting bracket.

II. BREAKER DISASSEMBLY

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

1. Be sure the breaker is open.
2. Remove the arc quencher retaining bar.
3. Remove the arc quenchers, lifting them clear of the movable arcing contacts. Remove the two inter-phase barriers.
4. Separate the breaker front frame from its back frame. Refer to GEK-7303, Page 7. For Power Sensor-equipped breakers, see pp. 35-39 for additional information.
5. Remove the overcurrent trip devices, referring to Maintenance Manual GEK-7303 as follows:
   - EC-1B type, pp. 26-29.
   - Power Sensor type, pp. 35-39.

III. FRONT FRAME CONVERSION

1. Referring to Figs. 1, 4 & 5, install the programmer mounting brackets 70 and 75 on the breaker's center channel.

Note 1
On some breakers the holes for mounting screws 71 and 73 already exist; if they do not, then layout, drill and tap the three holes per Fig. 2.

Note 2
On electrically operated AK-2/2A-breakers of the quick-close variety, it may be necessary to relocate the anti-pump relay "W" to make space for the SST programmer unit. On these breakers the "W" relay normally mounts on the left side of the center channel, sharing a common mounting bracket with control relay "X". Remove the "W" relay and relocate it to the upper left of the front frame as shown in the BEFORE and AFTER views of Fig. 3. In the process, remove the "X" relay, discard its original mounting bracket and then remount it in the same location using new bracket 207.

2. The next step is to mount the flux shift trip device, proceeding as follows:
   a. Layout and drill three (3) .209 DIA. mounting holes in the left side of the front frame as shown in Fig. 6.
   b. Mount the flux shift trip device assembly 40 to the side of the front frame per Figs. 5 and 6, being sure to position insulating sheet 41 and the connector support plate 50 next to the mounting base as indicated.

Note
If the breaker is an AKU-50 fused type, take care to position the flux shift trip device sufficiently upward to avoid interference with the coil of the open-fuse lockout (OFLO) device.

   c. Identify the programmer wire harness (part 141 or 143) and mount its male connector (P2 on Fig. 6) to support plate 50 using screws 51.
   d. Insert the two sleeve-terminated ends of harness X (the leads from the flux shift trip device) into female connector P1 on the opposite end of the programmer harness — red wire into socket B, black wire into socket E. See Table 5 and the applicable harness connection diagram — Fig. 16 or 19.

Note
Each kit contains a special Amp tool for removing leads from the connector sockets, should the need arise.

   e. Mount trip paddle 45 onto the breaker trip shaft per Fig. 6. Adjust the length of the trip rod on the flux shift trip device per Fig. 9. A front frame with flux shift trip device mounting completed is shown in Fig. 10.

3. Form harness X along with the programmer harness and wire tie them to the front frame per Fig. 5.

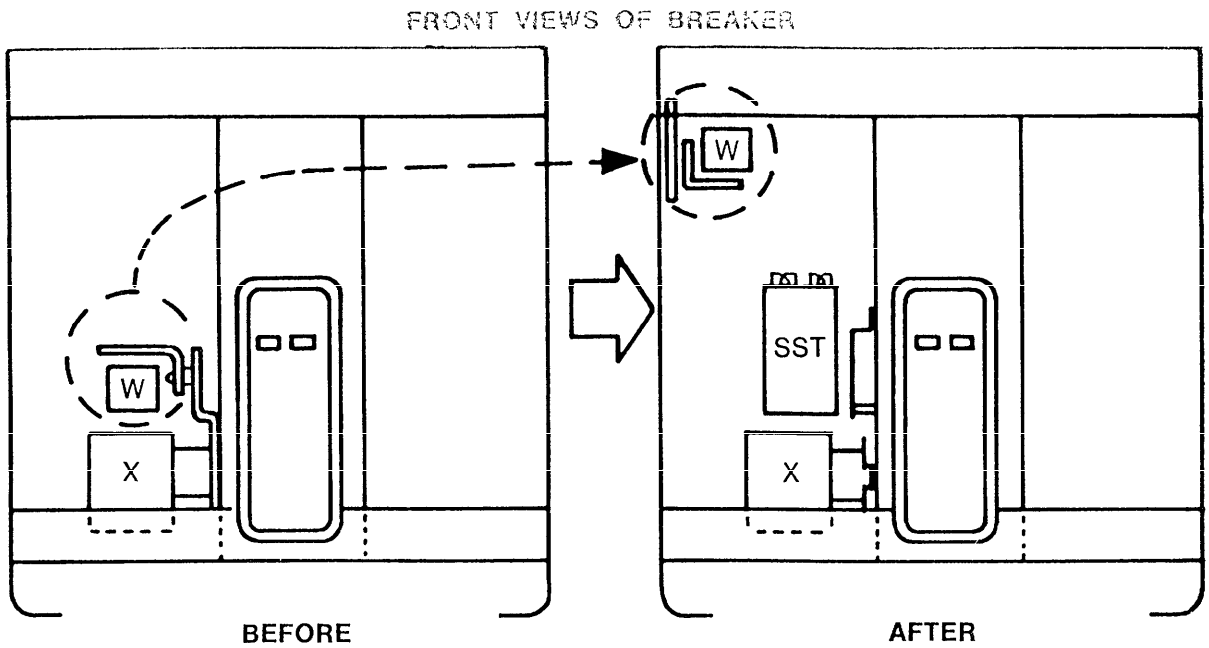


Fig. 3 — Remounting of "W" and "X" relays — required only on quick-close, electrically operated breakers equipped with EC trip devices.

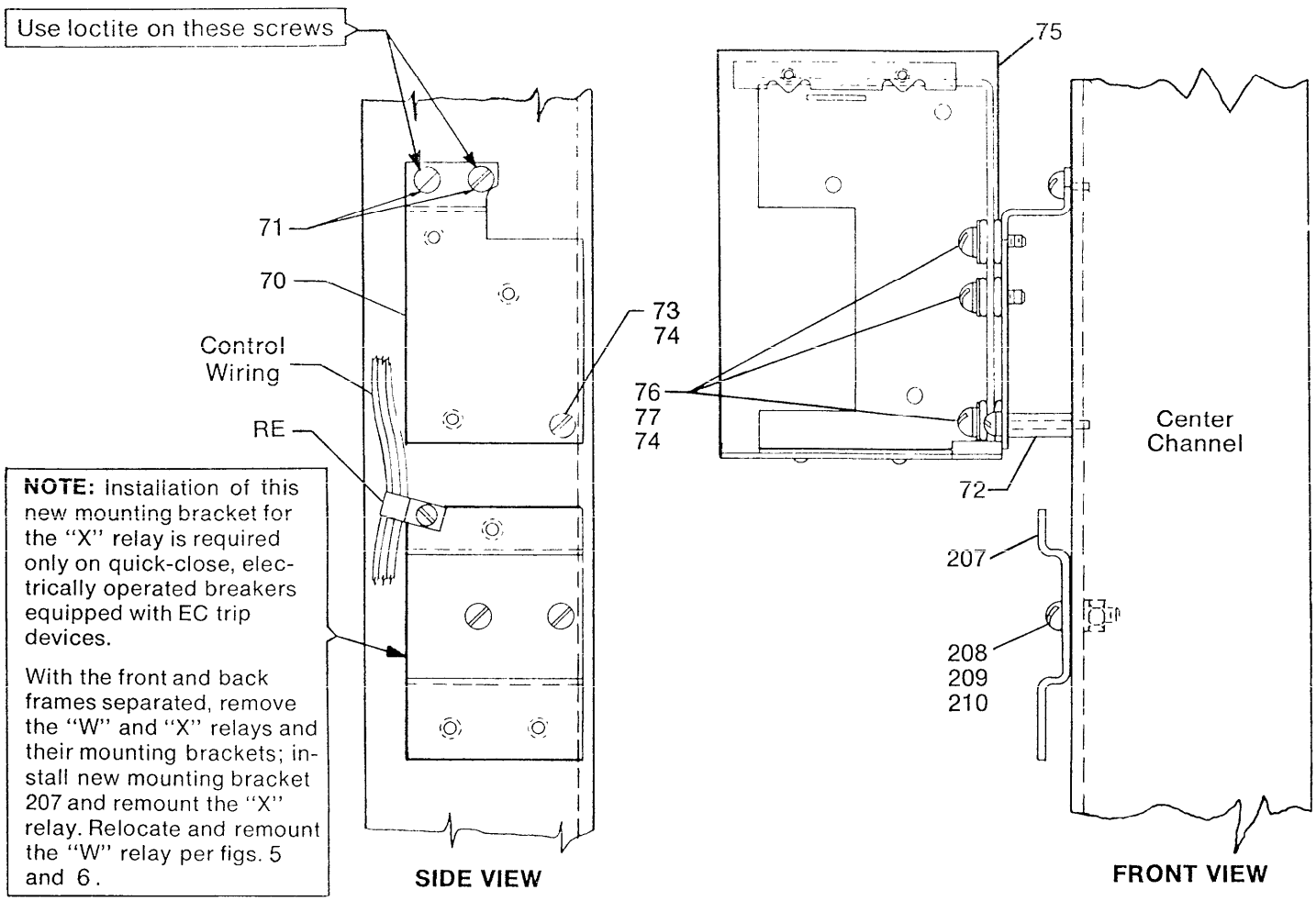


Fig. 4 — Installing SST programmer mounting bracket on center channel of front frame; remounting the "X" relay.

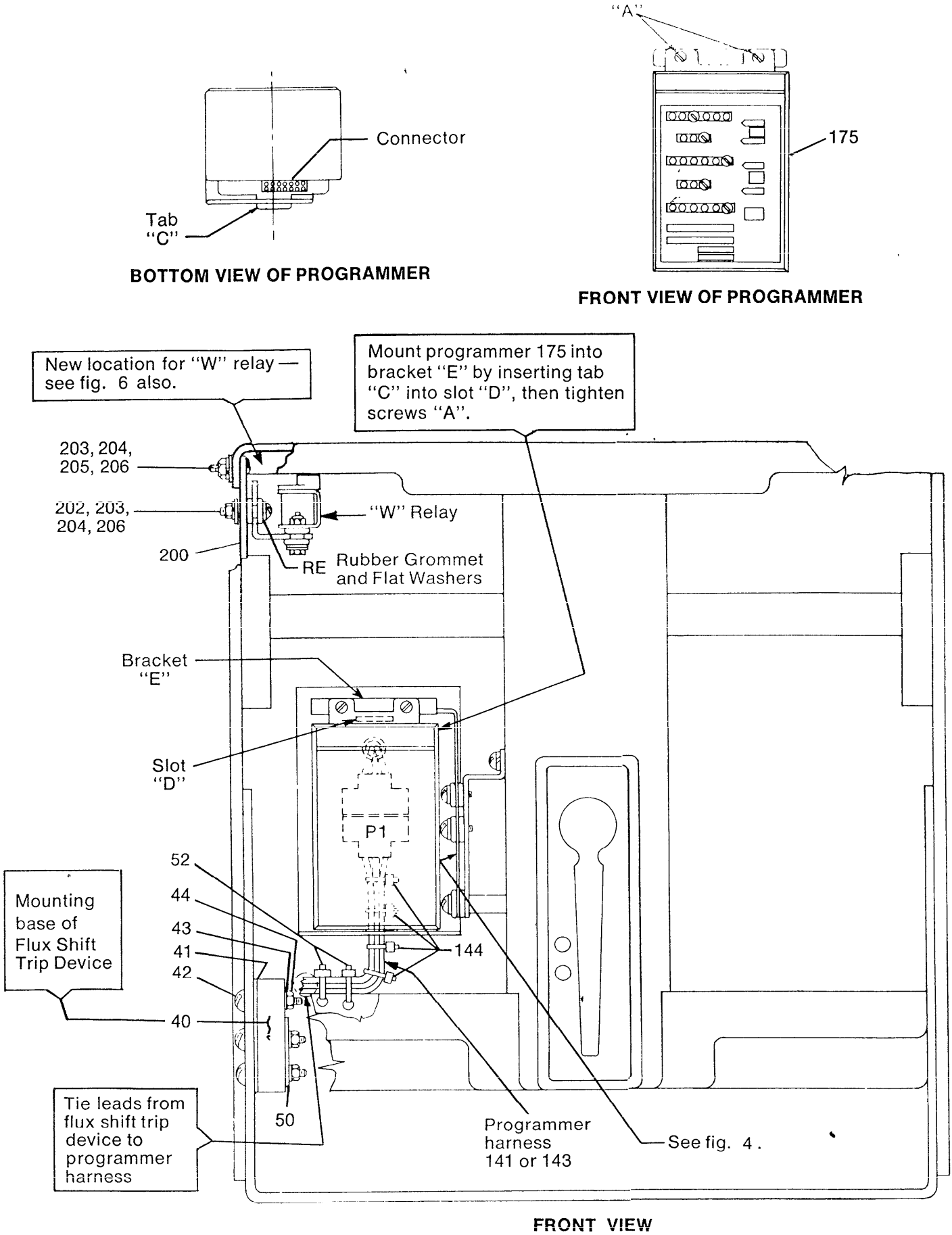


Fig. 5 — Converted front frame

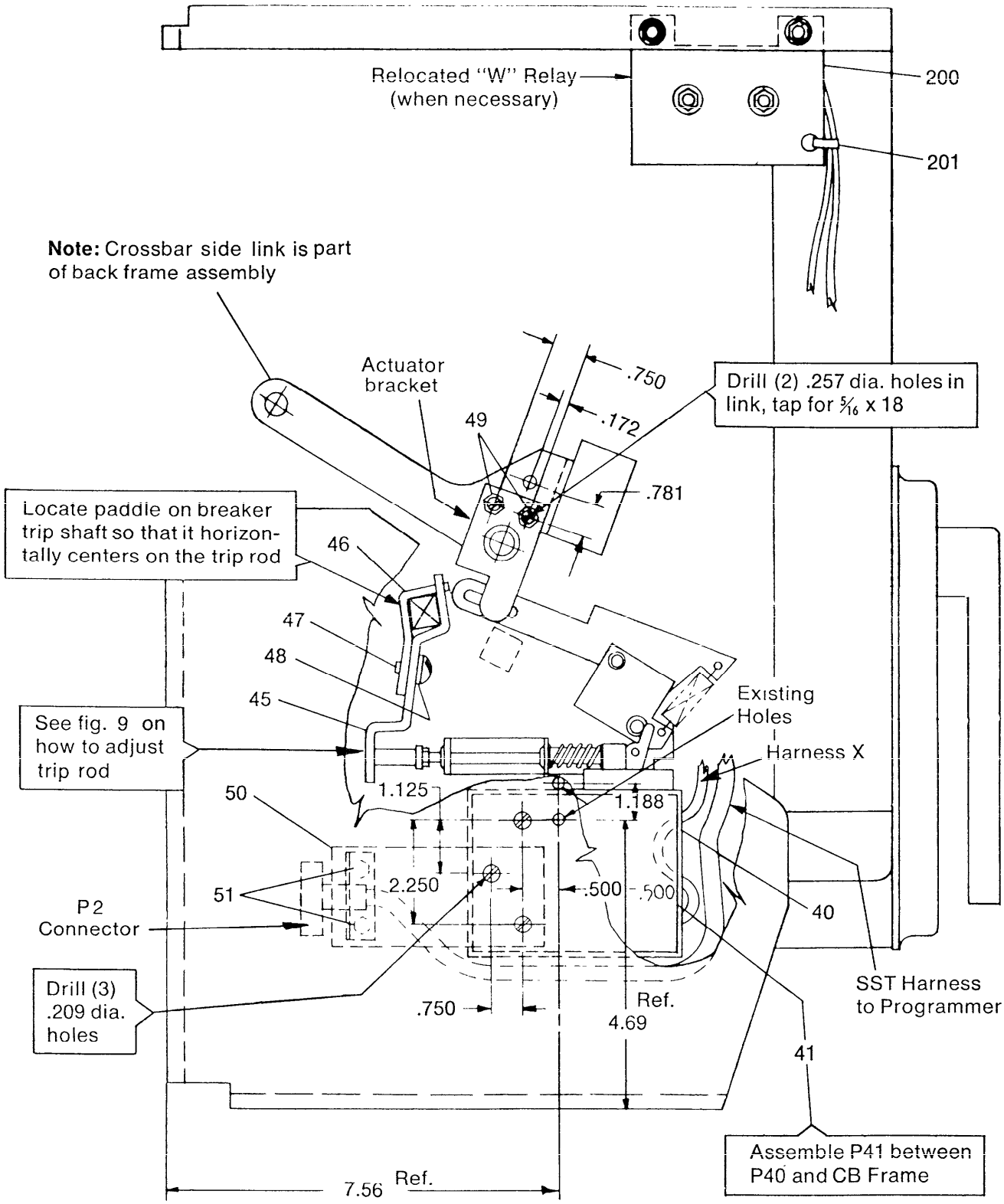


Fig. 6 — Side view of front frame showing mounting of flux shift trip device.

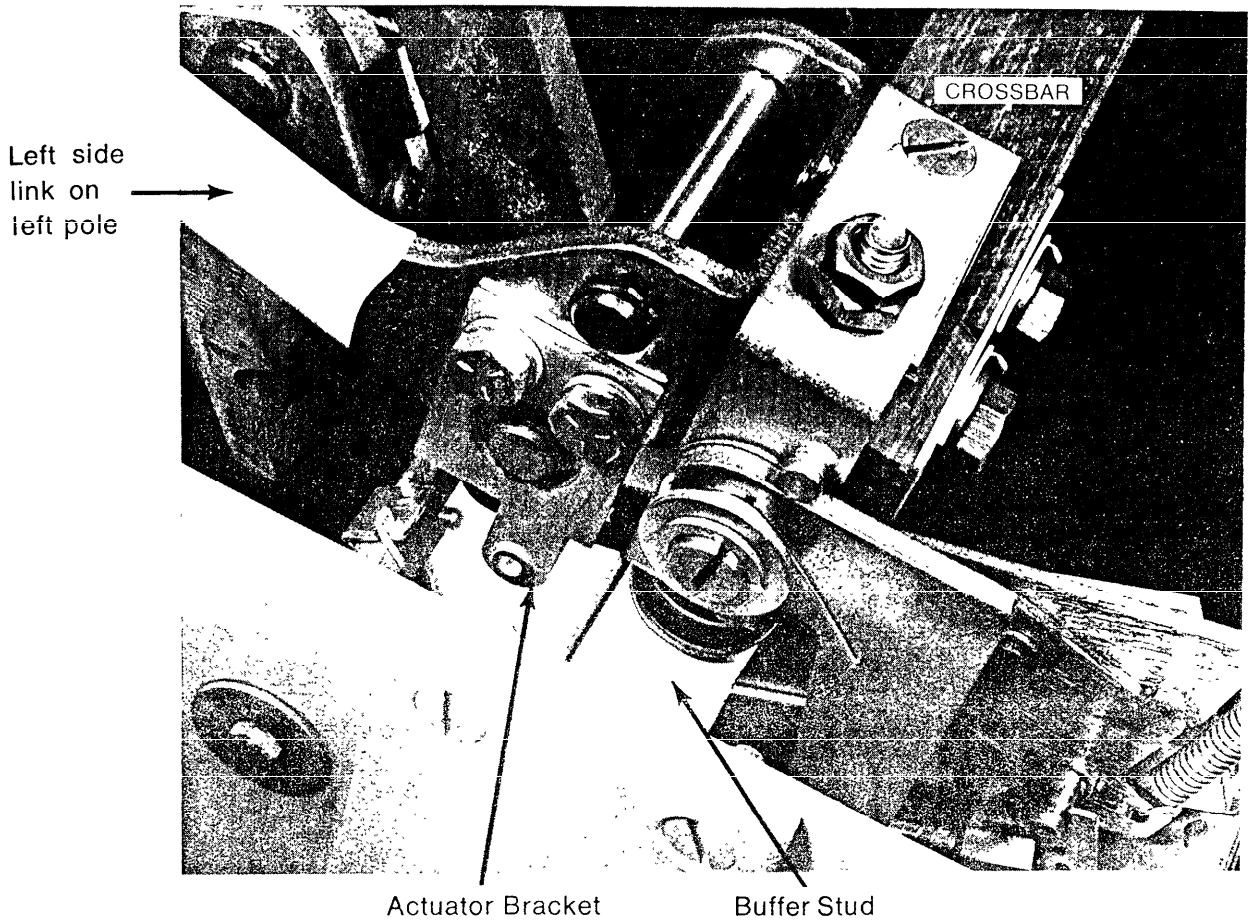
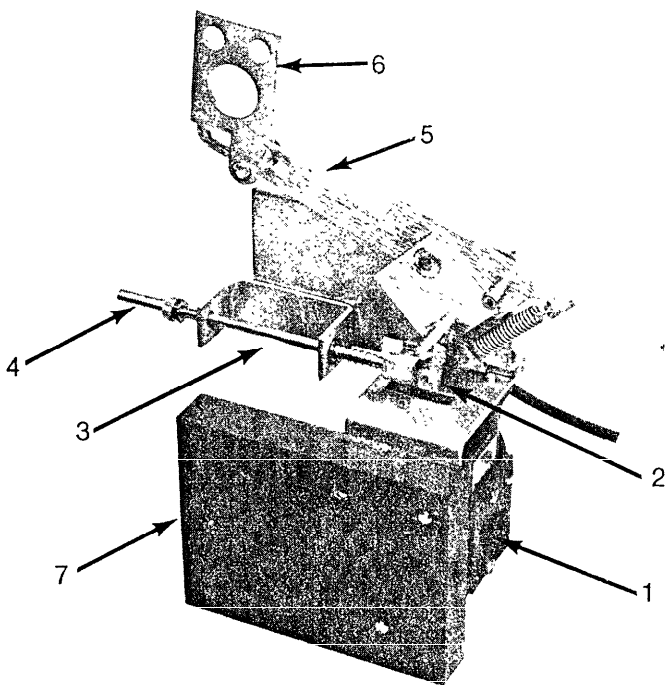
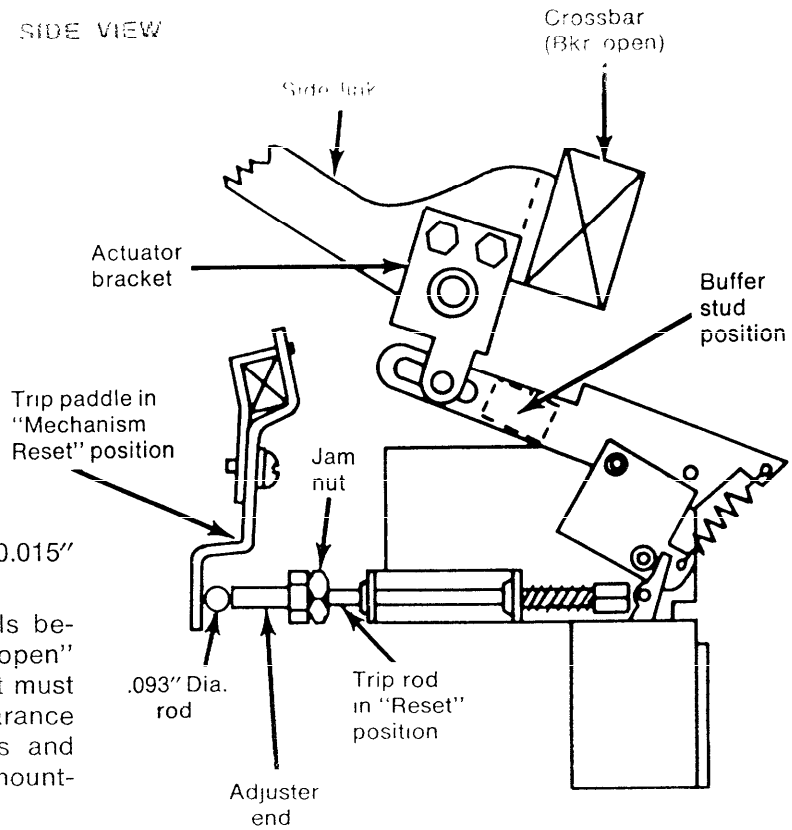


Fig. 7 — Flux shift trip device — reset linkage attachment.



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

Fig. 8 — Flux shift trip device assembly with operating linkages.



ADJUSTMENTS:

1. Trip rod length: Adjust gap to 0.093″ ± 0.015″ using 0.093″ diam. rod as shown.
2. Actuator bracket: As the crossbar travels between the "breaker closed" and "breaker open" positions, the tang of the actuator bracket must clear the buffer stud. If insufficient clearance exists, loosen it's two mounting screws and rotate the bracket clockwise to take up mounting hole slack. Retighten screws.

Fig. 9 — Flux shift trip device adjustments.

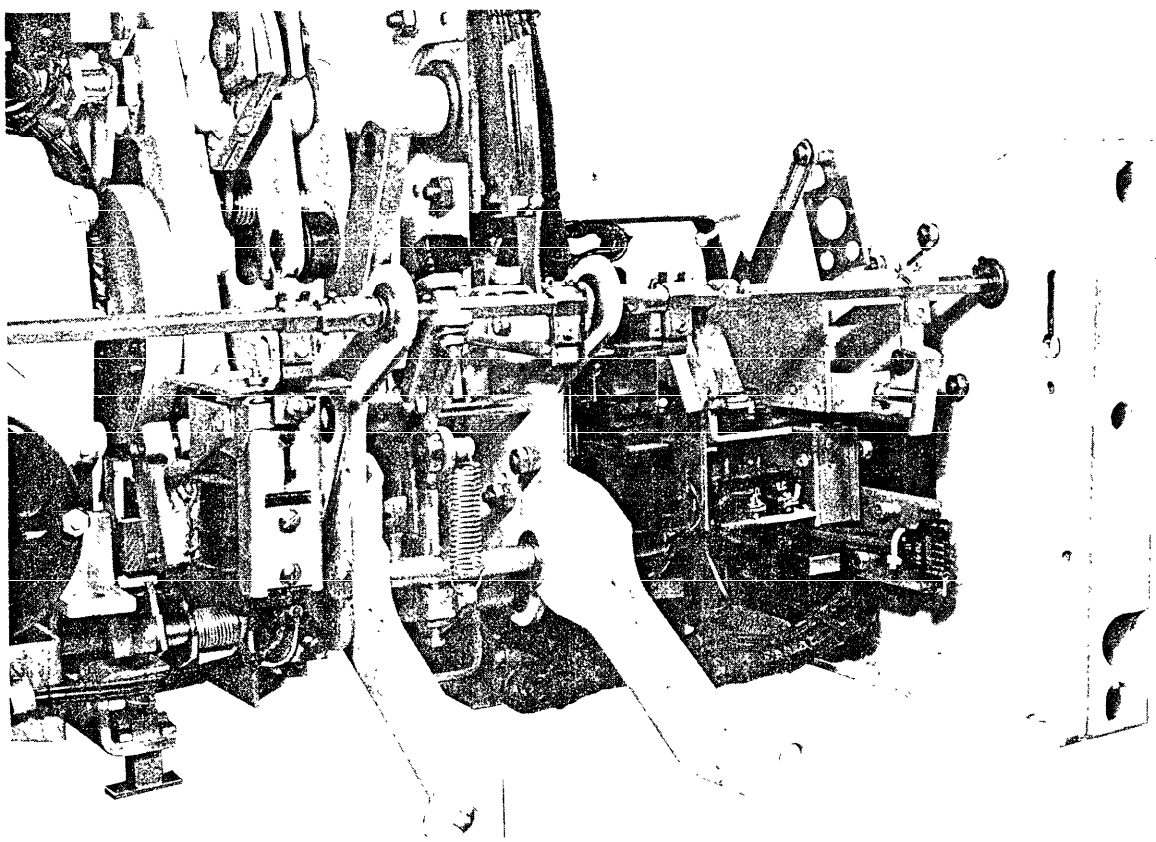


Fig. 10 — Rear view of an AK-50 front frame showing mounting of the flux shift trip device. The arrangement on AK-75 100 units is identical.

IV. BACK FRAME CONVERSION

1. Identify the crossbar side link on the left side of the breaker's left pole, layout, drill and tap the two .257 DIA. holes in it as shown in Fig. 6. These holes are used later to attach the trip device actuator bracket (Step V2).

2. Mount the three phase sensors (100) on the upper primary studs of the breaker as indicated in Figs. 11, 12 and 13. Position each sensor so that its leads will exit between the pole bases per Fig. 13, then tighten the rings.

3. Mount the three sensor terminal boards (TB1, TB2 and TB3) to the rear of the back frame as shown in Fig. 13, using hardware provided.

4. Form each sensor's leads downward between the pole bases and thru the hole in its terminal board per Fig. 13, then wire tie and solder to the terminals as indicated. Be sure to position wire colors as shown.

5. On breakers being equipped with 4-wire ground fault, mount neutral sensor disconnect block 225 below the left pole on the rear surface of the back frame per Fig. 13; be sure to select the proper mounting bracket as instructed in Fig. 15.

6. Attach wire harness (part 140, 142, 150 or 151) to the back frame per view B of Fig. 16 or 19, whichever applies. On TB1, TB2 and TB3, position each tap lead (black) on the same selected amp rating. Form and tie per Fig. 14.

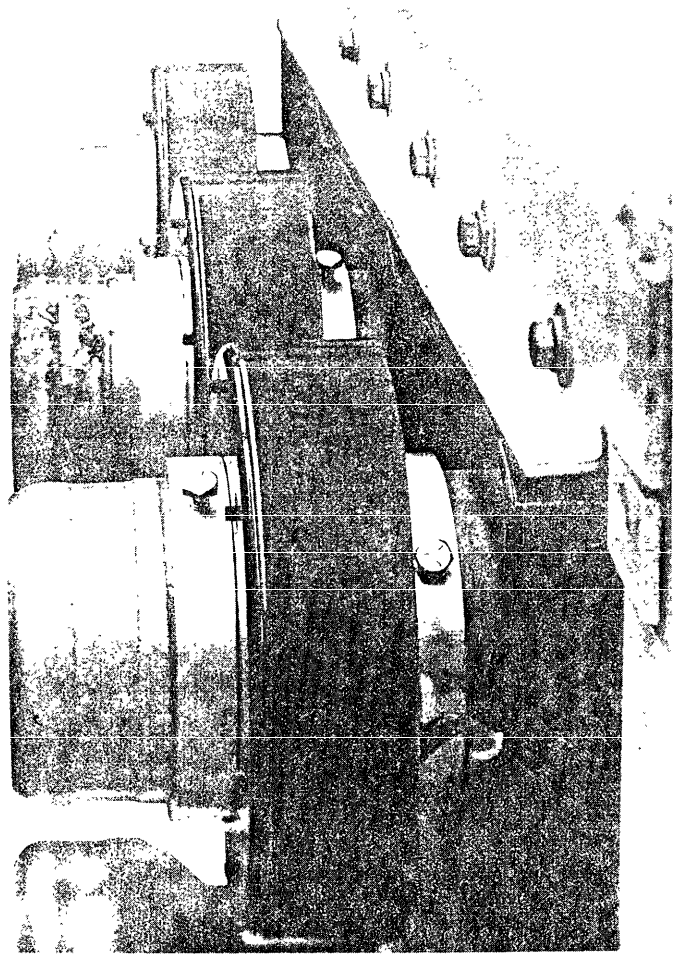
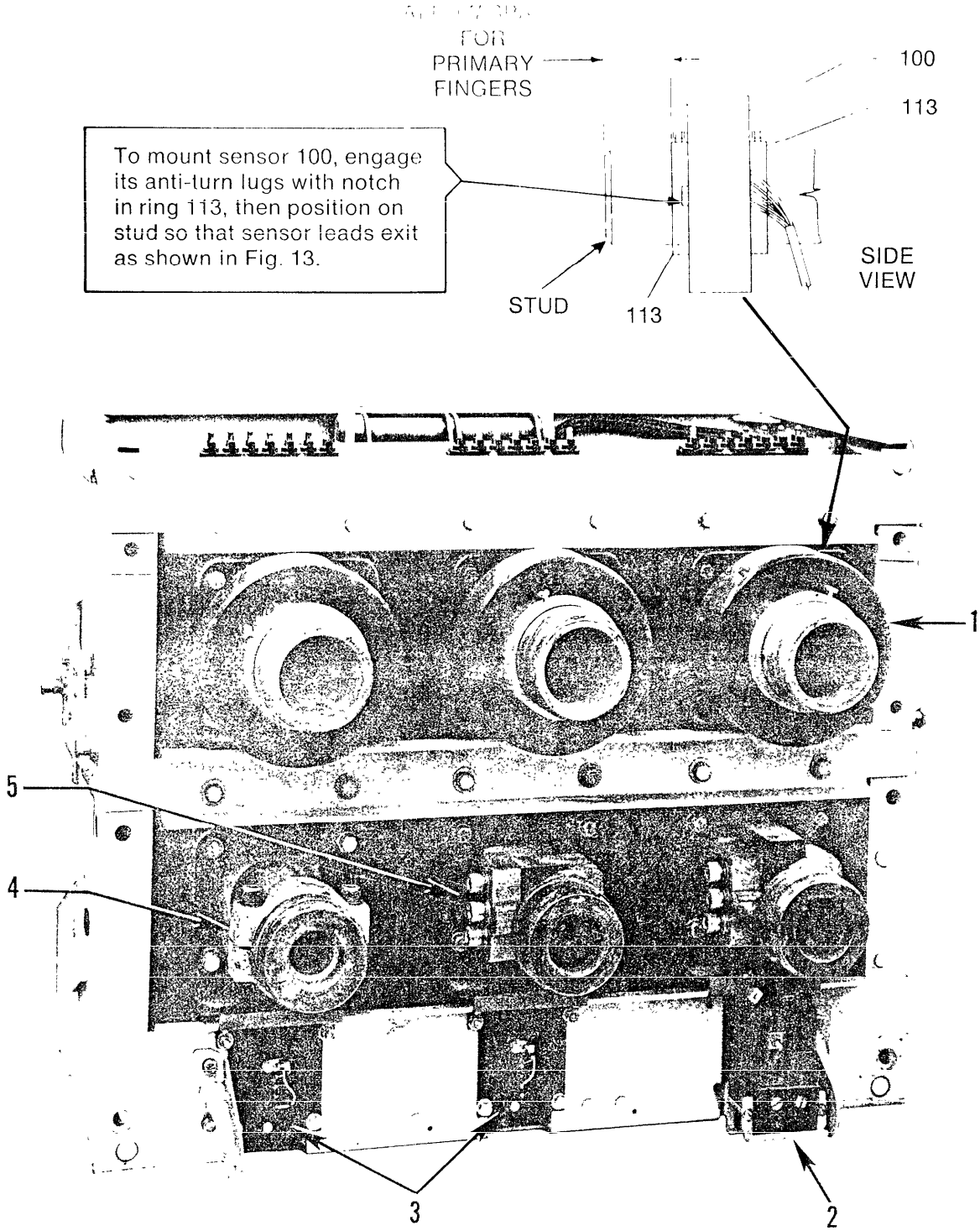


Fig. 11 — SST current sensor mounting.



1. SST phase sensor
2. EC-1B trip device (before removal)
3. SST sensor tap terminal boards
4. Primary stud type typical of Power Sensor equipped breakers
5. Primary stud type typical of EC equipped breakers

Fig. 12 — Composite Rear View — SST Conversion of AK-100. The AK-75 conversion is similar.

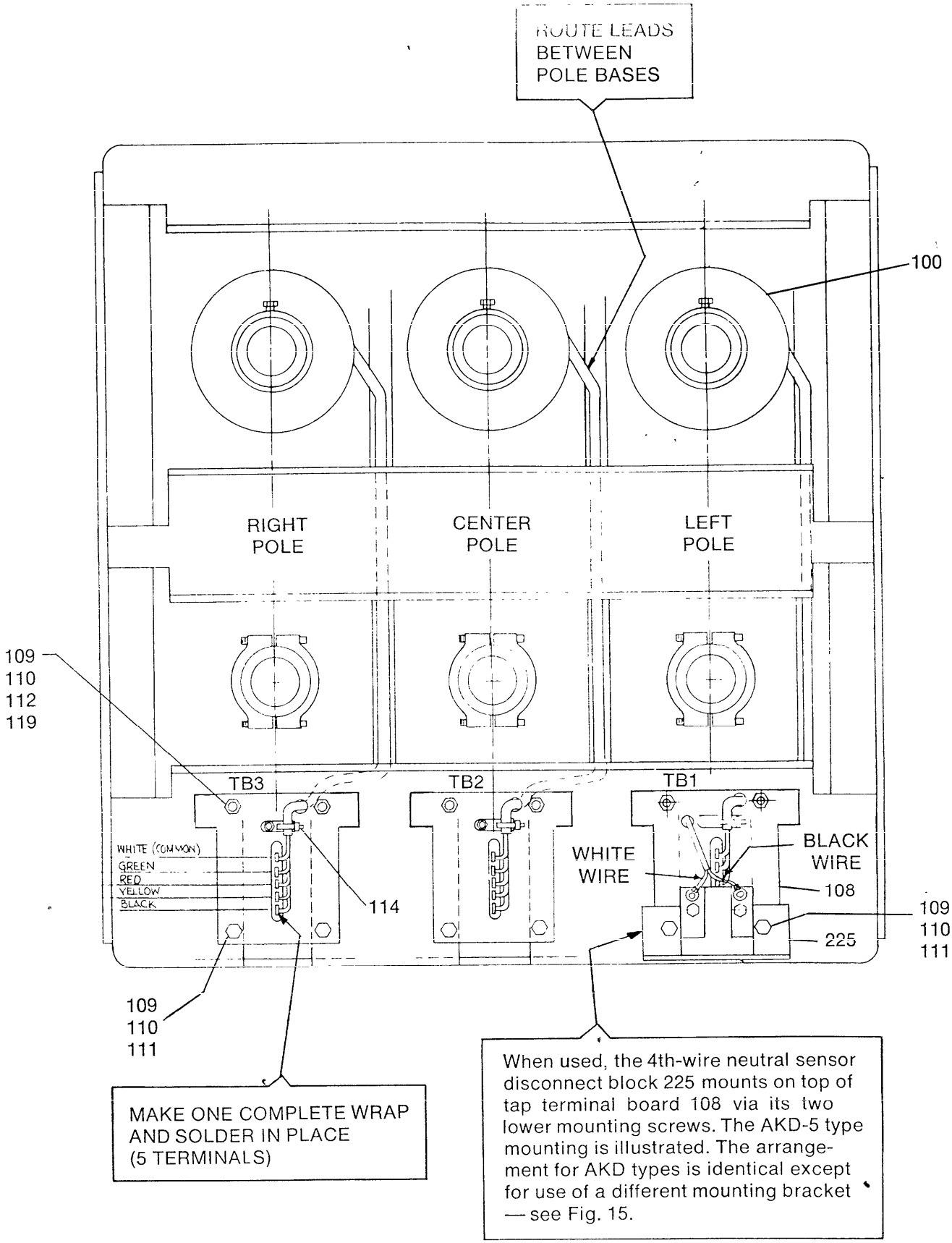


Fig. 13 — Typical AK-75/100 backframe conversion — rear view.

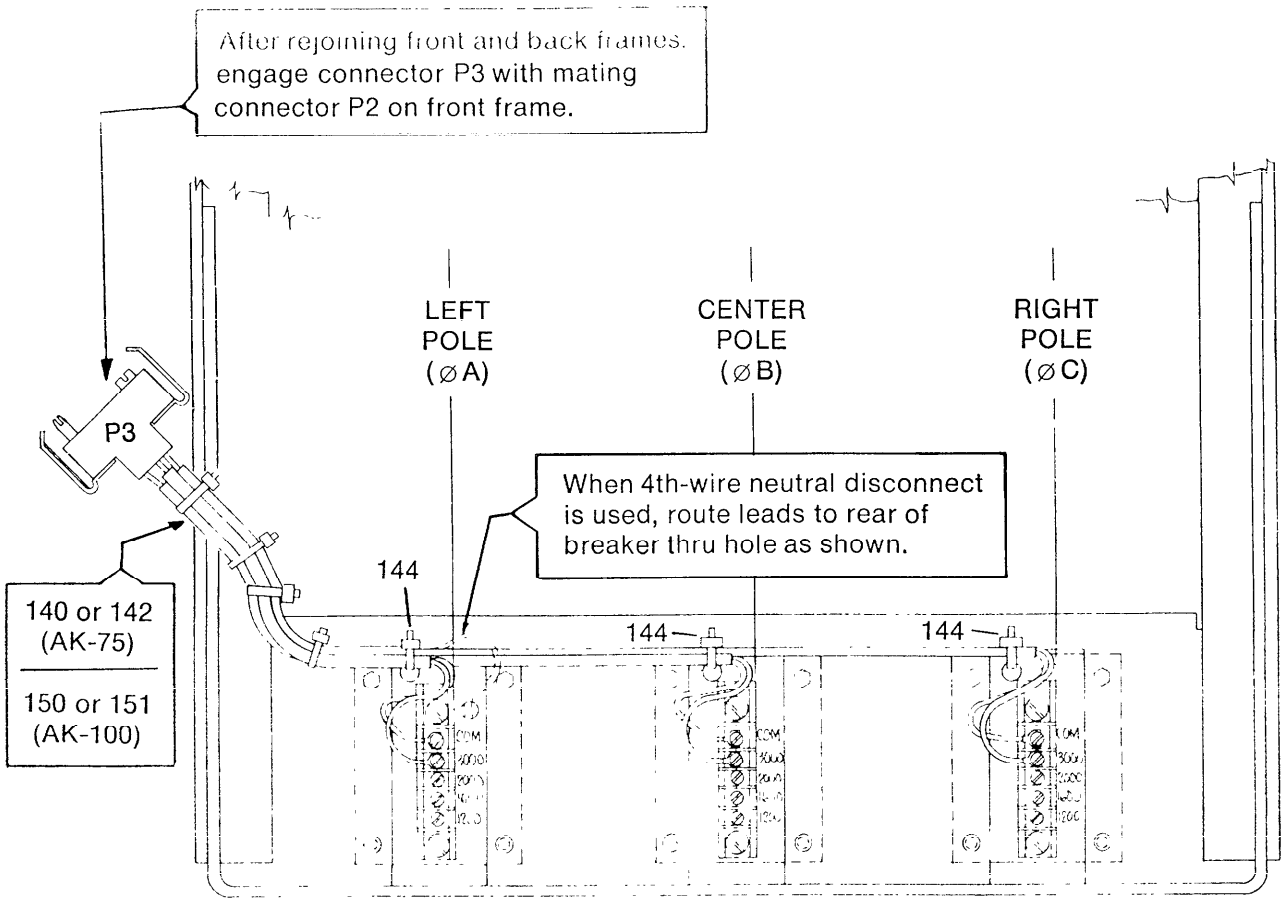
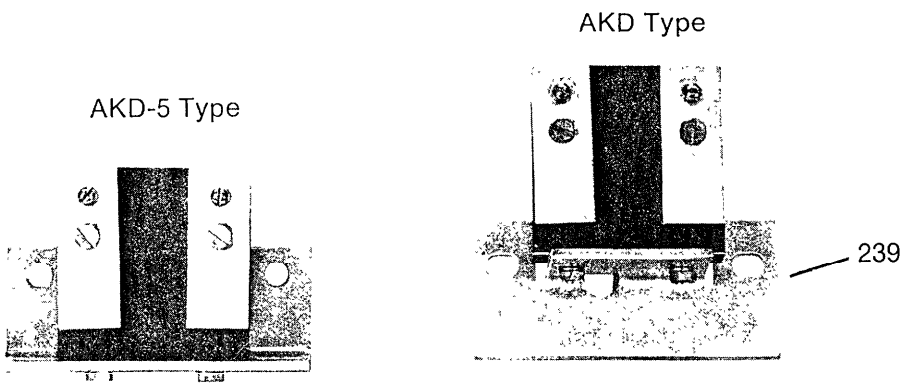


Fig. 14 — Front view of converted AK-75/100 back frame showing sensor terminal boards and harness arrangement.



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. 15 — Selection of mounting brackets for attaching the 4th-wire neutral sensor disconnect block to AK-75 & 100 drawout breakers.

V. BREAKER REASSEMBLY

1. Rejoin the front and back frames. Refer to GEK-7303 page 7 as necessary. Join harness connectors P2 & P3.

2. Referring to Figs. 6 and 7, attach the flux shift trip device actuator bracket to the left pole crossbar side link (previously drilled in Section IV). Be sure it clears the buffer stud as described in Fig. 9.

3. Install the programmer unit 175 into its mounting bracket on the breaker front frame as shown in Fig. 5. Join female connector P1 of the breaker harness to the male connector on the rear of the programmer.

CAUTION — To avoid shock hazard and possible damage to wire harness and sensor coils, insure that all harness connectors (P1, P2 and P3) are securely engaged before any attempt is made to energize the breaker.

Conversion of the breaker is now complete. Manually close and trip the breaker several times to insure proper mechanical operation. Use the maintenance handle to do this on electrically operated breakers. Recheck the flux shift trip device linkage and adjustments per Fig. 9.

Proceed next to Section VI — EQUIPMENT MODIFICATIONS. If these are not required, go directly to Section VII — TESTING.

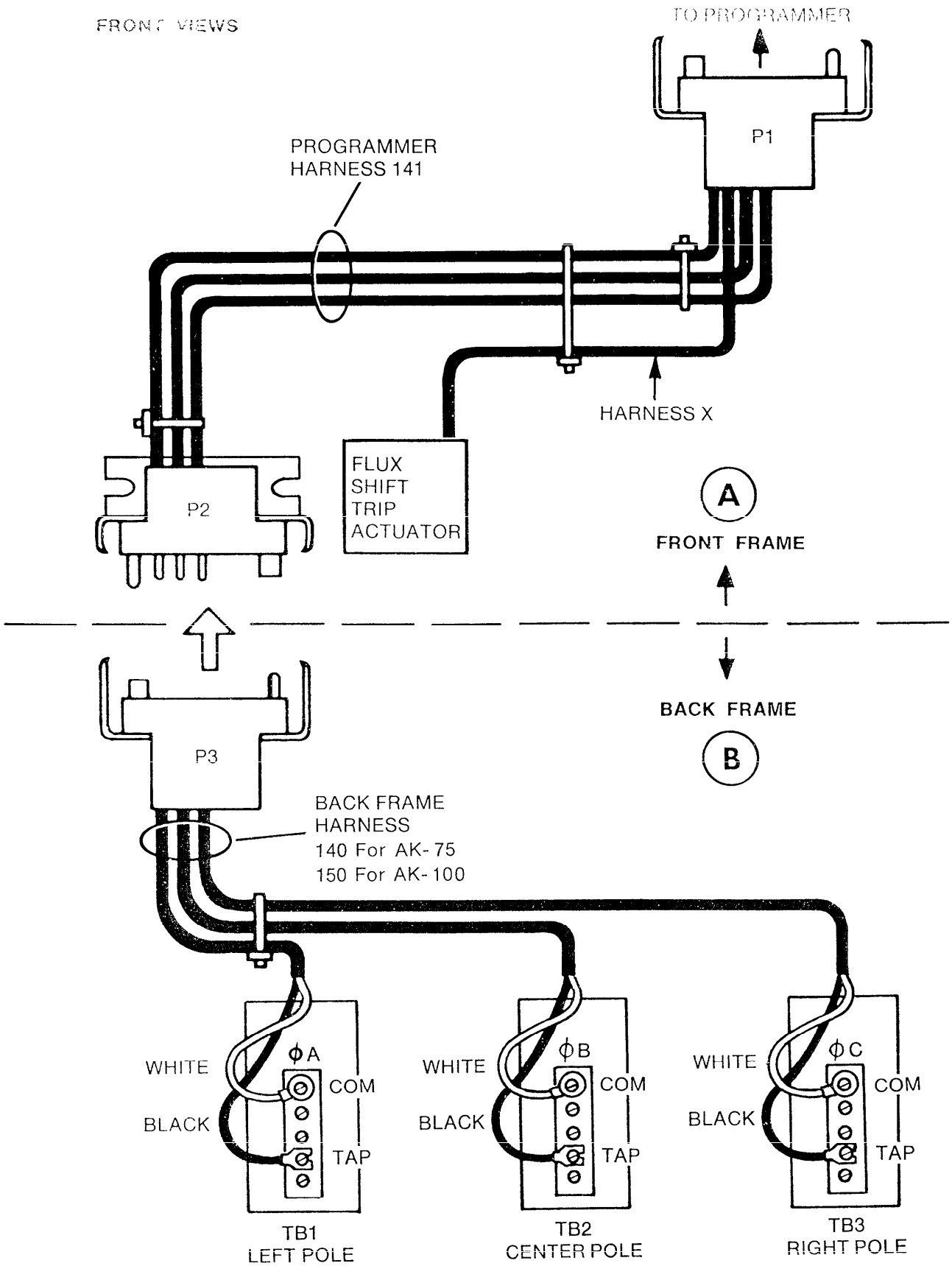


Fig. 16 — Harness connections for drawout and stationary breakers used on 3-wire systems — with and without ground fault. For elementary diagrams see Figs. 17 and 18.

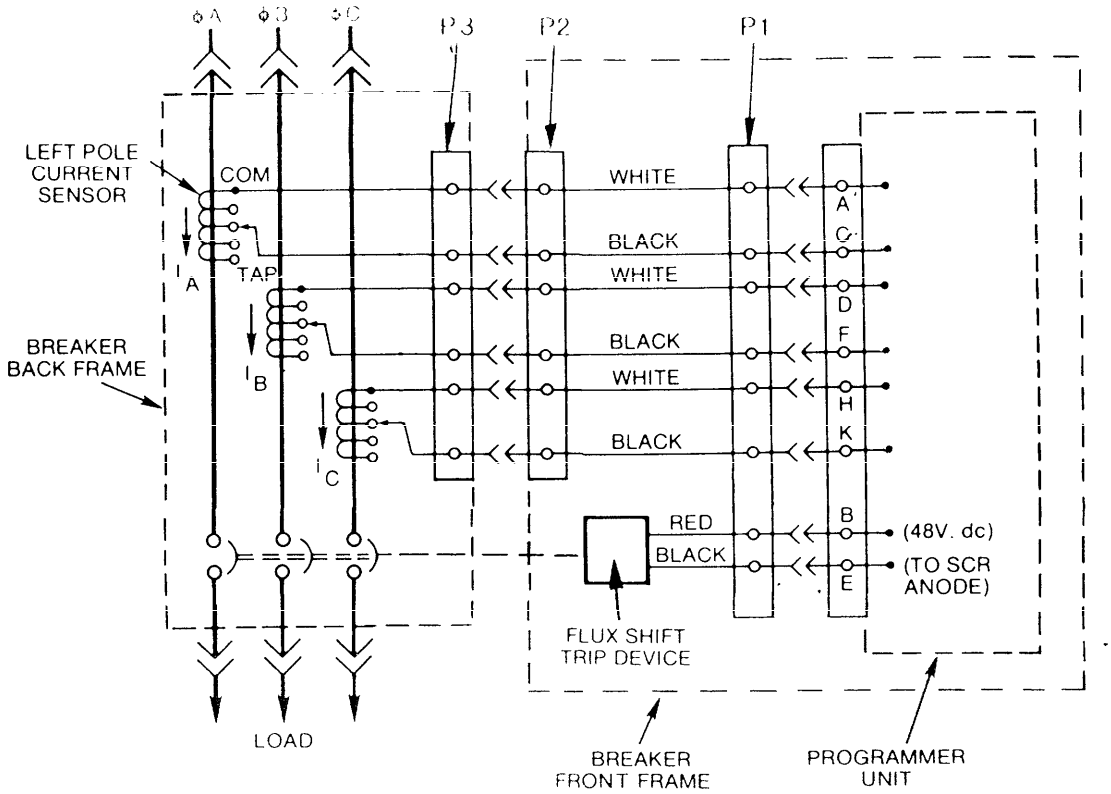


Fig. 17 — Elementary diagram — drawout breaker without ground fault.

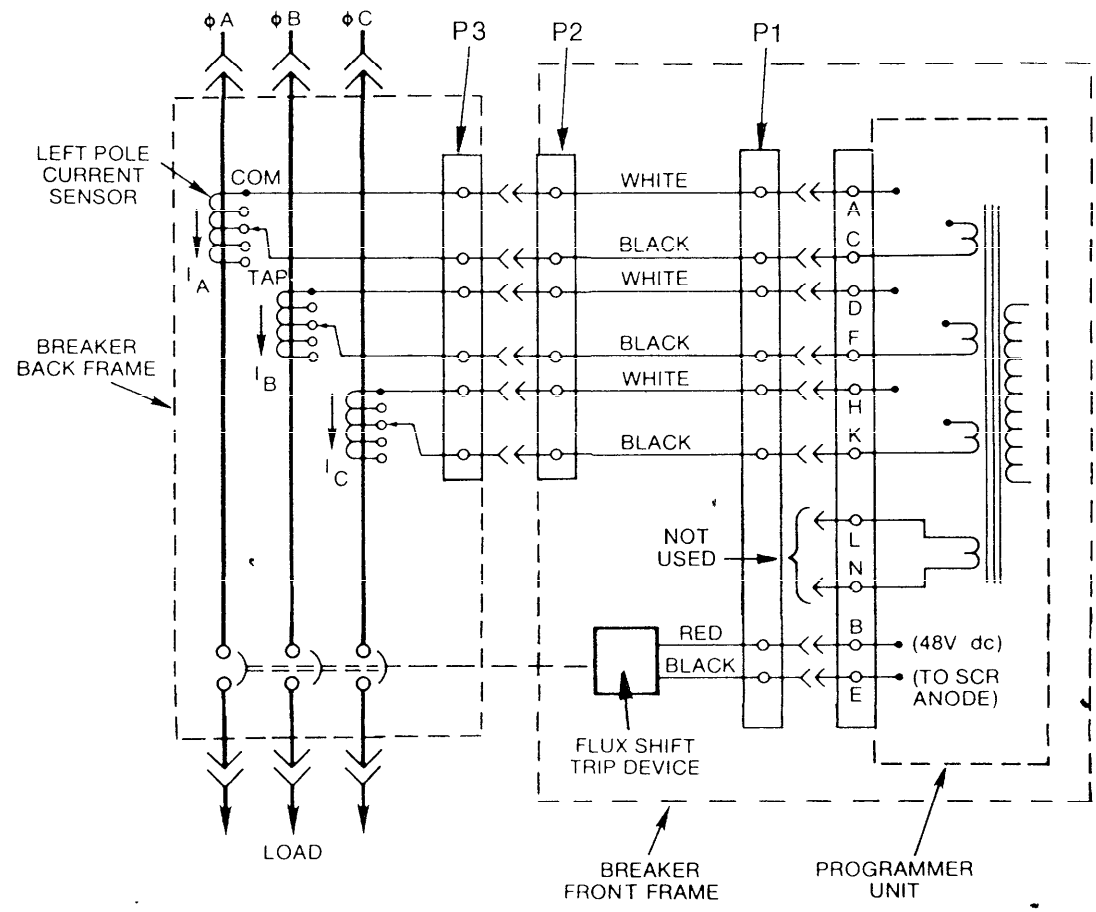


Fig. 18 — Elementary diagram — drawout breaker with 3-wire ground fault.

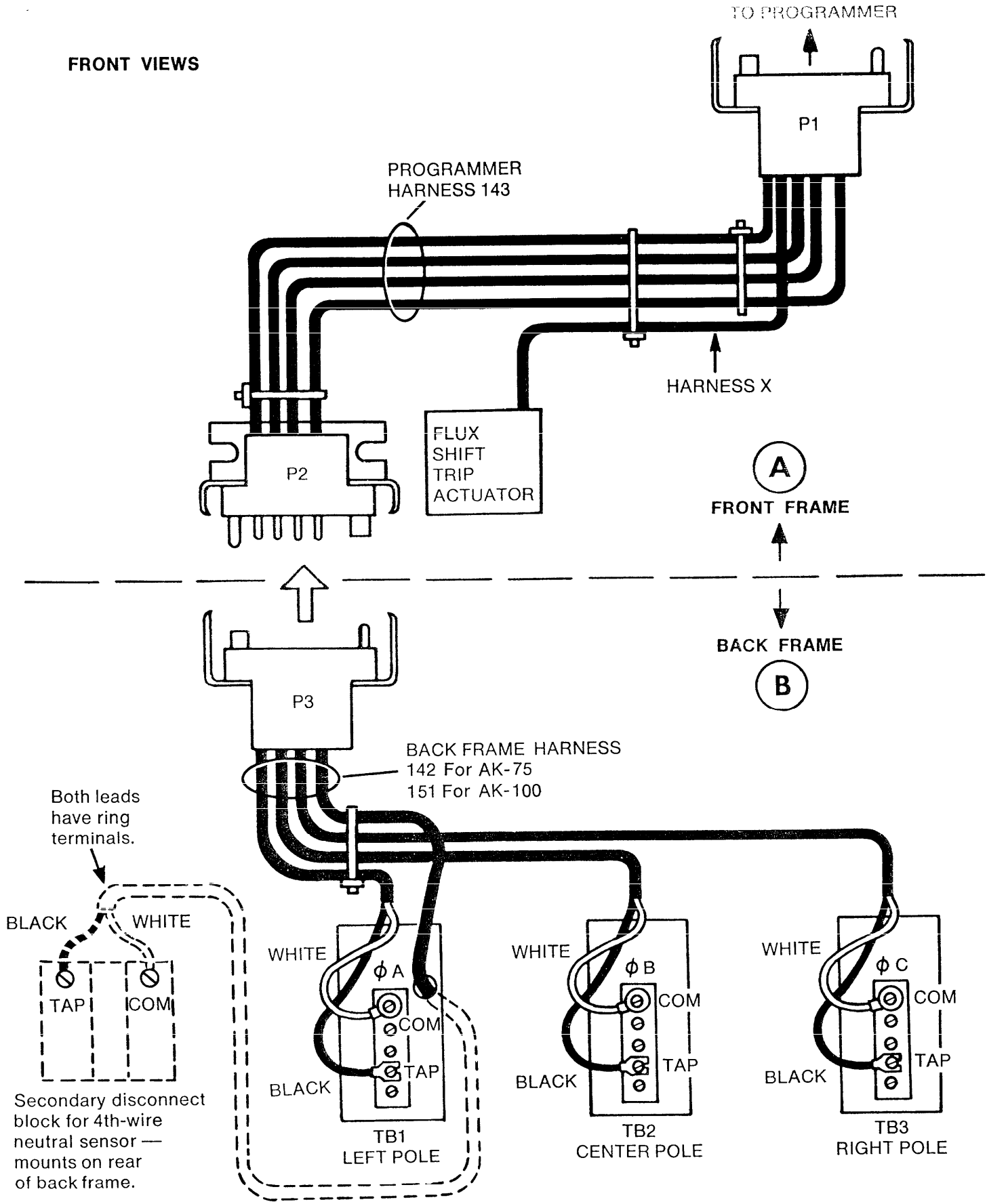


Fig. 19 — Harness connections for drawout breakers equipped with 4-wire ground fault. For elementary diagram see Fig. 20.

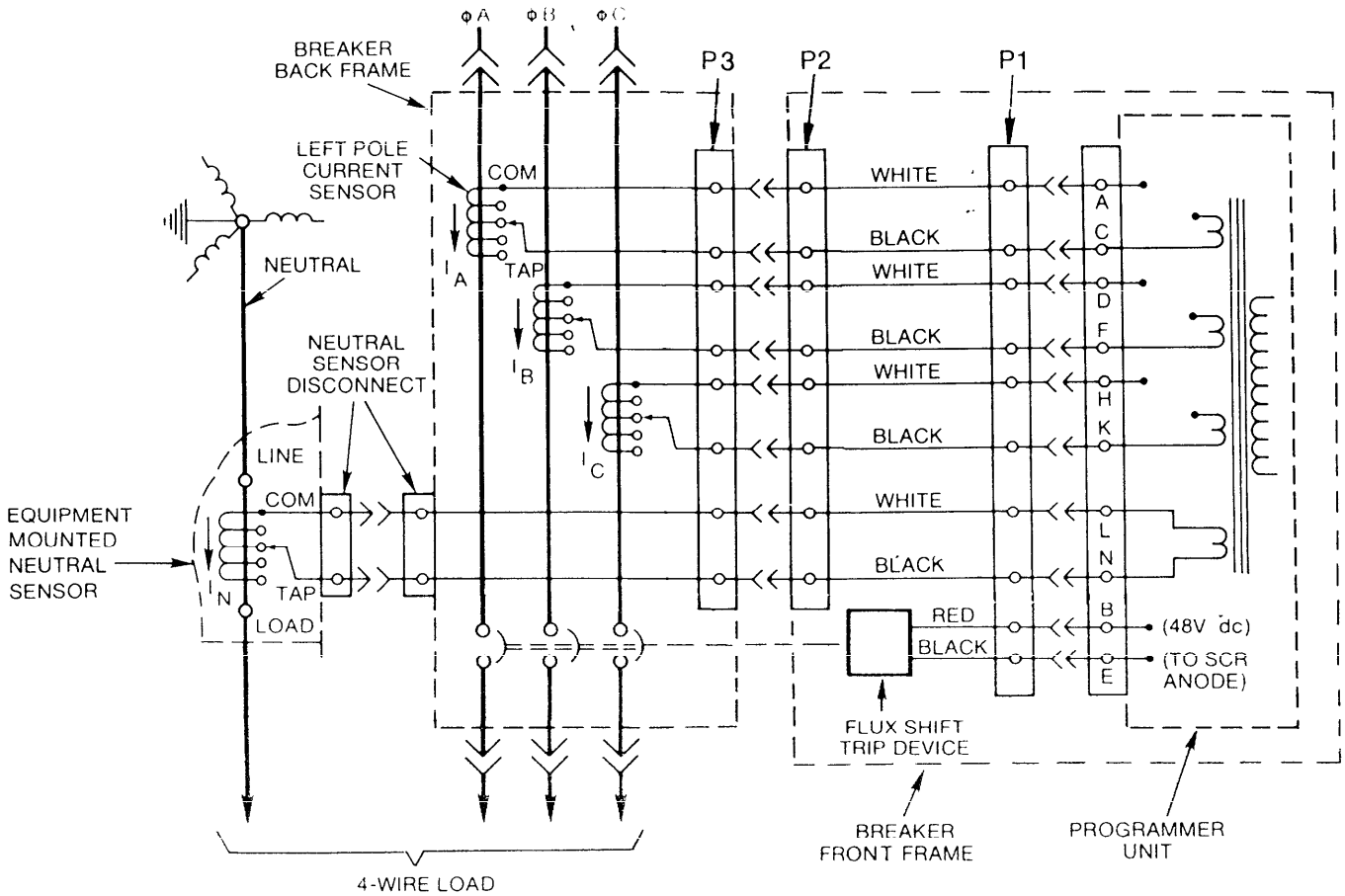
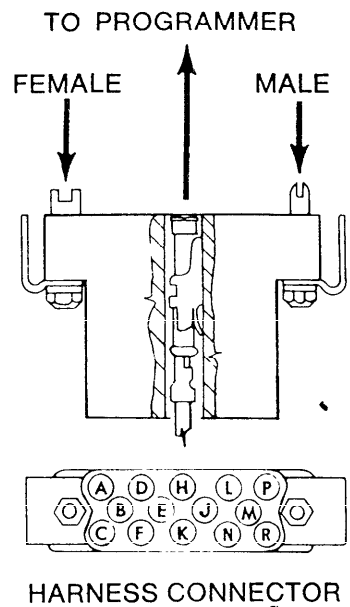


Fig. 20 — Elementary diagram — drawout breaker with 4-wire ground fault.

Table 5 — SST Harness Wire Table

FROM		TO
Harness Connector Socket Number	Wire Color	
A C	White Black	TB1 (ϕA)
D F	White Black	TB2 (ϕB)
H K	White Black	TB3 (ϕC)
B E	Red Black	Flux Shift Trip Device
L N	White Black	4th-wire Neutral Disconnect Block when used

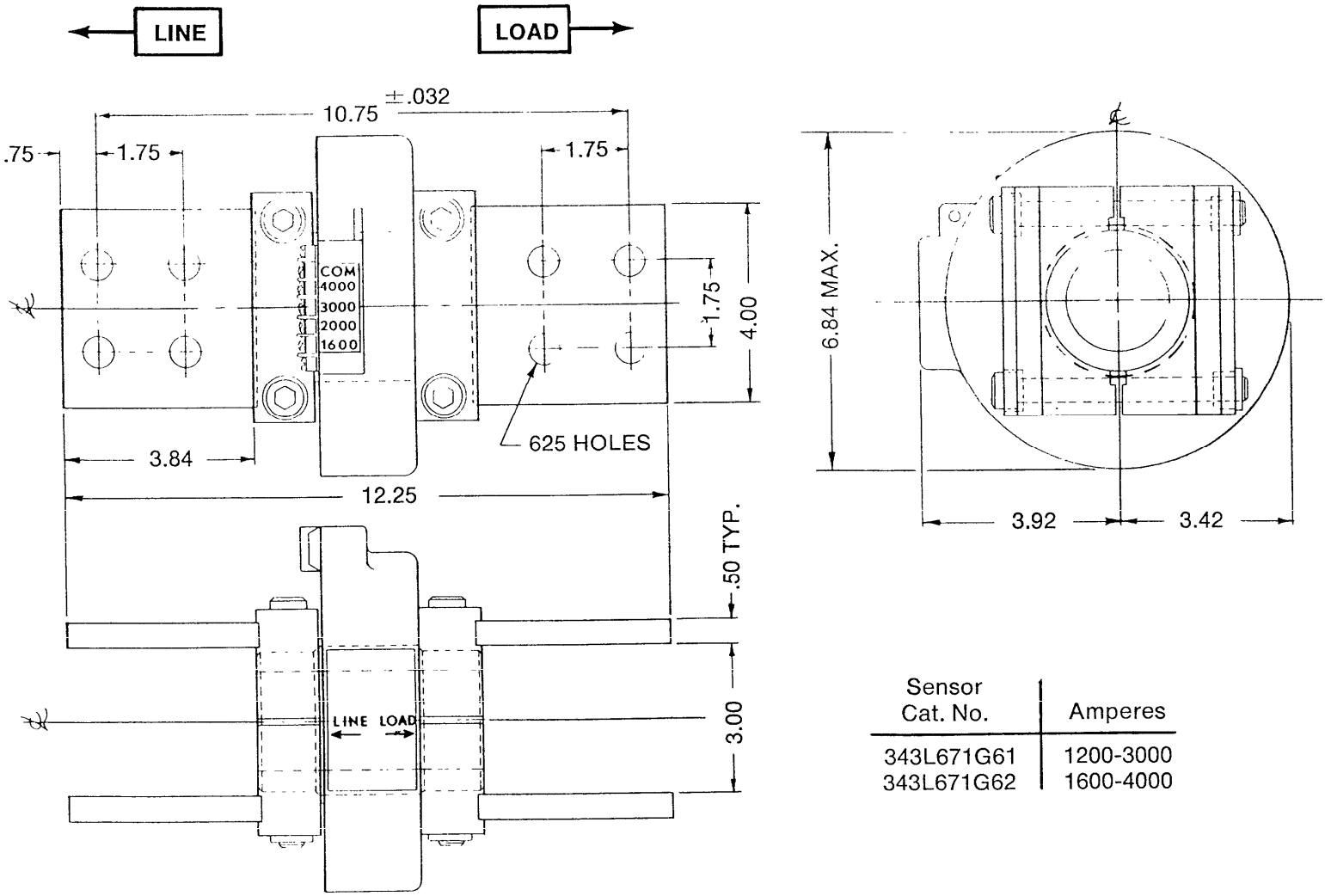


HARNESS CONNECTOR

VI. EQUIPMENT MODIFICATIONS

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

1. 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 & LOAD directional markings.* See Fig. 21 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. Mount the 4th-wire neutral sensor stationary disconnect block 226 inside the breaker compartment at the lower rear as shown in Figs. 23 & 24, whichever applies. Be careful to select the correct mounting bracket (part 227, 228 or 229).
3. Connect the neutral sensor to disconnect block 226 per Fig. 25 wiring instructions.



Sensor Cat. No.	Amperes
343L671G61	1200-3000
343L671G62	1600-4000

Fig. 21 — Outline of SST 4th-wire neutral sensors (from Outline Dwg. 568B227).

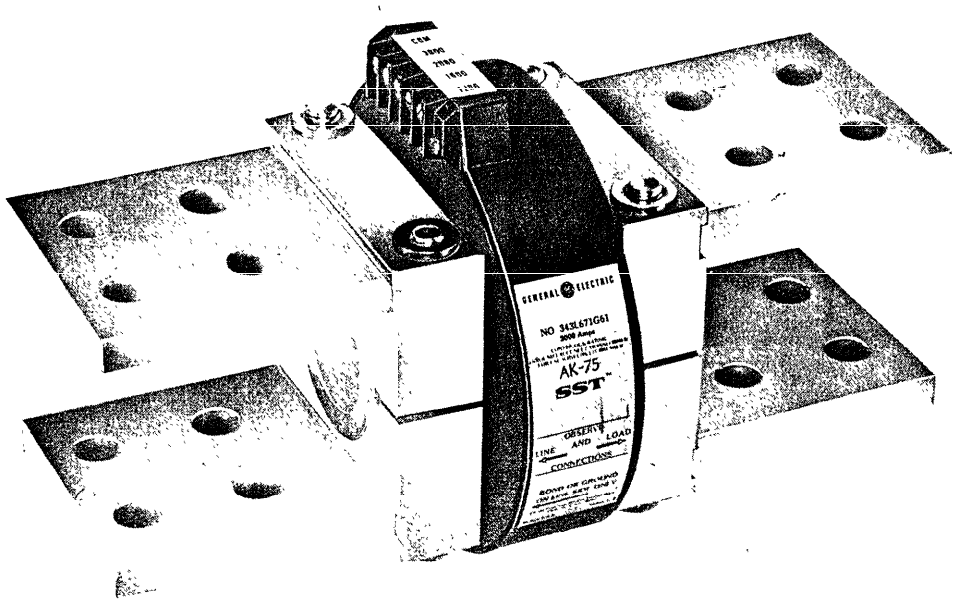
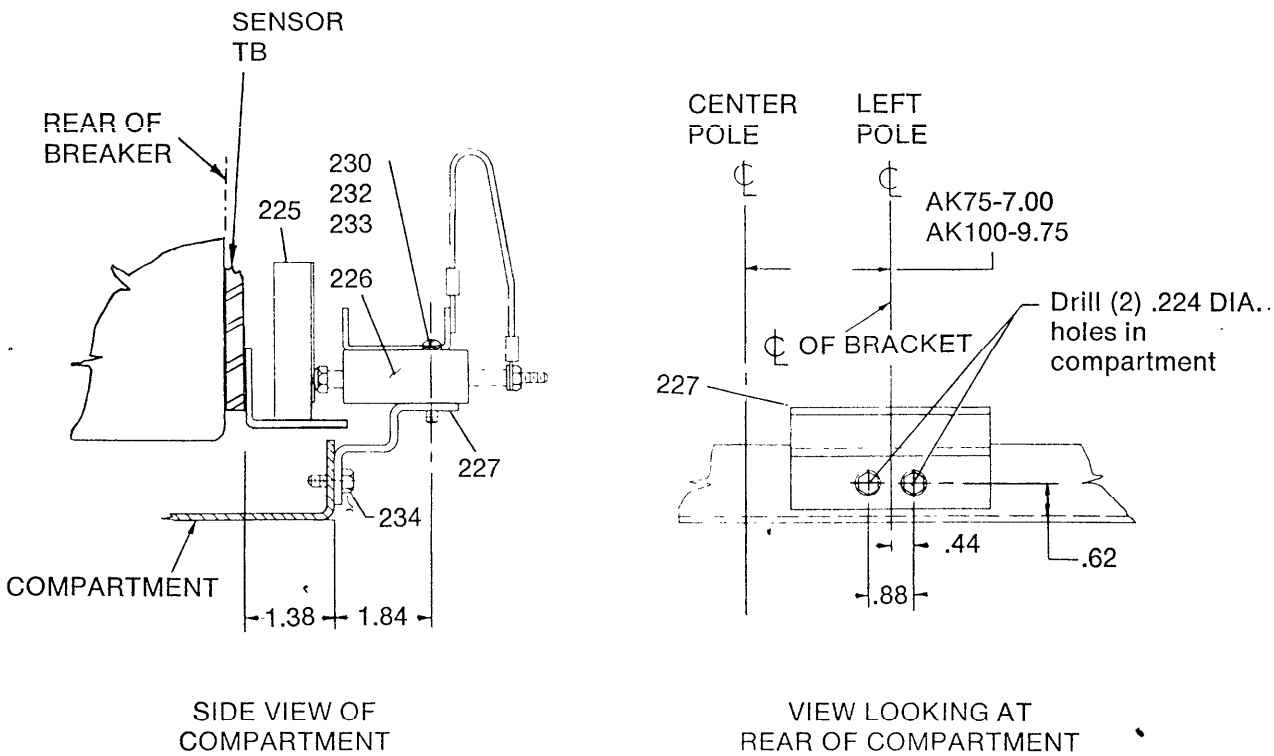
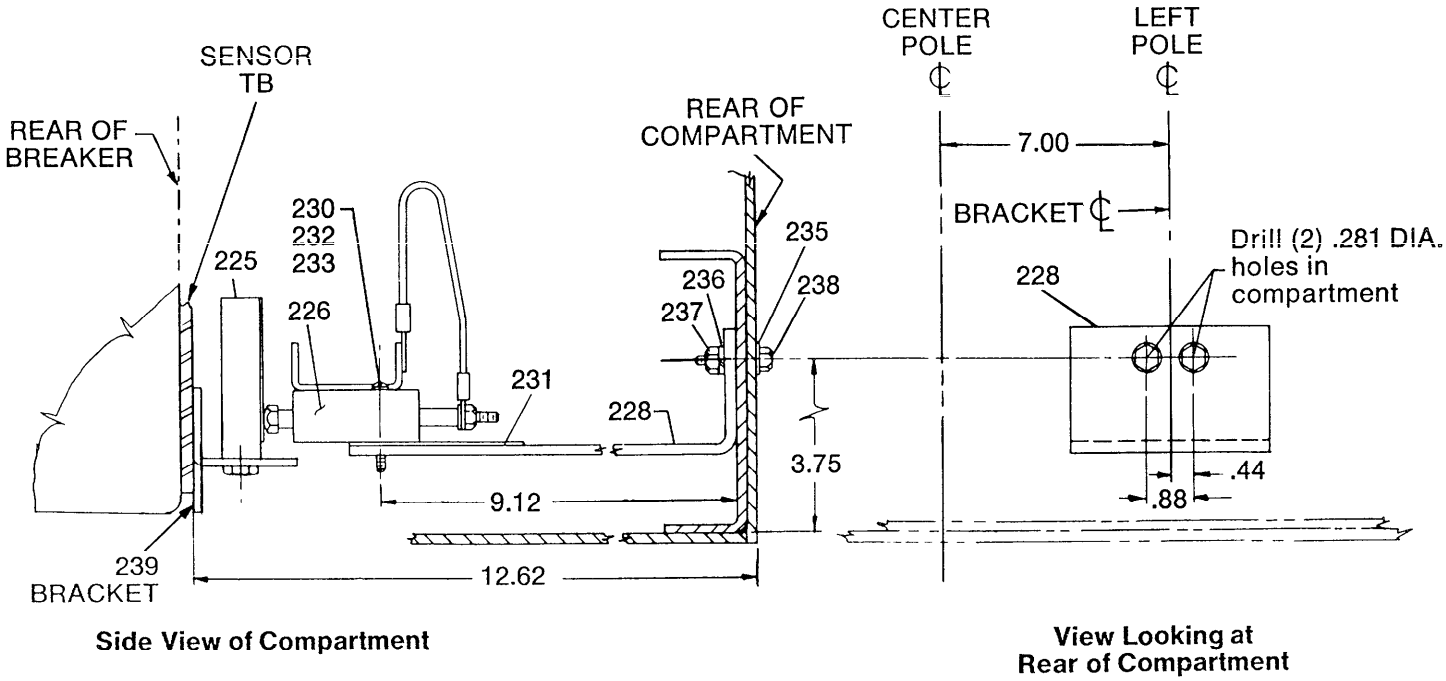


Fig. 22 — 3000A. neutral sensor 343L671G61

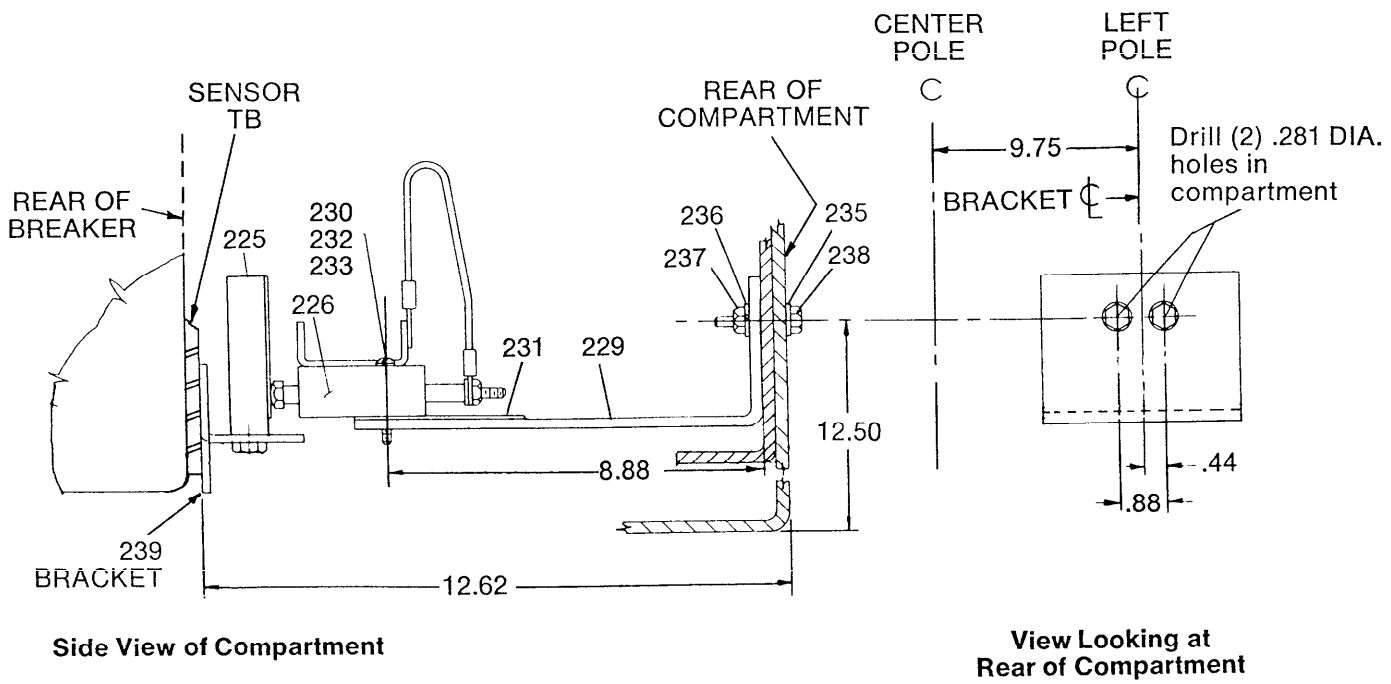


AK-75 & AK-100 BREAKERS

Fig. 23 — Mounting the 4th-wire neutral sensor disconnect block in AKD-5 type drawout compartments.



AK-75 BREAKERS



AK-100 BREAKERS

Fig. 24 — Mounting the 4th-wire neutral sensor disconnect block in AKD type drawout compartments.

INSTALLATION NOTES

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

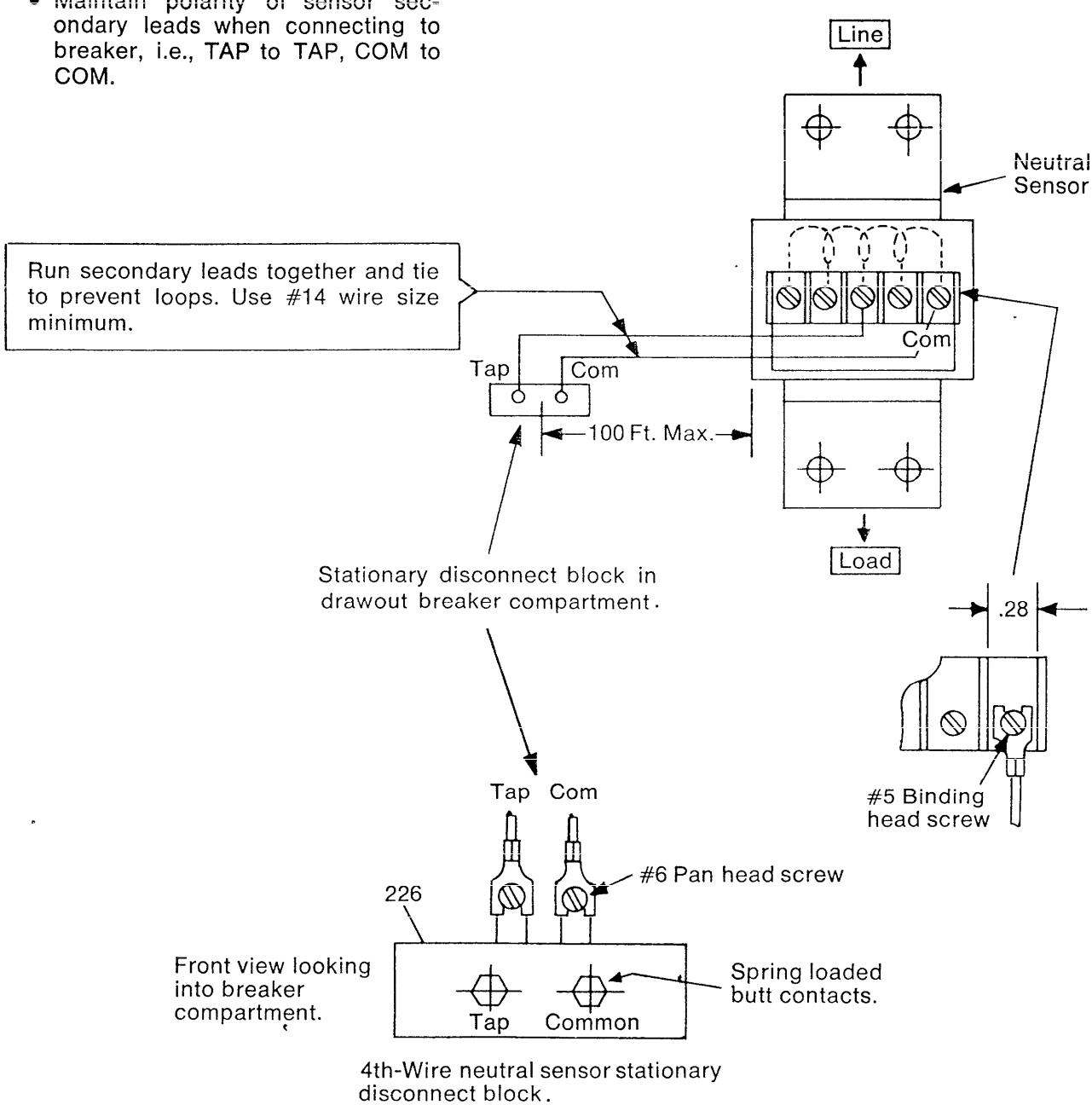


Fig. 25 — Connecting the 4th-wire neutral sensor.

VII. TESTING

Before reinstalling the breaker to service, perform steps 1, 2 & 3 below:

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

2. Verify that all tap leads have been properly connected to the terminal boards by checking the tap-to-tap resistances of each current sensor against the values in Table 6. These data apply both to phase and neutral sensors.

Table 6 — Sensor Resistance Values

Breaker	Tap Terminal (AMP)	Tap Lead Color	Resistance in ohms between COMMON terminal (white lead) and TAP terminal
AK-75	1200	Black	13.4-15.7
	1600	Yellow	18.3-21.5
	2000	Red	23.5-27.6
	3000	Green	37.7-44.3
AK-100	1600	Black	18.1-21.2
	2000	Yellow	23.1-27.2
	3000	Red	37.0-43.4
	4000	Green	52.4-61.5

3. Perform either of the following tests:

A — When available, portable test sets TAK-TS1 or TAK-TS2 should be used to check the breaker and its trip device for proper operation. Instruction manuals GEK-64454 and GEK-73300-1 respectively apply.

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 pages 26 & 27.

NOTE:

When high-current 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. 26 below. If this defeat cable is not available, the breaker can be tested by connecting two poles in series such that the currents are in opposing directions.

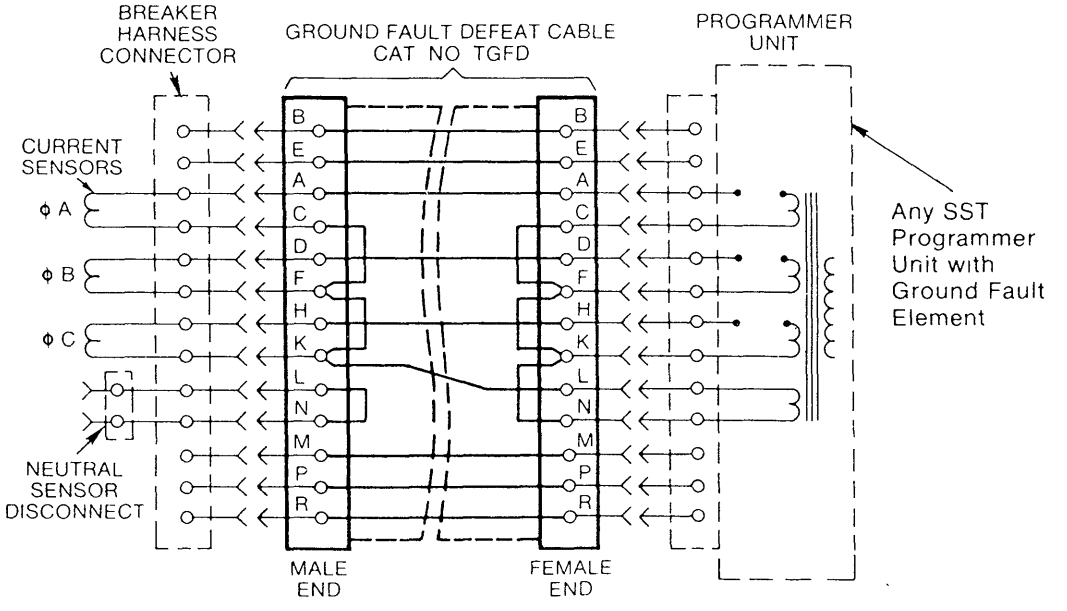


Fig. 26 — Cabling diagram with Ground Fault Defeat Cable inserted between breaker harness and SST Programmer Unit — for use during single-phase, high current-low voltage testing.

TABLE 7 — TRIP CHARACTERISTICS — SST CONVERSION KITS

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

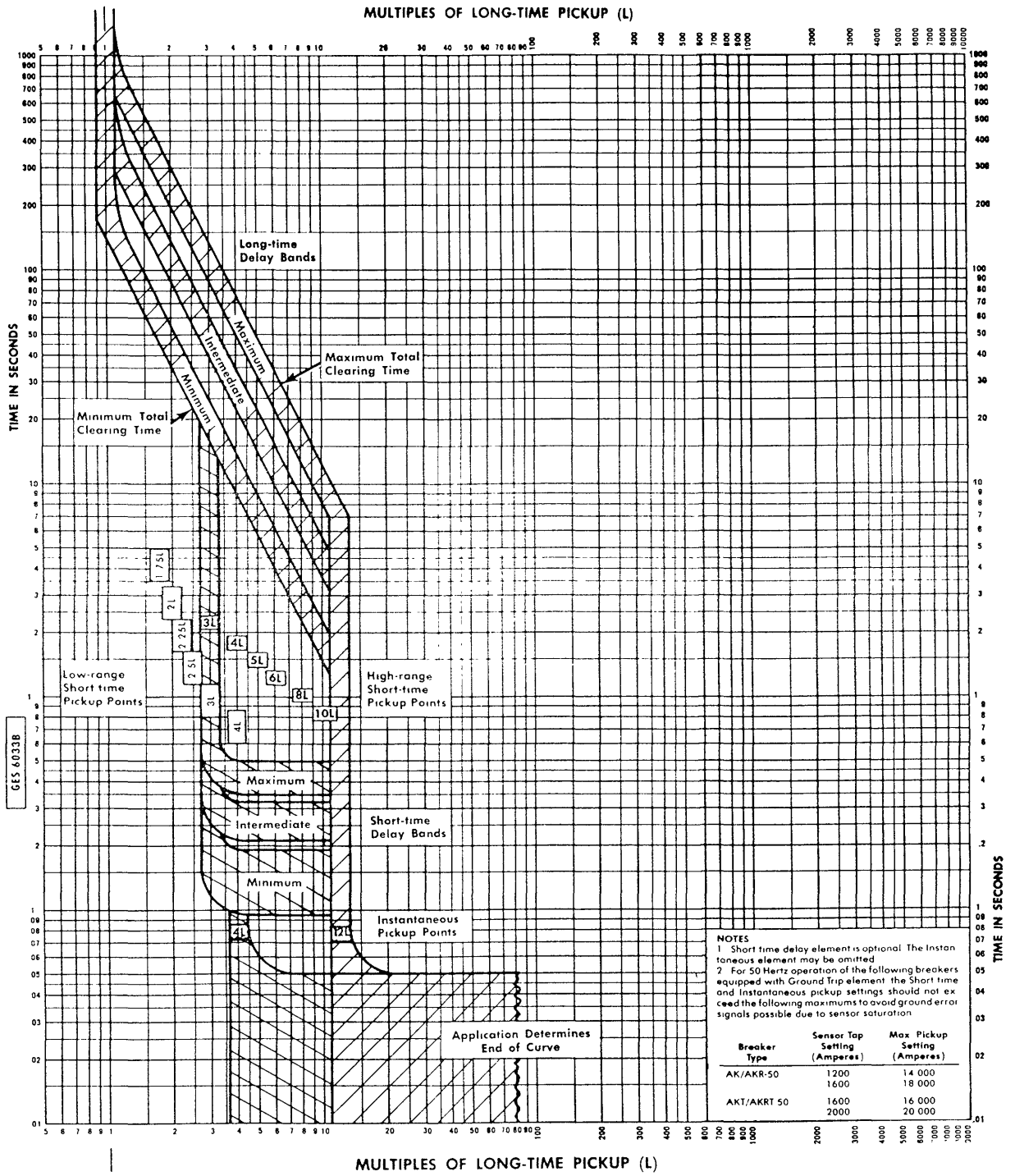
Breaker Frame Type	Frame Size (Amperes)	Sensor Taps (X) (Amperes)	SST Programmer Adjustment Range (Set Points)						
			Ground Fault		Long Time		Short Time		Instantaneous Pickup (Multiple of L)
			Pickup (Multiple of X)	Delay Band (Seconds)	Pickup (L) (Multiple of X)	Delay Band (Seconds)	Pickup (Multiple 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 X = 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

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

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

GES-6033B

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

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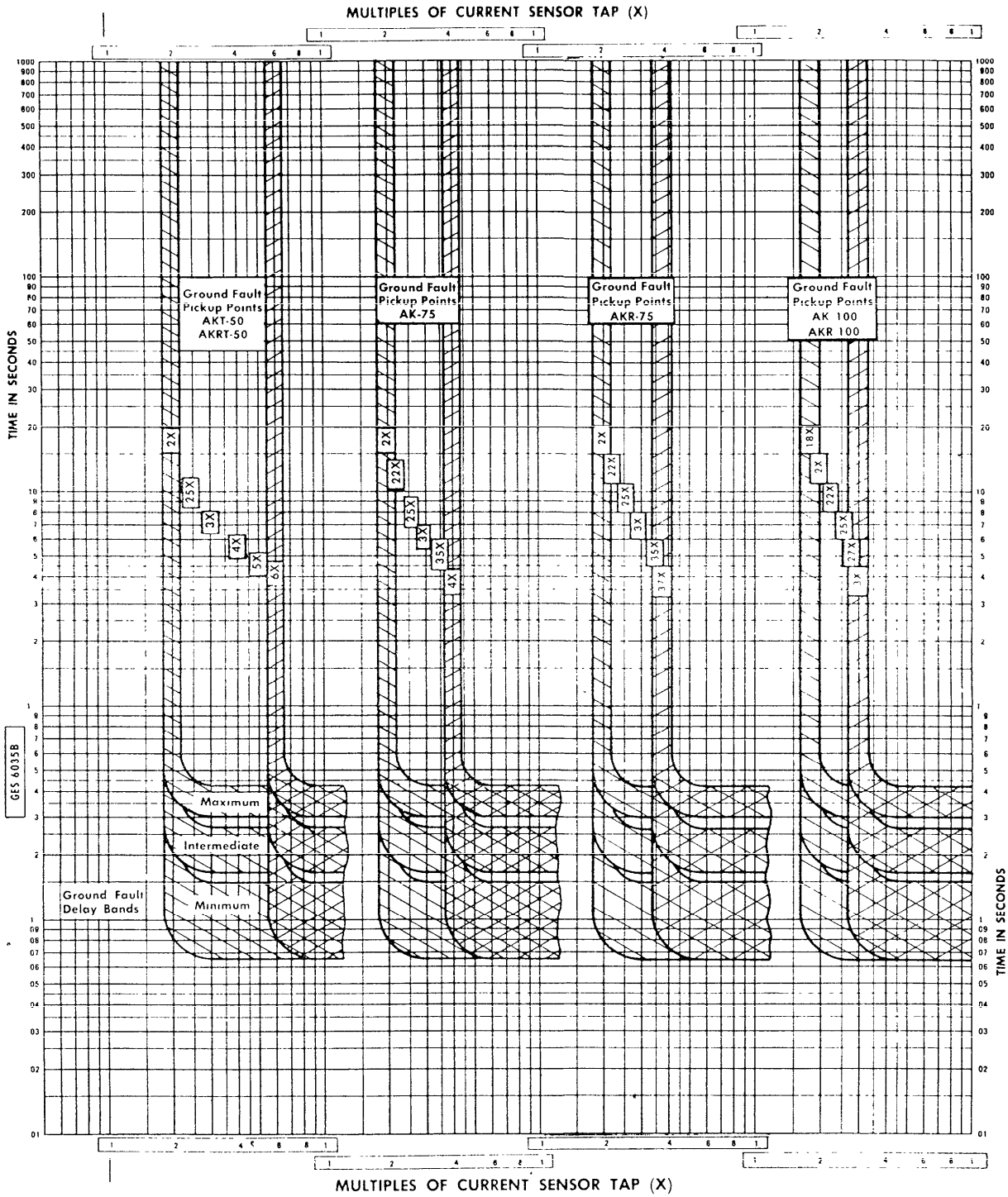

NOTE: 4th wire Ground sensor tap must be set same as phase sensor tap.

GENERAL ELECTRIC

AK/AKR LOW-VOLTAGE POWER CIRCUIT BREAKERS

SST™ SOLID STATE OVERCURRENT TRIP DEVICE

Ground Trip Time-current Curves

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

GES-6035B

X = Current Sensor Taps (Amperes)

AKT AKRT 50	800 1200 1600 2000
AK 75	1200 1600 2000 4000
AKR 75	1200 1600 2000 3200
AK AKR 100	1600 2000 3000 4000

Programmer Set Points

Ground Fault Pickup

AKT AKRT 50	2x 2.5x 3x 4x 5x & 6x
AK 75	2x 2.2x 2.5x 3x 3.5x & 4x
AKR 75	2x 2.2x 2.5x 3x 3.5x & 3.7x
AK AKR 100	1.8x 2x 2.2x 2.5x 2.7x & 3x

Where X = Sensor tap setting

Ground Fault Delay Bands

Maximum, Intermediate & Minimum

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