



Digitrip Retrofit System for Federal Pacific FP-50 (1600A) Breakers



SAFETY PRECAUTIONS



WARNING

POWER CIRCUIT BREAKERS ARE EQUIPPED WITH HIGH SPEED, HIGH ENERGY OPERATING MECHANISMS. THE BREAKERS AND THEIR ENCLOSURES ARE DESIGNED WITH SEVERAL BUILT-IN INTERLOCKS AND SAFETY FEATURES INTENDED TO PROVIDE SAFE AND PROPER OPERATING SEQUENCES. TO PROVIDE MAXIMUM PROTECTION FOR PERSONNEL ASSOCIATED WITH THE INSTALLATION, OPERATION, AND MAINTENANCE OF THESE BREAKERS, THE FOLLOWING PRACTICES MUST BE FOLLOWED. FAILURE TO FOLLOW THESE PRACTICES MAY RESULT IN DEATH, PERSONAL INJURY, OR PROPERTY DAMAGE.

- Only qualified persons, as defined in the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers and their associated switchgear assemblies should perform any work associated with these breakers.

- Completely read and understand all instructions before attempting any installation, operation, maintenance, or modification of these breakers.
- **Always turn off and lock out the power source feeding the breaker prior to attempting any installation, maintenance, or modification of the breaker. Do not use the circuit breaker as the sole means for isolating a high voltage circuit. Follow all lockout and tagging rules of the National Electric Code and all other applicable codes, regulations, and work rules.**
- Do not work on a closed breaker or a breaker with the closing springs charged. Trip (open) the breaker and be sure the stored energy springs are discharged before performing any work. The breaker may trip open or the charging springs may discharge, causing crushing or cutting injuries.
- For drawout breakers, trip (open), and then remove the breaker to a well-lit work area before beginning work.
- Do not perform any maintenance: including breaker charging, closing, tripping, or any other function which could cause significant movement of the breaker while it is on the extension rails. Doing so may cause the breaker to slip from the rails and fall, potentially causing severe personal injury to those in the vicinity.
- **Do not leave the breaker in an intermediate position in the switchgear cell. Always leave it in the connected, disconnected, or (optional) test position. Failure to do so could lead to improper positioning of the breaker and flashover, causing death, serious personal injury, and / or property damage.**
- **Do not defeat any safety interlock. Such interlocks are intended to protect personnel and equipment from damage due to flashover and exposed contacts. Defeating an interlock could lead to death, severe personal injury, and / or property damage.**

INTRODUCTION

Cutler-Hammer Digitrip Retrofit Kits are available in a number of configurations that provide a wide range of features. The Digitrip System starts with the 510 Basic Kit which offers true RMS sensing, overcurrent protection, and self-testing features. Advanced Digitrip Retrofit Kits feature zone interlocking, digital alphanumeric displays, remote alarm signals, PowerNet communications, energy monitoring capabilities, power factors, and harmonic content measurements.

Table 1 provides a quick reference of the components supplied with each level of Retrofit Kit. Before beginning the Retrofit process, take a minute to review the information contained in Table 1. It is important that the Retrofitter understands which

level of Retrofit Kit is to be installed and which components are included with the Kit.

The instructions contained in this manual cover the installation of all levels of Retrofit Kit. If the Kit you are installing does not contain a certain component, skip the instructions for that component and proceed to the next.

Throughout the Retrofit process, refer to the Torque Tables at the back of this manual for specific torque values.

If you have any questions concerning the Retrofit Kit and / or the Retrofit process, contact Cutler-Hammer at: 1-800-937-5487.

Table 1 Available Retrofit Kits

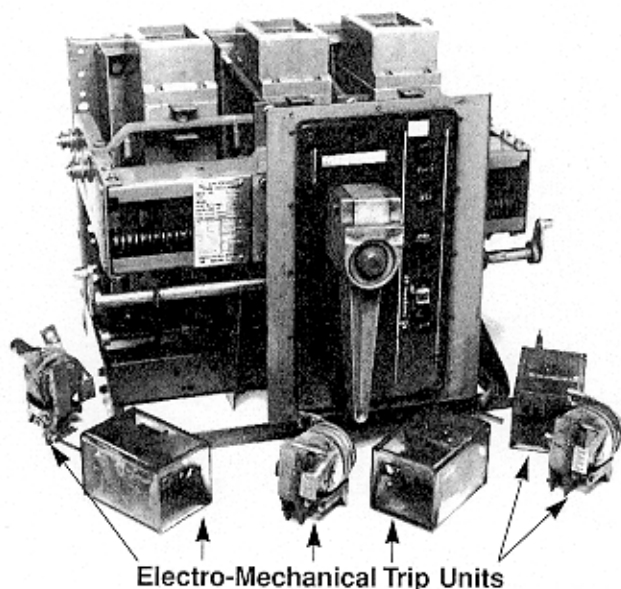
Components	510 Basic	510 with Zone Interlock	610	810	910
Trip Unit					
Rating Plug					
Auxiliary Current Transformer (CT) Module					
Auxiliary CT Harness					
Sensors					
Sensor Harness					
Direct Trip Actuator (DTA)					
Mounting Brackets and Hardware					
External Harness	Plug	1 Connector Harness	2 Connector Harness	4 Connector Harness	4 Connector Harness
Cell Harness					
Potential Transformer (PT) Module					
Auxiliary Switch					

STEP 1: Trip the Breaker and remove it from the Cell. Take the Breaker to a clean well lit work bench to perform the Retrofit.

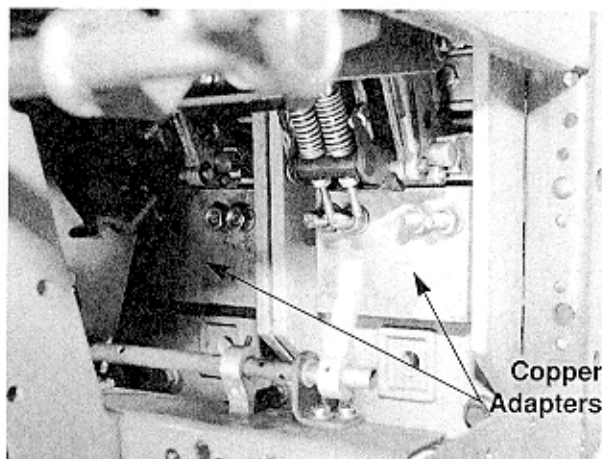
Before attempting to perform the Retrofit, be sure to read and understand the Retrofit Application Data supplied with this kit.

Refer to the components listing at the rear of this Booklet. Lay out the components and hardware according to the steps as outlined. The components and hardware will be used to complete each assembly step that follows.

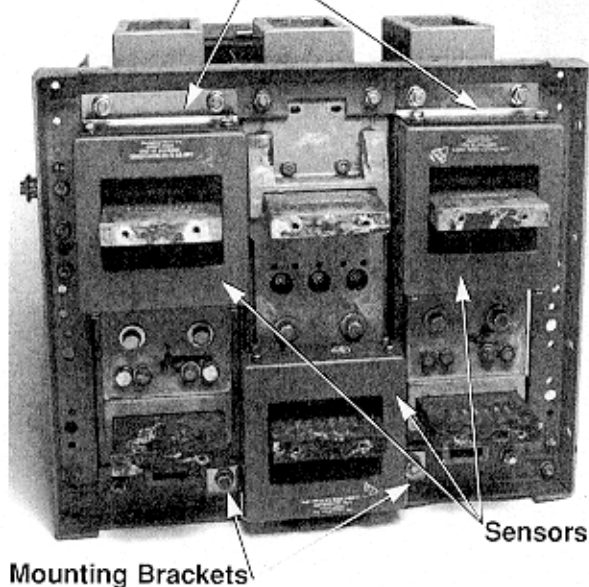
STEP 2:



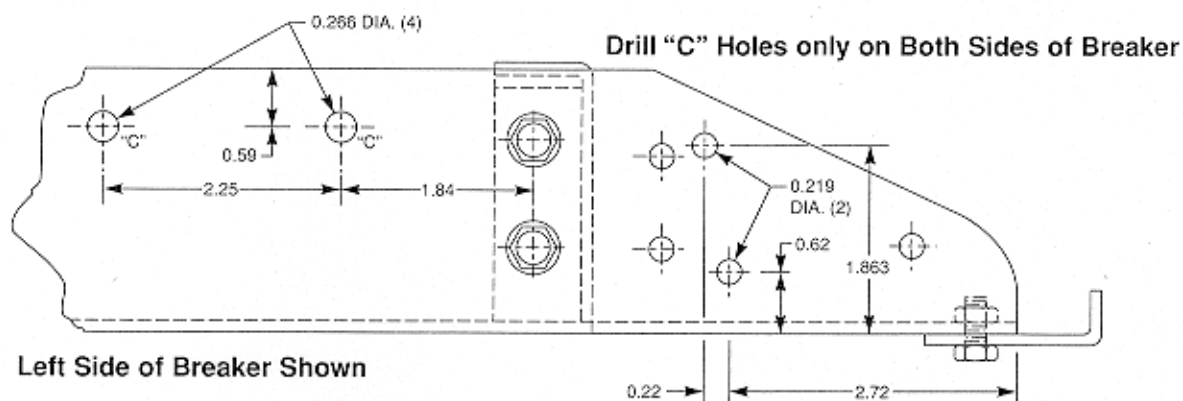
- A. Lean the Breaker back far enough to remove the bottom front Cross Angle. Support the Breaker securely in this position.
- B. Remove the Cross Angle and hardware from the Breaker and set them aside.
- C. Remove the two Phase Barrier Assemblies from the top of the Breaker and lay them safely aside.
- D. Starting with Phase 1, disconnect the Linkage Rod from the Copper Coil Assembly on the Breaker back plate.
- E. Remove and scrap the hardware that attaches the front portion of the Electromechanical Trip Unit to the Breaker Cross Channel.
- F. Remove the Insulating Link, hex nuts and Trip Finger from the Linkage Rod.
- G. Remove the front portion of the Electromechanical Trip Unit from the Breaker. Scrap the Trip Unit, Insulating Link, hex nuts and Trip Finger.
- H. Install the bottom front Cross Angle back in its original position using existing hardware. Remove the supports and lower the Breaker down.
- I. From the rear of the Breaker, remove and scrap the two hex bolts located 1.50 inches above and one hex bolt directly below the bottom Stud. The Copper Coil Assembly will fall free when the bolts are removed. Scrap the Copper Coil Assembly and hardware.
- J. Repeat Steps 2-D through 2-I for Phases 2 and 3.

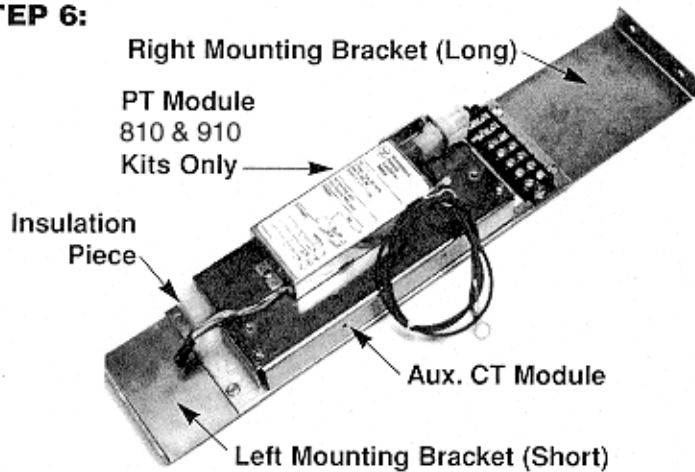
STEP 3:

- A. Install two Copper Adapters on each Pole Unit as shown with the hardware provided. The bolts should be installed from the rear of the Breaker using the four holes located 1.50 inches above the bottom Studs. *Note: For RMS/R 810 & 910 Kits only. Leave the nut, lockwasher, and flatwasher off of one bolt on each phase of the copper adapters, it will be installed later along with the PT Module Wires.*

STEP 4: Mounting Brackets

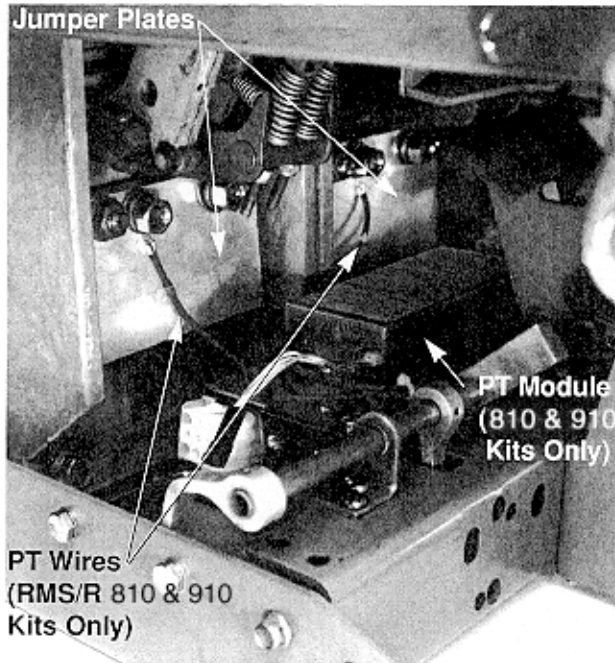
- A. Remove the Finger Clusters from the two top end Studs and the bottom center Stud of the Breaker.
- B. Mount the Sensors on the Mounting Brackets with the nameplates facing you as shown using the hardware provided. Use the existing hardware to fasten the Mounting Brackets to the Breaker.
- C. Replace the Finger Clusters.

STEP 5: A. Drill the left and right side bottom Angles per Drilling Plan 'A'.

STEP 6:

A. Mount the Mounting Brackets with the legs facing up on the bottom of the Aux. CT Module as shown with the hardware provided. The long Mounting Bracket mounts on the Terminal Block end of the Aux. CT Module. Do not tighten at this time.

B. *For RMS/R 810 & 910 Kits only.* Remove and scrap the Warning Nameplate from the PT Module. Mount the PT Module on top of the Aux. CT Module with the Insulation Piece between as shown using the thread forming screws provided. The White Plug of the PT Module should face the Terminal Block end of the Aux. CT Module.

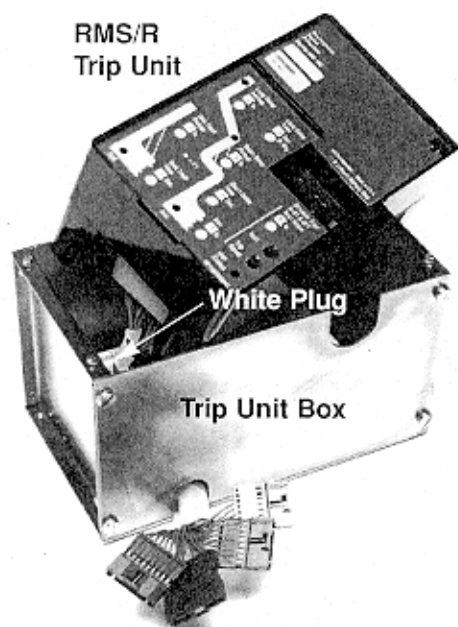
STEP 7:

A. Mount the Aux. CT Module Assembly with the Terminal Block on the right side and the white plug on the left side between the Breaker Frame as shown, use the holes just drilled in step 5 and the hardware provided. *For RMS/R 810 & 910 Kits only.* Do not tighten the Mounting Bracket to the right side of the Breaker Frame at this time.

STEP 8:

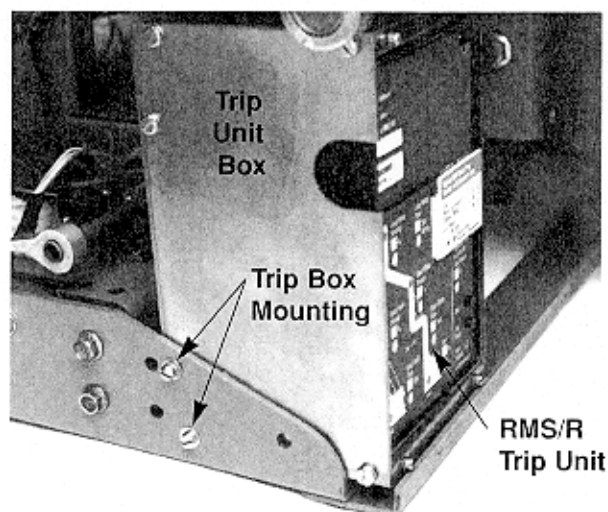
- A. Remove the Cover from the Trip Unit Box.
- B. Carefully pull out the White Plug from the bottom of the Trip Unit Box. Plug the White Plug into the bottom of the RMS Trip Unit. The slots in the White Plug should face the Trip Unit and the solid side face down. Make certain the White Plug is fully engaged and properly oriented.

STEP 8: (cont.)



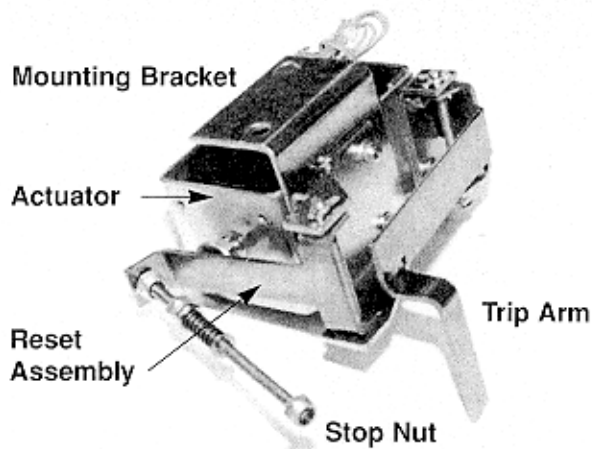
- C. Make certain the Jacking Screws on the back of the Trip Unit Box are fully retracted. Turn the Screws clockwise until they stop.
- D. Slide the RMS Trip Unit into the Trip Unit Box. Make certain that the edge card connector on the back of the Trip Unit seats fully into the receptacle in the Trip Box. The front of the Trip Unit will be approximately 1/16 inch lower than the front of the Trip Unit Box.
- E. Install the Rating Plug.
- F. Install the Trip Box Cover. The holes in the cover should expose the Trip Reset and Step buttons of the Trip Unit.

STEP 9:



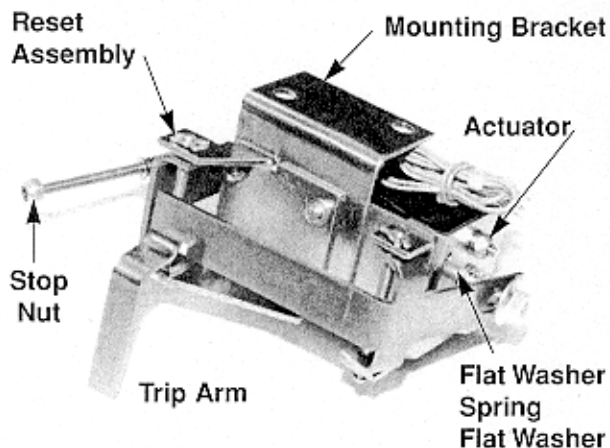
- A. Remove and scrap the bottom rear screw from the left side of the Trip Unit Box.
- B. Mount the Trip Box Assembly on the inside of the left Breaker Side Angle as shown. Use the holes drilled in Step 5 and the hardware provided. The thread forming screw should be used in the top hole.

STEP 10:



- A. Remove the Flange Nut from the end of the DTA (Direct Trip Actuator) Shaft.
- B. Apply Loc-tite to the threads of the DTA shaft and slide a .25 flat washer, spring and a .25 flat washer over the shaft. Tighten the Flange Nut on flush with the end of the shaft with the flat side facing towards the DTA.
- C. Apply Loc-tite to the threads on the opposite end of the DTA shaft. Install a Flange Nut flush with the end of the shaft, with the flat side away from the DTA.

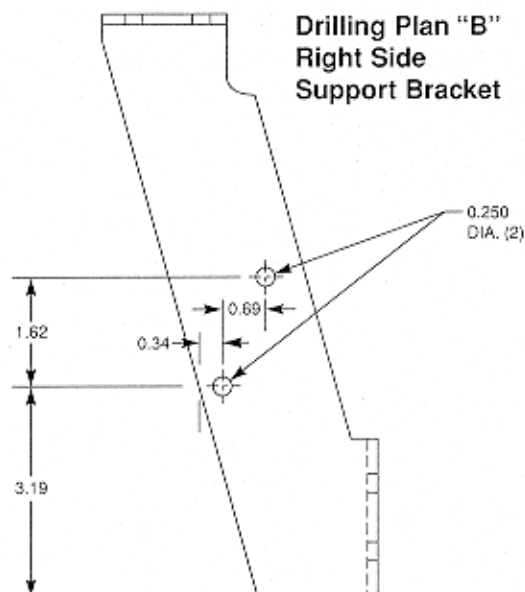
STEP 10: (cont.)



D. Mount the Mounting Bracket and the Reset Assembly on the DTA as shown with the hardware provided. The leg of the Mounting Bracket should be on the same side that the wires exit, while the Reset Assembly goes over the flat of the Flange Nut.

E. Mount the Trip Arm Pivot as shown with the hardware provided. Insert the fork of the Trip Arm as shown between the Flange Nut and the Flat Washer of the DTA Shaft. Position the Tabs of the Trip Arm between the Tabs of the Pivot Mounting and align the holes. Insert the Pivot Pin and secure in place with an X-Washer on each end of the Pin.

STEP 11:

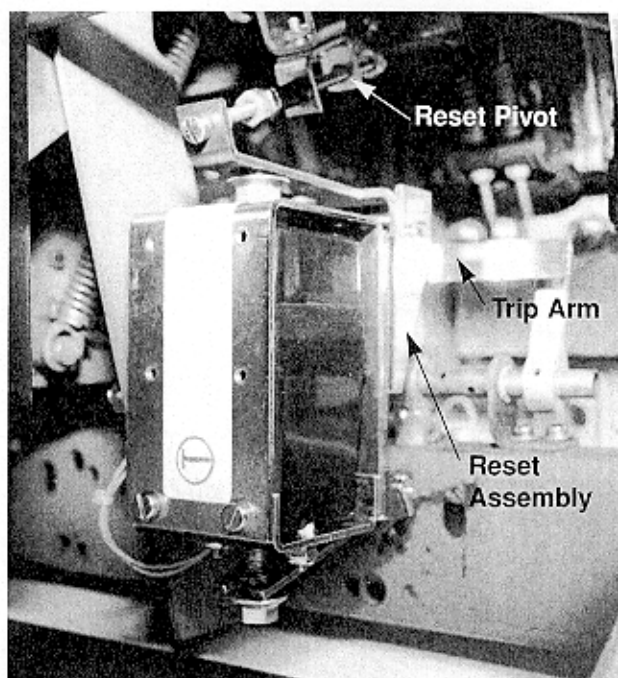


F. Remove the right front center support and drill per Drilling Plan "B". Reinstall the support to its original location.

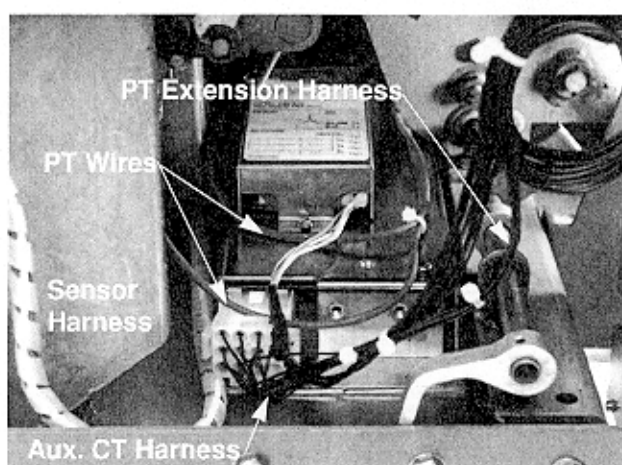
STEP 12:



A. Remove the E-Rings from the Phase 3 Wrist Pin and slide the Wrist Pin to the right. Insert the Reset Pivot Assembly onto the left side of the Wrist Pin. Slide the Wrist Pin back to its original position. Reinstall the E-Rings and any spacers that will not interfere with the Reset Pivot Assembly or the Breaker operation back on the Wrist Pin. The Reset Pivot Assembly will hang freely from the Wrist Pin. The heads of the screws that hold the Reset together must face down.

STEP 13:

- A. Remove the Stop Nut from the Reset Screw on the DTA Reset.
- B. Position the DTA Assembly on the right side of the center support just drilled in Step 10. Insert the Reset Screw through the Reset Pivot Assembly. Fasten the DTA Mounting Bracket to the center support.
- C. Replace the Stop Nut removed from the Reset Screw in 'A' above.
- D. Connect a 24V DC power supply to the DTA Terminals, Positive to Positive and Negative to Negative. Close the Breaker manually. Energize the DTA to trip the Breaker, de-energize the DTA when the Breaker trips. Make certain that the DTA resets. If the Breaker fails to trip, adjust the position of the Trip Arm by adjusting the Flange Nut or by bending the Trip Arm slightly. If the DTA fails to reset, adjust the hex nuts on the Reset Screw. Repeat until the trips and resets are sure and positive every time.

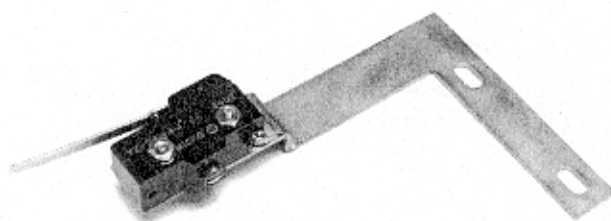
STEP 14:

- A. These Instructions refer to the Wiring Diagrams in the Retrofit Application Data for the proper connection and application.
- B. Connect the Snap Spade Terminals of the Sensor Harness to the proper terminals on the 7 Point Terminal Block on the right side of the Aux. CT Module. (The long tan and green wires are for a remote Neutral Sensor on a 4W Ground Breaker. They should be removed if not required.)
- C. Connect the green wire (Ring Terminal) to one of the threaded holes in the right side of the Aux. CT Module Cover as shown using the hardware provided.
- D. Route the DTA Wires back to the 7 point Terminal Block of the Aux. CT Module. Connect the wire with + to the 'OP' Terminal and the unmarked wire to the 'ON' Terminal.

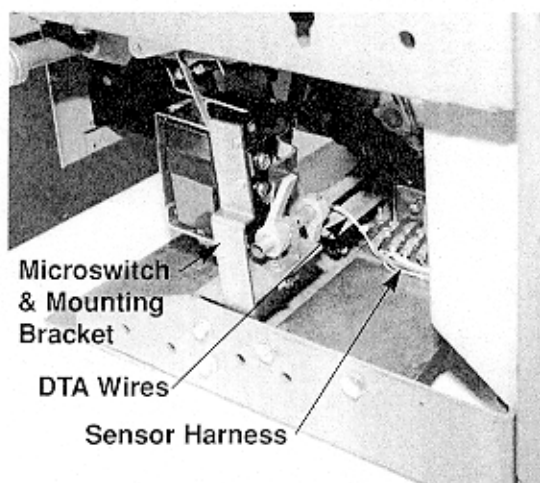
- STEP 14:** E. Install a Grommet in the middle left hole in the Breaker Back Plate. Route the Sensor Harness along the back of the Aux. CT Module over to and through the Grommet to the Sensors. Connect the proper Ring Terminals of the Sensor Harness to the correct Terminals of the Sensors.
- (cont.)
- F. *For RMS/R 810 & 910 Kits only.* Route the three wires from the PT Module back to the Copper Adapters installed in Step 3A. Cut the wire marked with 1 to Phase 1. Cut the wire marked with 2 to Phase 2. Cut the wire marked with 3 to Phase 3. Strip each wire 1/4 inch and install a .38 Ring Terminal on each. Connect each wire to the correct Copper Adapter using the hardware left from Step 3A.
- G. Use nylon wire ties provided to dress up the wiring to keep it away from any interference with the Breakers moving parts.

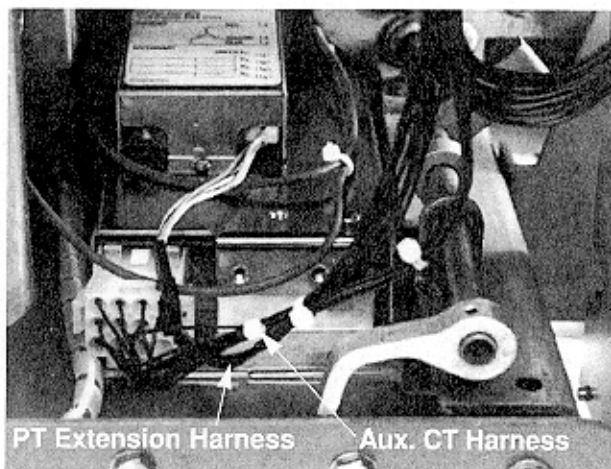
STEP 15:

- A. *For RMS/R 810 & 910 Kits only.* Mount the Microswitch on the Microswitch Mounting Bracket. Mount the Bracket to the right side of the Breaker using the bolts that mount the right side of the Aux. CT Module Mounting Bracket to the Breaker.

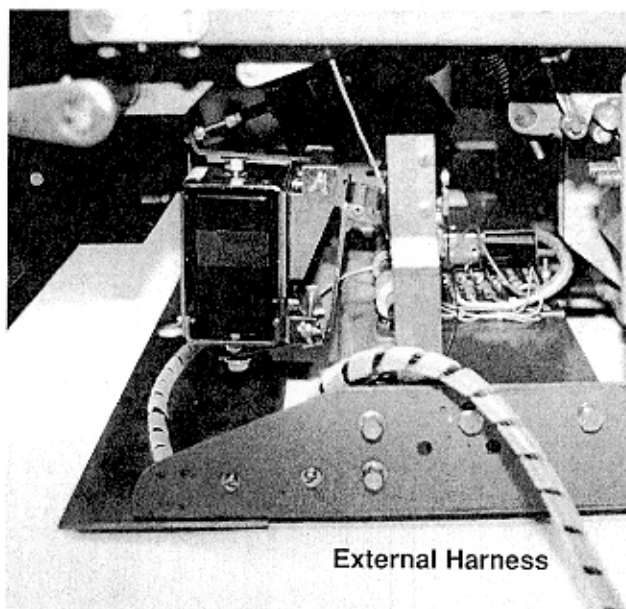


Microswitch & Mounting Bracket
(RMS/R 810 & 910 Kits Only)



STEP 16:

Note: For RMS/R 510 Basic Retrofit Kits. The External Harness is the Plug pictured below. It is to be plugged into the socket at the right rear of the Trip Box.



- A. Plug the White Plug of the Aux. CT Harness into the right side of the Aux. CT Module. Route the Harness over to the Trip Box. Plug the Harness into one of the Sockets at the right rear of the Trip Box.
- B. Plug the External Harness into the sockets at the right rear of the Trip Box. Route the Harness across and attach it to the right front side of the Breaker with the 2 nylon wire clamps and hardware provided.
- C. *For RMS/R 810 & 910 Kits only.* Connect the two wires with the Ring Terminals from the External Harness to the Aux. Switch. Connect one wire to the normally open terminal and the other to the common terminal.
- D. *For RMS/R 810 & 910 Kits only.* Plug the PT Extension Harness into the socket on the PT Module. Route the Harness over to the Trip Box and plug it into the plug coming from the External Harness.
- E. Use nylon wire ties provided to dress up the wiring and to keep it away from any interference of the Breakers moving parts.

STEP 17: The Cell Harness is to be mounted in the Breaker Cell. The Plug End is to be mounted on the right front side of the Cell. The Terminal Blocks can be mounted anywhere space is available in the Cell.

STEP 18: The Retrofit is now complete and ready to be tested.

STEP 19: TESTING THE BREAKER

- A. Measure the force necessary to trip the Breaker at the point where the Trip Adjusting Screw Finger impacts the Breaker Trip Plate. The force necessary to trip the Breaker **MUST NOT EXCEED THREE (3) lbs.**
- B. The Retrofit must be tested using primary injection. Refer to Section 8 of the Instructions for the *Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers* (Publication AD 33-855-2), supplied with the Retrofit Kit, for detailed testing procedures and specifications. For test information specific to the Trip Unit, refer to the IL publication supplied with the Retrofit Kit (see the Pick List for the IL number).
- C. While Section 8 of the *Instructions for the Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers* provides the information necessary for testing the Breaker, please keep the following notes in mind when reviewing other sections of the publication.

**CAUTION**

WHEN ALL TESTING IS COMPLETE, THE TRIP UNIT MUST BE RESET. FAILURE TO DO SO MAY CAUSE THE BATTERY IN THE RATING PLUG TO RUN DOWN.

NOTES:

- 1. *For All Kits Other Than 510 Basic.* If testing the Breaker with Short Delay or Ground Fault functions, be sure to either plug in the Cell Harness Assembly or use the Zone Interlock Shorting Plug. Failure to do so may result in shorter than expected trip times.
- 2. *For 810 and 910 Kits Only.* Without any power applied to the system (neither the 120 volt power supply nor the Aux. Power Module connected), plug the External Harness into the Cell Harness and check the impedance between COM 1 and COM 2. The impedance should be between one (1) and three (3) ohms. If the impedance is not within this range, trace

the wiring and examine each connection to assure its integrity.

Confirm that the PowerNet communication wiring is correct by following the procedures detailed in Section 7.4 of the Instructions for the Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers. Note that for 810 and 910 Kits, the impedance between COM 1 and COM 2 should be between one (1) and three (3) ohms.

When testing is complete, disconnect the External Harness from the Cell Harness. Final External Harness connection will be performed later in the Retrofit Process.

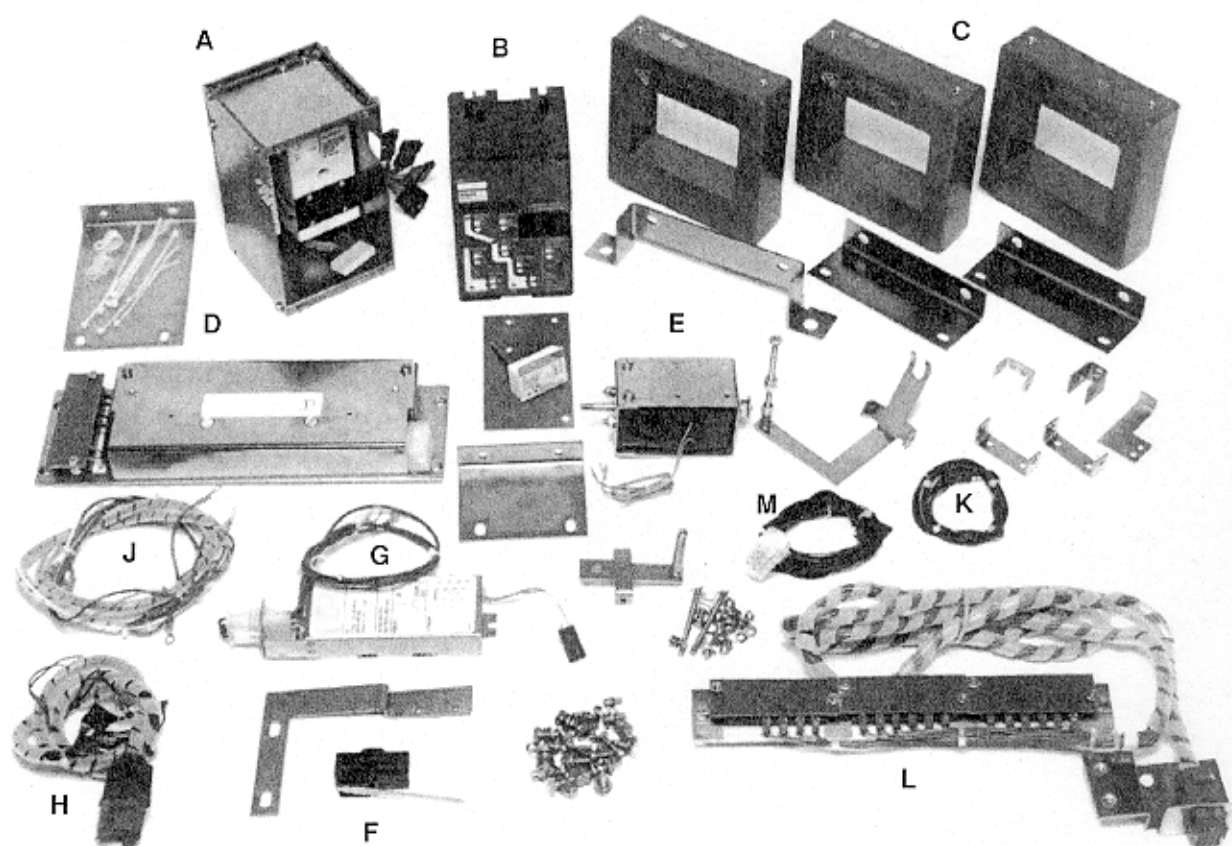
DIGITRIP RETROFIT KIT INSTALLATION COMPONENTS FOR FEDERAL PACIFIC FPS-50 (1600A) BREAKERS

STEP	DESCRIPTION	STYLE NO.	QTY.	COMMENTS
STEP 3	COPPER ADAPTER PARTS	256A85G04	1	
	COPPER ADAPTERS		6	
	.376-16 X 3.00 LNG HEX BOLT		12	
	.375 FLAT WASHER STL		24	
	.375 LOCK WASHER STL		12	
	.375-16 NUT HEX STL		12	
STEP 4	SENSOR 1600/5 MR	8187A57H01	3	FP-50
	SENSOR MOUNTING PARTS	8256A85G15	1	
	MOUNTING BRACKET		2	
	MOUNTING BRACKET		1	
	.250-20 X .500 LNG HEX BOLT		6	
	.250 FLAT WASHER STL		6	
	.250 LOCK WASHER STL		6	
STEP 6	AUX. CT MODULE ASSEMBLY PARTS	8256A85G05	1	810/910 KITS ONLY
	PT MODULE	6502C82G01	1	
	MOUNTING BRACKET (LONG)		1	
	MOUNTING BRACKET (SHORT)		1	
	.190-32 X .500 LNG SCREW FH		4	
	.190 FLAT WASHER STL		4	810/910 KITS ONLY 810/910 KITS ONLY
	.190 LOCK WASHER STL		4	
	.190-32 NUT HEX STL		4	
	.138-32 X .375 LNG SCREW TC		2	
	INSULATION PIECE		1	
STEP 7	AUX. CT MODULE MOUNTING PARTS	8256A85G06	1	
	.250-20 X .750 LNG HEX BOLT		4	
	.250 FLAT WASHER STL		8	
	.250 LOCK WASHER STL		4	
	.250-20 NUT HEX STL		4	
STEP 8	RMS TRIP UNIT	1230C97G__	1	
	TRIP BOX	6506C23G__	1	
	RATING PLUG	3D86701G__	1	
STEP 9	TRIP BOX MOUNTING PARTS	8256A85G07	1	
	.164-32 X .500 LNG SCREW FIL			
	.164-18 X .500 LNG SCREW TC			
	DTA	8256A85G03	1	
	DTA UNIVERSAL	6503C67G01	1	
	DTA MOUNTING PARTS	8256A85G08	1	
	DTA RESET PARTS	8256A85G09	1	
	DTA TRIP ARM PARTS	8256A85G10	1	
	MOUNTING BRACKET		1	
	RESET ASSEMBLY		1	
	TRIP ARM		1	

DIGITRIP RETROFIT KIT INSTALLATION COMPONENTS FOR FEDERAL PACIFIC FPS-50 (1600A) BREAKERS (CONTINUED)

STEP	DESCRIPTION	STYLE NO.	QTY.	COMMENTS
STEP 10	PIVOT BRACKET		1	
	PIVOT SHAFT		1	
	X-WASHER		2	
	FLANGE NUT		2	
	SPRING		1	
	.250 FLAT WASHER STL		2	
	.164-32 X .375 LNG SCREW FIL		4	
	.164-32 X .250 LNG SCREW FIL		2	
	.164 FLAT WASHER STL		6	
	.164 LOCK WASHER		6	
	LOC-TITE 243		1	
STEP 11	BREAKER RESET PARTS	8256A85G11	1	
	BREAKER RESET ASSEMBLY		1	
STEP 13	DTA ASSEMBLY (FROM STEP 10)		1	
	DTA MOUNTING PARTS	8256A85G12	1	
	.250-20 X .750 LNG HEX BOLT		2	
	.250 FLAT WASHER STL		4	
	.250 LOCK WASHER STL		2	
	.250-20 NUT HEX STL		2	
STEP 14	HARNESS MOUNTING PARTS	8256A85G13	1	
	SENSOR HARNESS		1	
	.190-32 X .375 LNG SCREW FIL		1	
	.190 FLAT WASHER STL		1	
	.190 LOCK WASHER STL		1	
	GROMMET		1	
	NYLON WIRE TIES		8	
	RING TERMINAL .375		3	810/910 KITS ONLY
STEP 15	MICROSWITCH		1	810 & 910 KITS ONLY
	MOUNTING BRACKET		1	810 & 910 KITS ONLY
	.138-32 X 1.00 LNG SCREW FIL		2	810 & 910 KITS ONLY
	.138 FLAT WASHER STL		4	810 & 910 KITS ONLY
	.138 LOCK WASHER STL		2	810 & 910 KITS ONLY
	.138-32 NUT HEX STL		2	810 & 910 KITS ONLY
STEP 16	EXTERNAL HARNESS PARTS	8256A85G14	1	
	EXTERNAL HARNESS	6502C83G__	1	
	AUX. CT HARNESS	6502C84G__	1	
	PT EXTENSION HARNESS	6502C85G01	1	810/910 KITS ONLY
	.190-32 X .750 LNG SCREW FIL		2	
	.190 FLAT WASHER STL		4	
	.190 LOCK WASHER STL		2	
	.190-32 NUT HEX STL		2	
	WIRE CLAMP NYLON		2	
	NYLON WIRE TIES		8	
STEP 17	CELL HARNESS	6503C57G__	1	ALL EXCEPT 510 BASIC

TYPICAL RMS/R RETROFIT KIT



- A. Trip Unit Box
- B. RMS/R Trip Unit Assembly
- C. Sensors and Hardware
- D. Auxiliary CT Module
- E. Direct Trip Actuator and Hardware
- F. Auxiliary Switch (810 & 910 Kits Only)

- G. PT Module and Mounting Hardware
(810 & 910 Kits Only)
- H. External Wire Harness
- J. Sensor Harness
- K. PT Extension Harness
- L. Cell Harness
- M. Auxiliary CT Harness

Table 1 Torque Values for General Mounting and Screw Size Conversion

<i>Decimal Size (in)</i>	<i>Standard Size</i>	<i>Torque (in-lbs)</i>	<i>Torque (ft-lbs)</i>
.112	4-40	10	0.8
.138	6-32	18	1.5
.164	8-32	36	3.0
.190	10-32	46	3.8
.250	1/4-20	100	8.3
.312	5/16-18	206	17.2
.375	3/8-16	356	29.7
.438	7/16-14	572	47.7
.500	1/2-13	856	71.3

Table 2 Torque Values for Copper BUS Connectors

<i>Decimal Size (in)</i>	<i>Standard Size</i>	<i>Torque (in-lbs)</i>	<i>Torque (ft-lbs)</i>
.250	1/4-20	60	5
.312	5/16-18	144	12
.375	3/8-16	240	20
.500	1/2-13	600	50

Notes

Notes

Notes

We wish to thank you for purchasing the Digitrip Retrofit System. Digitrip Retrofit Kits are designed and manufactured in America with pride. All the components are engineered to fit the existing Circuit Breaker with little or no modifications to the existing Breaker. However due to the wide variety and vintage of Breakers in use today, an occasional problem may arise. Please contact us with any questions, comments or concerns.

Phone: **1-800-937-5487** Fax. (724) 779-5899

The instructions for installation, testing, maintenance, or repair herein are provided for the use of the product in general commercial applications and may not be appropriate for use in nuclear applications. Additional instructions may be available upon specific request to replace, amend, or supplement these instructions to qualify them for use with the product in safety-related applications in a nuclear facility.

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Cutler-Hammer

Pittsburgh, Pennsylvania U.S.A.

Publication No. I.B. 33-863-1A

February 2001

Printed in U.S.A./TBG00028