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



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.

Effective 2/01

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.

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

Table 1 Available Retrofit Kits

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:

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- 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.

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.
- 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.





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.

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 7:

PT Wires (RMS/R 810 & 910 Kits Only)

Jumper Plates

STEP 8:

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A. Remove the Cover from the Trip Unit Box.

PT Module (810 & 91 Kits Only

> 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 13:

STEP 14:



PT Exension Hamess PT Wires Sensor Harness 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.
- 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 (cont.) 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.
 - 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:

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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)

Microswitch -& Mounting Bracket

DTA Wires

Sensor Harness

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.

Etternal Harness

- 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.

 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.

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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.



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 COPPER ADAPTERS .376-16 X 3.00 LNG HEX BOLT .375 FLAT WASHER STL .375 LOCK WASHER STL .375-16 NUT HEX STL	256A85G04	1 6 12 24 12 12	S
STEP 4	SENSOR 1600/5 MR SENSOR MOUNTING PARTS MOUNTING BRACKET MOUNTING BRACKET .250-20 X .500 LNG HEX BOLT .250 FLAT WASHER STL .250 LOCK WASHER STL	8187A57H01 8256A85G15	3 1 2 1 6 6 6 6	FP-50
STEP 6	AUX. CT MODULE ASSEMBLY PARTS PT MODULE MOUNTING BRACKET (LONG) MOUNTING BRACKET (SHORT) .190-32 X .500 LNG SCREW FH .190 FLAT WASHER STL .190 LOCK WASHER STL .190-32 NUT HEX STL .138-32 X .375 LNG SCREW TC INSULATION PIECE	8256A85605 6502C82G01	1 1 1 4 4 4 4 2 1	810/910 KITS ON 810/910 KITS ON 810/910 KITS ON
STEP 7	AUX. CT MODULE MOUNTING PARTS .250-20 X .750 LNG HEX BOLT .250 FLAT WASHER STL .250 LOCK WASHER STL .250-20 NUT HEX STL	8256A85G06	1 4 8 4 4	
STEP 8	RMS TRIP UNIT TRIP BOX RATING PLUG	1230C97G 6506C23G 3D86701G	1 1 1	
STEP 9	TRIP BOX MOUNTING PARTS .164-32 X .500 LNG SCREW FIL .164-18 X .500 LNG SCREW TC DTA DTA UNIVERSAL DTA MOUNTING PARTS DTA RESET PARTS DTA TRIP ARM PARTS MOUNTING BRACKET RESET ASSEMBLY	8256A85G07 8256A85G03 6503C67G01 8256A85G08 8256A85G09 8256A85G10	1 1 1 1 1 1 1	

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

STEP	DESCRIPTION	STYLE NO.	QTY.	COMMENTS
STEP 10	PIVOT BRACKET PIVOT SHAFT X-WASHER FLANGE NUT SPRING .250 FLAT WASHER STL .164-32 X .375 LNG SCREW FIL .164-32 X .250 LNG SCREW FIL .164 FLAT WASHER STL .164 LOCK WASHER LOC-TITE 243		1 2 2 1 2 4 2 6 6 1	Sol
STEP 11	BREAKER RESET PARTS BREAKER RESET ASSEMBLY	8256A85G11		
STEP 13	DTA ASSEMBLY (FROM STEP 10) DTA MOUNTING PARTS .250-20 X .750 LNG HEX BOLT .250 FLAT WASHER STL .250 LOCK WASHER STL .250-20 NUT HEX STL	8256A85G12	1 1 2 4 2 2	
STEP 14	HARNESS MOUNTING PARTS SENSOR HARNESS .190-32 X .375 LNG SCREW FIL .190 FLAT WASHER STL .190 LOCK WASHER STL GROMMET NYLON WIRE TIES RING TERMINAL .375	8256A85G13	1 1 1 1 1 8 3	810/910 KITS ONLY
STEP 15	MICROSWITCH MOUNTING BRACKET .138-32 X 1.00 LNG SCREW RIL .138 FLAT WASHER STL .138 LOCK WASHER STL .138-32 NUT HEX STL		1 1 2 4 2 2	810 & 910 KITS ONLY 810 & 910 KITS ONLY
STEP 16	EXTERNAL HARNESS PARTS EXTERNAL HARNESS AUX. CT HARNESS PT EXTENSION HARNESS .190-32 X .750 LNG SCREW FIL .190 FLAT WASHER STL .190 LOCK WASHER STL .190-32 NUT HEX STL WIRE CLAMP NYLON NYLON-WIRE TIES	8256A85G14 6502C83G 6502C84G 6502C85G01	1 1 1 2 4 2 2 8	810/910 KITS ONLY
STEP 17	CELL HARNESS	6503C57G	1	ALL EXCEPT 510 BASIC

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TYPICAL RMS/R RETROFIT KIT



A. Trip Unit Box

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- 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

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•		0	
Decimal Size (in)	Standard Size	Torque (in-lbs)	Torque
0120 (111)	0120	(11-103)	(11-103)
.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 1 Torque Values for General Mounting and Screw Size Conversion

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.

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.

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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Cutler-Hammer

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