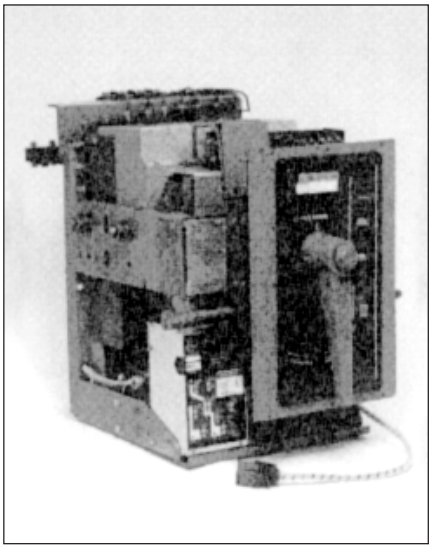
Digitrip Retrofit System for Federal Pacific FP-25 and FP-50 Small Frame (200 to 800A) Breakers



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

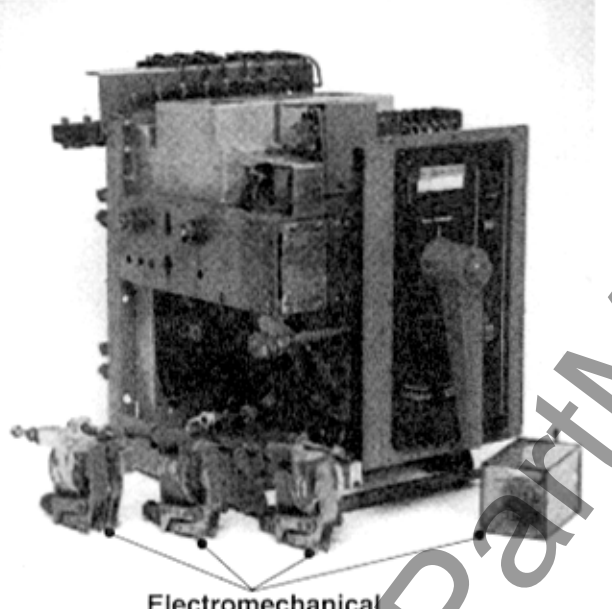
Components	510 Basic	510 with Zone Interlock	610	810	910
Trip Unit					
Rating Plug					
Auxiliary Current Transformer (CT) Module					
Auxiliary CT Harness					
Sensors					
Sensor Harness					
Direct Trip Actuator (DTA)					
Mounting Brackets and Hardware					
External Harness	Plug	1 Connector Harness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

STEP 1: Trip Breaker and remove from Cell. Take 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:



Electromechanical Trip Units

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 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 Breaker Cross Channel.

F. Remove the Insulating Link, hex nuts and Trip Finger from the Linkage Rod.

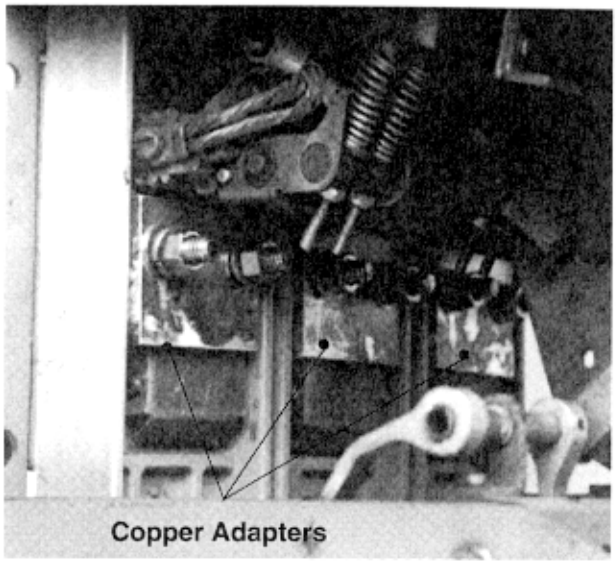
G. Remove the front portion of the Electromechanical Trip Unit from the Breaker. Scrap the Trip Unit, Insulating Link, hex nuts and Trip Finger.

H. Install the bottom front Cross Angle back in its original position using existing hardware. Remove the supports and lower 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 2D through 2I for Phases 2 and 3.

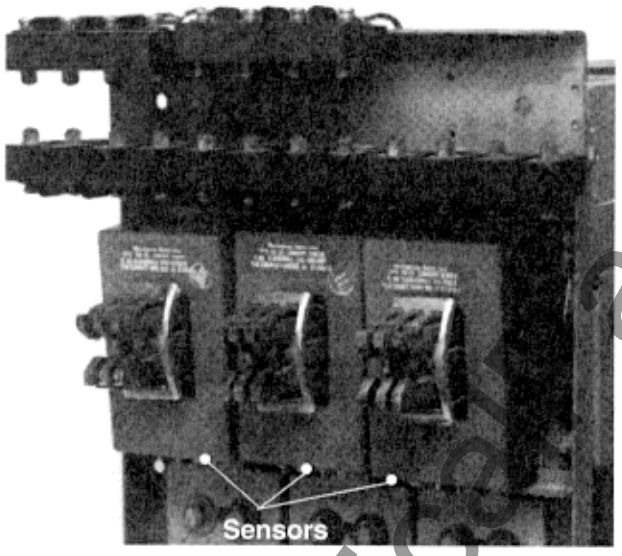
STEP 3:



A. Install a Copper Adapter on each Pole Unit as shown with the hardware provided. The bolts should be installed from the rear of the Breaker using the holes located 1.50 inches above the bottom Studs.

Note: *For RMS/R **810 & 910** Kits only.* Leave one bolt out of each Copper Adapter, it will be installed later along with the PT Module Wires.

STEP 4:



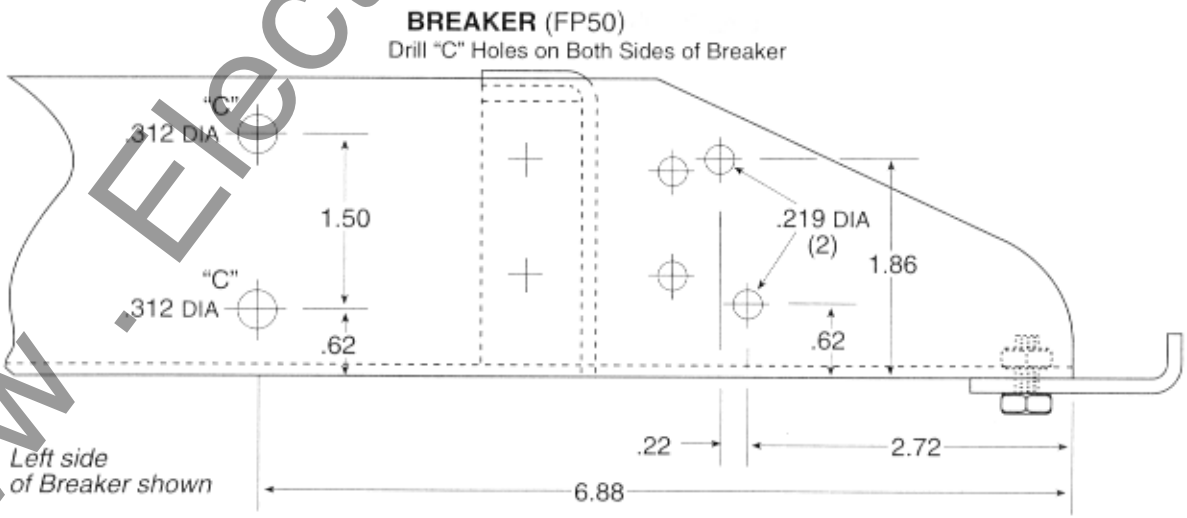
A. Remove the Finger Clusters from the top Studs of the Breaker.

B. Slide a Sensor over each top Stud with the Terminals facing down and Name-plate facing you.

C. Replace the Finger Clusters.

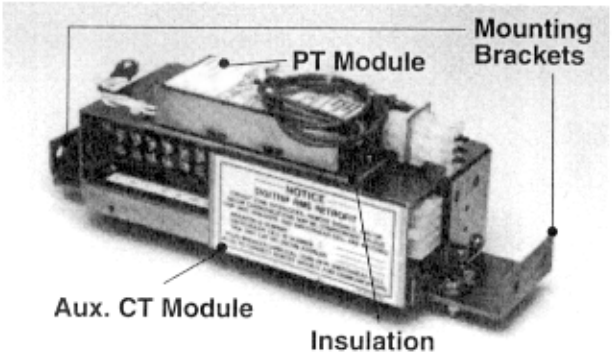
STEP 5:

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



Drilling Plan "A"

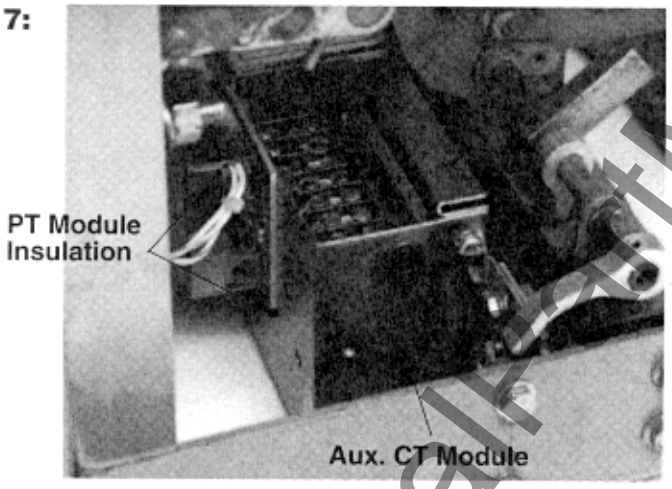
STEP 6:



A. Mount the Mounting Brackets with the legs facing up on the bottom of the Aux. CT Module feet as shown with the hardware provided. The Mounting Bracket with the notch mounts on the Terminal Block end of the Aux. CT Module.

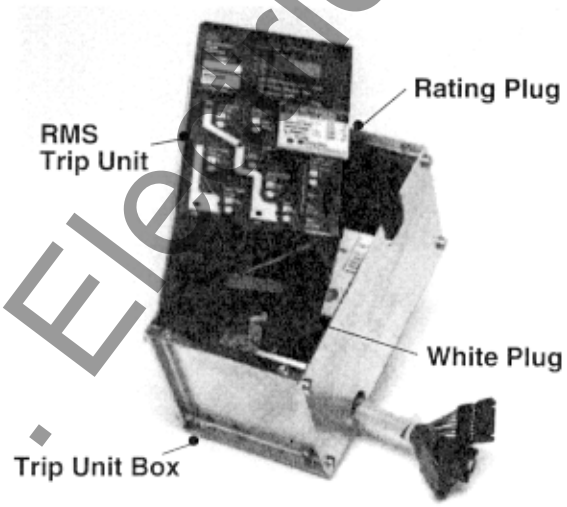
B. For RMS/R **810 & 910** Kits only. Remove and scrap the Warning Nameplate and Mounting Clip from the PT Module. Relocate the White Plug and Mounting down on the PT Module Frame as shown using the existing hardware. Mount the PT Module on top of the Aux. CT Module with the Insulation Piece between as shown using the thread forming screws provided. The White Plugs of the PT Module and Aux. CT Module should face the same direction.

STEP 7:



A. Mount the Aux. CT Module Assembly with the Terminal Block on the left facing up between the Breaker Side Angles as shown. Use the holes just drilled in Step 5 and the hardware provided.

STEP 8:



A. Remove the cover from the Trip Unit Box.

B. For RMS/R **810 & 910** Kits only. 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.

C. Make certain the Jacking Screws on the back of the Trip Unit Box are fully retracted. Turn the Screws clockwise until they stop.

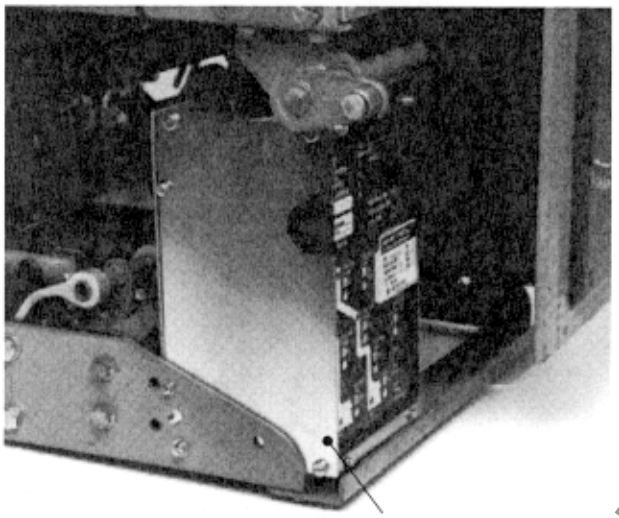
STEP 8: (cont.)

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:

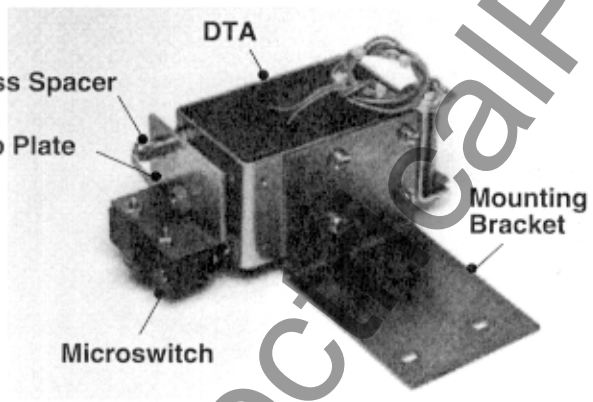


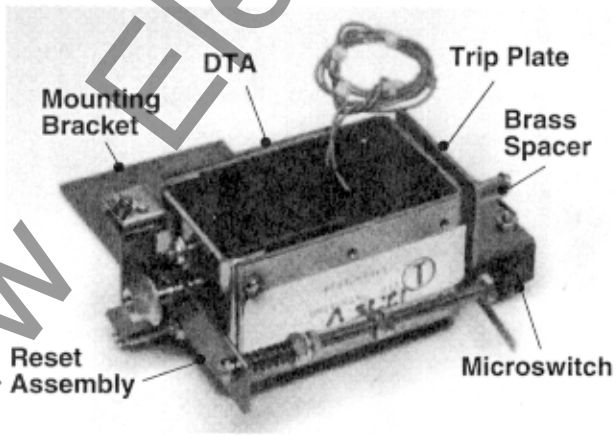
Trip Box Assembly

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. Mount the Mounting Bracket on the DTA as shown with the hardware provided. The leg of the Bracket should be opposite the side that the wires exit and be flush with the end of the Frame.

B. Mount the Reset Assembly on the end of the DTA as shown with the hardware provided.

C. Apply Loc-tite to the threads on the end of the DTA Shaft. Push the Shaft through the hole in the Reset and thread the Flange Nut all the way on. The Reset should float over the Shaft between the Flange of the Nut and the DTA Frame.

D. Apply Loc-tite to the threads of a .164-32 x 1.0 screw, slide the Brass Spacer over the screw and install a hex nut to lock the spacer against the screw head.

E. Install the Brass Spacer Assembly in the top right hole of the DTA Frame in the opposite end of the Reset Assembly.

STEP 10: (cont.)

F. Apply Loc-tite to the threads on the other end of the DTA Shaft. Thread the Trip Plate all the way on the DTA Shaft with the guide hole over the Brass Spacer. Lock in place with a hex nut.

G. For RMS/R 810 & 910 Kits only. Mount the Microswitch Mounting Bracket on the end of the DTA Frame with the leg next to the Trip Plate. Cut 2.50 inches off the end of the Microswitch Lever. Mount the Microswitch on the outside of the Mounting Bracket as shown with the hardware provided.

STEP 11:

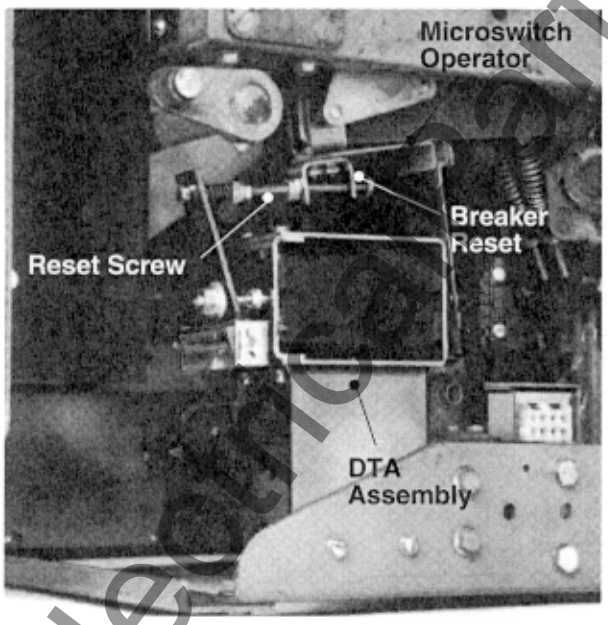
A. Remove the E-Rings from the Phase 3 Wrist Pin, remove the Wrist Pin. Lay the Wrist Pin and E-Rings safely aside.

B. Position the Breaker Reset between Phase 3 flanges of the Breaker Pole Shaft with the Insulating Link in the center.

C. Install the Wrist Pin and E-Rings back in the Breaker, the Breaker Reset will hang from the Wrist Pin. The heads of the screws that hold the Reset together must face up.

Note: *On RMS/R* 810 & 910 *Kits only.* The Microswitch Operator will be between the two sections of the Breaker Reset, it must be on the outside facing the rear with the tab facing down.

STEP 12:



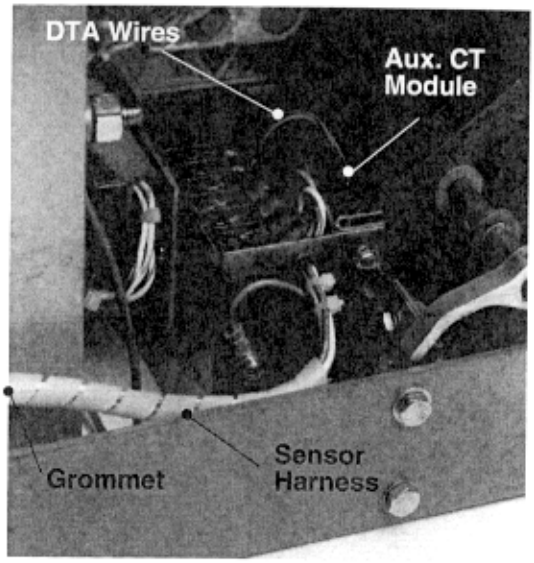
A. Remove the hex nut from the Reset Screw on the DTA Reset.

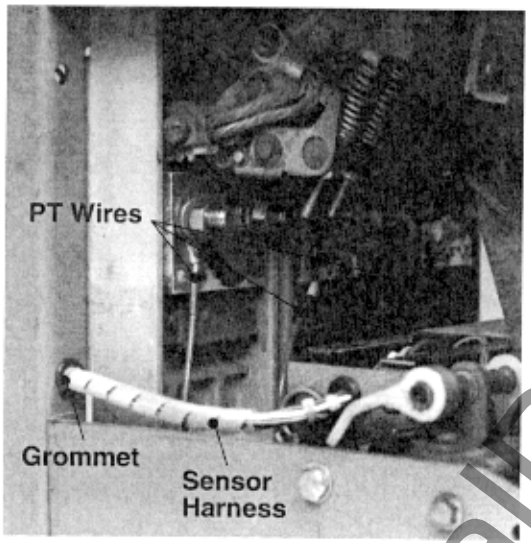
B. Position the DTA Assembly on the inside of the right Breaker Side Angle, the Reset Screw should go through the holes in the Breaker Reset. Mount in place as shown using the existing holes located there with the hardware provided.

C. Apply Loc-tite to the threads on the end of the DTA Screw and replace the hex nut.

D. Connect a 24V DC power supply to DTA Terminals, positive to positive and negative to negative. Close the Breaker manually. Energize the DTA to trip the Breaker, de-energize when Breaker trips. Make certain the DTA is reset. If the Breaker fails to trip, adjust the position of the Trip Plate on the DTA Shaft. If the DTA fails to reset, adjust the hex nuts on the Reset Screw. Repeat until trips and resets are sure and positive every time.

STEP 13:





A. These Instructions refer to the Wiring Diagrams in the Retrofit Application Data for proper connection and application.

B. Route the Snap Spade Terminals of the Sensor Harness through the hole in the left side of the Aux. CT Module Cover. Connect the Terminals to the proper terminals of the 7 point Terminal Block. (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 the top threaded hole in the left side of the Aux. CT Module Cover as shown with the hardware provided.

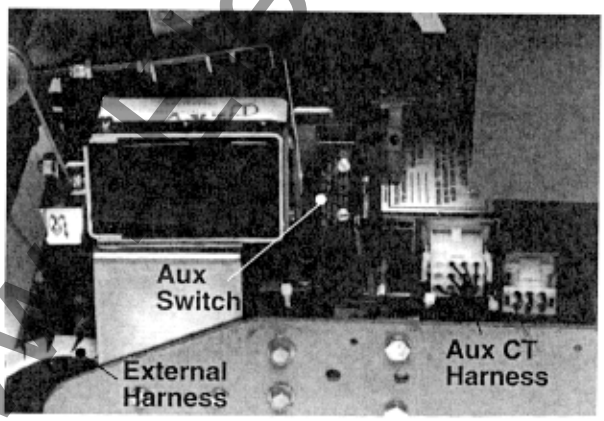
D. Route the DTA Wires over to the 7 point Terminal Block of the Aux. CT Module, connect the wire with + to the 'OP' Terminal and the unmarked wire to the 'ON' Terminal.

E. Install a Grommet in the bottom left hole in the Breaker back Plate. Route the Sensor Harness back through the Grommet and up to the Sensors. Connect the proper Ring Terminals of the Sensor Harness to the correct Terminals of the Sensors.

F. *For RMS/R 810 & 910 Kits only:* Route the 3 wires from the PT Module back to the Copper Adapters installed in Step 3A. Cut the wire marked with Red or 1 to Phase 1. Cut the wire marked with yellow or 2 to Phase 2. Cut the wire marked with blue or 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 wiring and keep it away from any interference of Breaker moving parts.

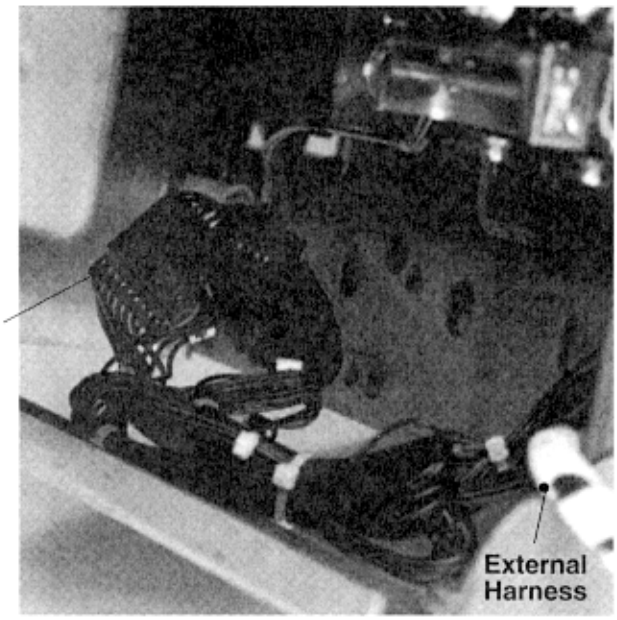
STEP 14:



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 the Socket 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 DTA mounting screws with two nylon wire clamps as shown with the hardware provided.

STEP 14: (cont.)



Note: For RMS/R 510 Basic Retrofit Kits, the External Harness is the plug pictured at right. It is to be plugged into the right side of the Trip Unit.

C. *For RMS/R 810 & 910 Kits only.* Connect the two wires with 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 up to the Trip Box and plug it into the plug coming from the External Harness.

E. Use nylon wire ties provided to dress up wiring and keep it away from any interference of Breaker moving parts.

STEP 15: 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 16: The Retrofit is now complete and ready to be tested. See the Retrofit Application Data for test procedures.

STEP 17: 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.

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 FP-25 AND FP-50 (SMALL FRAME)

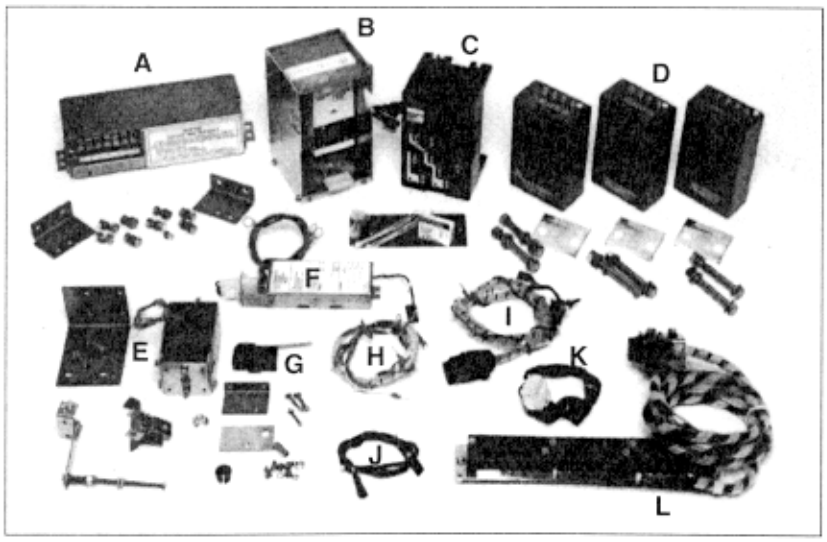
STEP	DESCRIPTION	STYLE NO.	QTY	COMMENT
STEP 3	COPPER ADAPTER PARTS	8256A85G04	1	
	COPPER ADAPTERS		3	
	.376-16 X 3.00 LNG HEX BOLT		6	
	.375 FLAT WASHER STL		12	
	.375 LOCK WASHER STL		6	
	.375-16 NUT HEX STL		6	
STEP 4	SENSOR 600/5 MR	8184A39H01	3	FP-25 & FP-50
	SENSOR 800/5	8184A75H01	3	FP-50 ONLY
STEP 6	AUX. CT MODULE ASSEMBLY PARTS	8256A85G05	1	
	PT MODULE	6502C82G01	1	810/910 KITS ONLY
	MOUNTING BRACKET		1	
	MOUNTING BRACKET		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	
	.138-32 X .375 LNG SCREW TC		2	810/910 KITS ONLY
	INSULATION PIECE		1	810/910 KITS ONLY
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		1	
	.138-32 X .375 LNG SCREW TC			
STEP 10	DTA	8256A85G03	1	
	DTA UNIVERSAL	6503C87G01	1	
	DTA MOUNTING PARTS	8256A85G08	1	
	DTA RESET PARTS	8256A85G09	1	
	DTA TRIP PLATE PARTS	8256A85G10	1	
	AUX. SWITCH KIT	8256A85G02	1	810/910 KITS ONLY
	MOUNTING BRACKET		1	
	RESET ASSEMBLY		1	
	TRIP PLATE		1	
	.164-32 X .375 LNG SCREW FIL		2	
	.164-32 X .250 LNG SCREW FIL		4	
	.164 FLAT WASHER STL		6	
	.164 LOCK WASHER		6	
	.164-32 X 1.00 LNG SCREW FIL		1	
	.164-32 NUT HEX STL		1	
	.250-20 NUT HEX STL		1	
	SPACER BRASS		1	
	LOC-TITE 243		1	
	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
	.164-32 X .250 LNG SCREW FIL		2	810/910 KITS ONLY
	.164 FLAT WASHER STL		2	810/910 KITS ONLY
	.164 LOCK WASHER STL		2	810/910 KITS ONLY
STEP 11	BREAKER RESET PARTS	8256A85G11	1	
	BREAKER RESET ASSEMBLY		1	

DIGITRIP RETROFIT KIT INSTALLATION COMPONENTS FOR FEDERAL PACIFIC FP-25 AND FP-50 (800A). *(CONTINUED)*

STEP	DESCRIPTION	STYLE NO.	QTY	COMMENT
STEP 12	DTA ASSEMBLY (FROM STEP 10)		1	
	DTA MOUNTING PARTS	8256A85G12	1	
	.190-32 X .750 LNG SCREW FIL		2	
	.190 FLAT WASHER STL		4	
	.190 LOCK WASHER STL		2	
	.190-32 NUT HEX STL		2	
STEP 13	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 14	EXTERNAL HARNESS PARTS	8256A85G14	1	
	EXTERNAL HARNESS	6502C83G__	1	
	AUX. CT HARNESS	6502C84G__	1	
	PT EXTENSION HARNESS	6502C85G01	1	810/910 KITS ONLY
	.190 FLAT WASHER STL		2	
	.190 LOCK WASHER STL		2	
	.190-32 NUT HEX STL		2	
	WIRE CLAMP NYLON		2	
	NYLON WIRE TIES		8	
STEP 15	CELL HARNESS	6503C57G__	1	ALL EXCEPT 510 BASIC

NOTE: DUE TO THE WIDE VINTAGE OF BREAKERS AND MULTIPLE FUNCTIONS OF THE RETROFIT COMPONENTS SOME EXCESS HARDWARE MAY BE LEFT WHEN THE RETROFIT IS COMPLETE.

Typical RMS/R Retrofit Kit



A - Aux. CT Module
B - Trip Box
C - RMS/R Trip Unit
D - Sensors
E - Direct Trip Actuator and Hardware
F - PT Module (*810 & 910* Kits Only)
G - Aux. Switch (*810 & 910* Kits Only)
H - Sensor Harness
I - External Harness
J - PT Extension Harness
K - Aux. CT Harness
L - Cell Harness

Table 1 Torque Values for General Mounting and Screw Size Conversion

Decimal Size (in)	*Standard Size*	*Torque (in-lbs)*	*Torque (ft-lbs)*
.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

Decimal Size (in)	*Standard Size*	*Torque (in-lbs)*	*Torque (ft-lbs)*
.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

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.

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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.

The information, recommendations, descriptions, and safety notations in this document are based on Cutler-Hammer's experience and judgement with respect to Retrofitting of Power Breakers. This information should not be considered to be all inclusive or covering all contingencies. If further information is required, Cutler-Hammer should be consulted.

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