

etc-12 e-series, direct replacement retrofit for

WESTINGHOUSE / CUTLER HAMMER “DS” POWER BREAKERS

Section 1 Installation Manual

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Introduction:

The Satin American etc-12 / etd retrofit system is designed to replace obsolete solid state tripping systems on OEM power circuit breakers. Upgrading with the *etc-12* allows for the utilization of modern controls and safety features without significant downtime or expense.

These instructions are intended to serve as guidelines to individuals with circuit breaker maintenance experience to install the *Satin American etc-12/etd* trip unit on *Westinghouse "DS"* series circuit breakers that originally had *Amptector* trip units installed.

Kit installation requires familiarity with circuit breaker operation and maintenance, careful workmanship and compliance with all instructions. The conversion requires removal of the existing trip unit and installation of *etc* components. In this application, the original current sensors, flux trip actuator, and breaker wiring is utilized.

The *etd* display can either be nested with the

etc-12 controller or mounted outside of the breaker cubicle to facilitate safe monitoring of loads and settings. If the display is to be remote mounted, minor wiring and modifications to the cubicle door will be required.

A direct replacement for the original flux trip actuator is optionally available. This manual provides instructions for installation of this replacement.

Each kit is supplied with all of the necessary materials to upgrade the circuit breaker. In the special instance where a breaker is applied with ground fault protection on a 4-wire system, an additional neutral sensor, copper details and secondary disconnects may be required. Contact the factory before beginning a conversion of such a system.

Note that this retrofit kit is not intended to increase the interrupting capacity of a breaker. The converted breaker must be applied within its original short-circuit ratings

WARNING!!

TO PREVENT ELECTRICAL SHOCK OR INJURY, DISCONNECT THE BREAKER FROM ALL PRIMARY AND SECONDARY POWER SOURCES AND CONFIRM THAT THE BREAKER IS OPEN AND THE CHARGING SPRINGS ARE DISCHARGED BEFORE DOING ANY WORK.

REFER TO NFPA-70E FOR COMPREHENSIVE ELECTRICAL SAFETY GUIDELINES.

IMPORTANT!!

RETROFITTED BREAKERS MUST BE PERFORMANCE TESTED BEFORE BEING RETURNED TO SERVICE. PRIMARY INJECTION TESTING IS STRONGLY RECOMMENDED. REFER TO THE TESTING SECTION IN THE SECTION II MANUAL FOR DETAILED INSTRUCTIONS.

1.0 Required Tools:

As each installation situation is unique, it is advised that a complete set of tools are available. The below list details the absolute minimum complement of tools required to complete this task.

- Socket set – 3/8” drive
- Crimping tools
- Open end wrench set
- Assorted screwdrivers
- Ball-peen hammer
- Center punch
- Electric drill
- Drill bit set
- 9V battery

Reference Material:

- Manufacturers Circuit Breaker Maintenance Manual
- *etc-12 / etd* section II manual

2.0 Pre-Installation:

- 2.1. Verify that the proper kit was supplied and thoroughly inspect it for damage or missing components.
- 2.2. Read and understand these instructions before beginning the retrofit.
- 2.3. Place the breaker on a sturdy surface, in a clean work area where there is access to all sides of the breaker.
- 2.4. Perform a detailed mechanical inspection of the breaker. At a minimum, verify that the breaker opens and closes properly. Any mechanical problems should be fixed before starting the retrofit project. Normal maintenance can be performed prior to or during kit installation.

3.0 Programmer Installation:

IMPORTANT!!

BEFORE PROCEEDING, VERIFY THAT THE BREAKER IS OPEN AND CHARGING SPRINGS ARE DISCHARGED

- 3.1. Remove and retain the operating handle by removing the bolt which secures it to the man manual charging lever. The bolt is located on the bottom, underneath the handle.
- 3.2. Remove and retain the screws that hold the front cover. Depending on the breaker type, there can be either 4 or 6 screws.
- 3.3. Tag and remove the wire harness that is attached to the *Amptector* programmer. Take care not to damage the harness as it will be re-used.
- 3.4. Locate and remove the two screws that fasten the *Amptector* to the breakers top cover plate. Discard the existing programmer but retain the hardware.
- 3.5. Install the new *etc* programmer onto the top plate of the circuit breaker. The mounting feet on the programmer will align with the existing holes on the breaker and it will be secured with the hardware retained in step 3.4. If necessary, minor adjustments can be made by loosening the 4 nuts on the bottom of the programmer mount.

4.0 Wiring

In most instances, the new trip unit can be wired in the same fashion as the original device but special care should be given to ensure that proper connections are made to the ground and neutral terminals. **Improper wiring can result in either nuisance ground fault trips or this protection band being unintentionally defeated.**

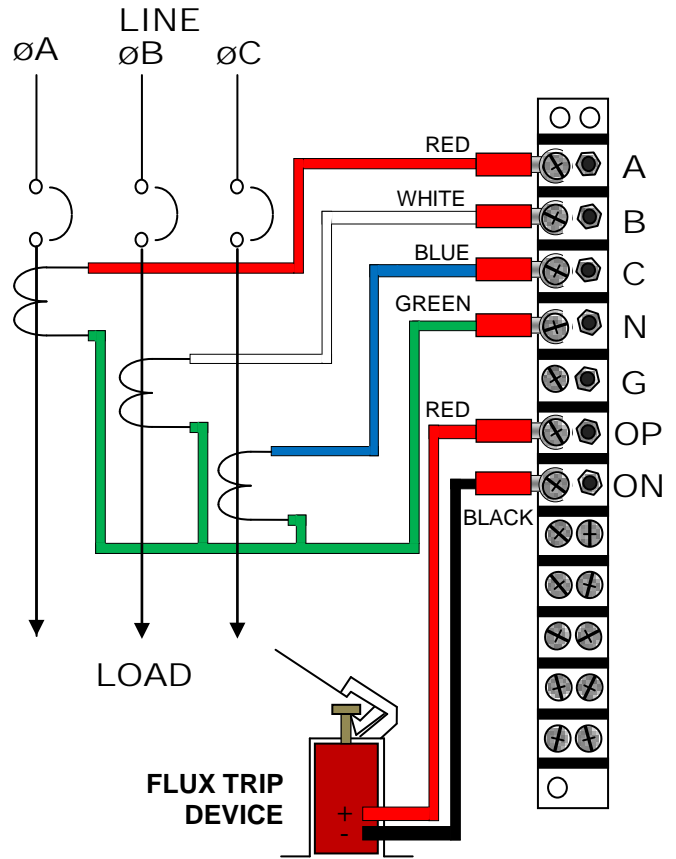
4.1. The *etc-12 e-series* can be wired to work with several ground fault protection schemes. It is important that the trip unit is wired appropriately for the specific application.

IMPORTANT!

In some original applications, the trip unit is wired as shown in figure 1, this wiring defeats ground fault protection. If ground fault protection is not required, it is recommended that the *etc-12* trip unit be wired for the appropriate ground fault scheme and protection be defeated through the *etc-12* setup menu. Refer to the *Section II* manual for further details.

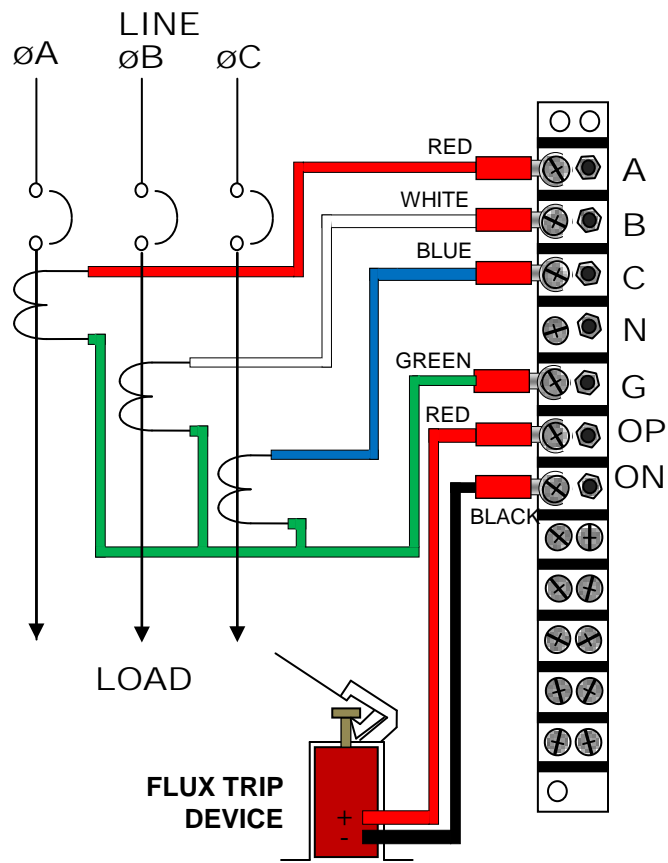
NOTE:

Figures 1 through 4 depict existing wiring colors as found on many original breakers. These colors may vary from breaker to breaker and it is important to visually verify wiring.

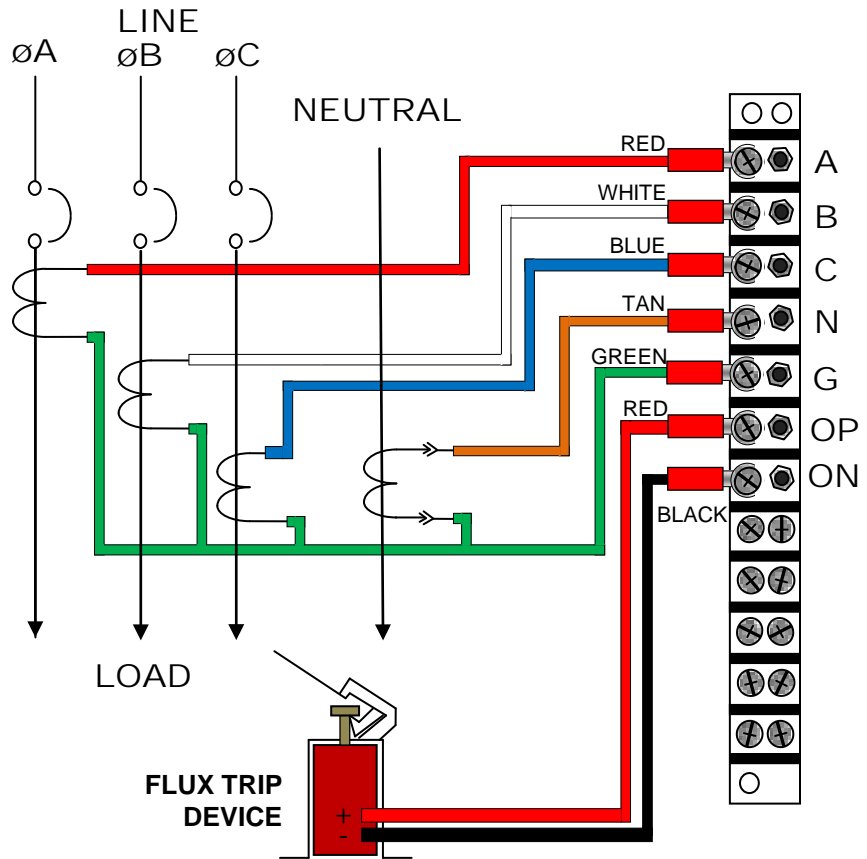


**FIGURE 1,
WIRING WHICH DEFEATS GROUND
FAULT PROTECTION (NOT RECOMMENDED
BUT MAY EXIST ON ORIGINAL BREAKER)**

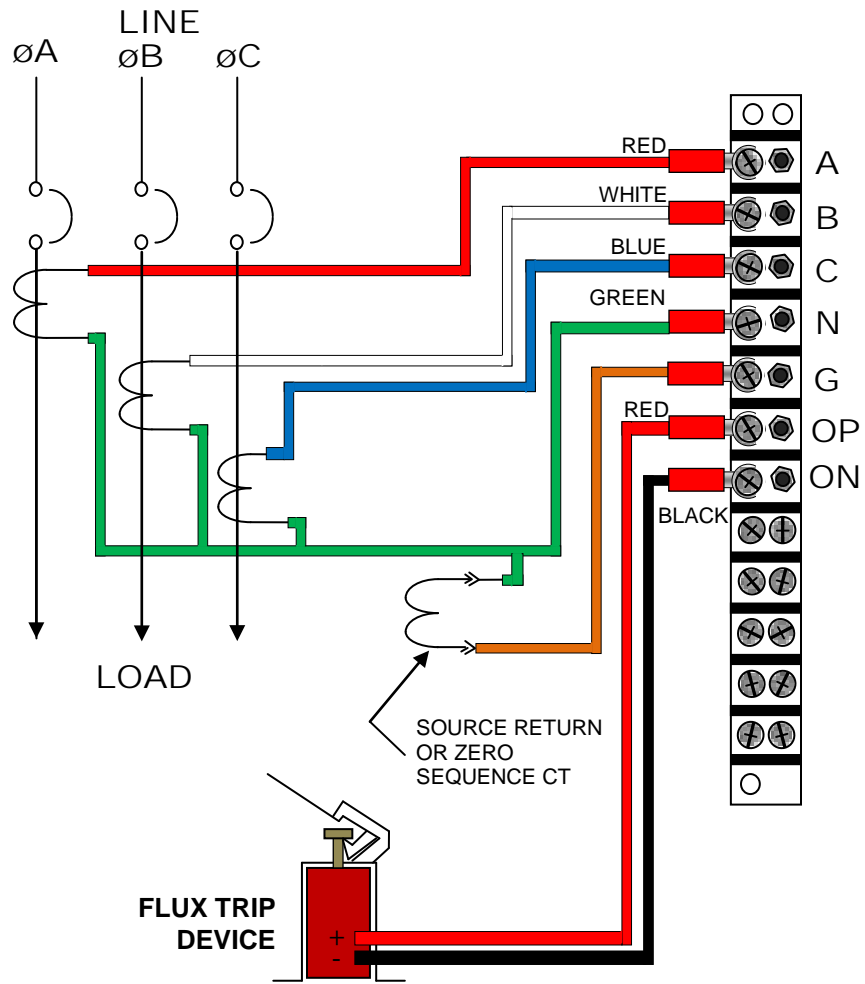
- 4.2. For 3 wire applications, both with and without ground fault protection, the *etc-12 e series* should be wired in accordance with figure 2.
- 4.3. For 4 wire applications utilizing residual ground fault, the *etc-12 e series* should be wired in accordance with figure 3.
- 4.4. For 3 or 4 wire applications that utilize either an external source ground or a zero-sequence ground, the *etc-12 e series* should be wired in accordance with figure 4.



**FIGURE 2,
RECOMMENDED WIRING FOR 3 WIRE APPLICATIONS
BOTH WITH AND WITHOUT GROUND FAULT PROTECTION**



**FIGURE 3,
WIRING FOR 4 WIRE RESIDUAL GROUND
FAULT APPLICATIONS**



**FIGURE 4,
WIRING FOR SOURCE GROUND OR ZERO
SEQUENCE FOR BOTH 3 AND 4 WIRE
APPLICATIONS**

5.0 Replacement of OEM flux trip device:

If a replacement flux trip device was not purchased as part of this kit, proceed with step 6.0.

NOTE

A video showing the installation of a flux trip device on a *Westinghouse DS* style circuit breaker is available on the *Satin American* web site and can be viewed at the following URL:

<http://www.etc-12.com/downloads/DS-416.mov>

- 5.1. Locate the existing flux trip device in the lower left portion of the circuit breaker.
- 5.2. Taking care to avoid damage, move the breaker so that it lies on its backside.
- 5.3. Remove and retain the three bolts and washer securing the existing flux trip device.
- 5.4. Remove and retain the trip bar spring. This is a small spring located on the left side of the actuator by the trip bar screw. **IT IS IMPORTANT TO LOCATE AND REMOVE THIS SPRING PRIOR TO REMOVING THE FLUX TRIP DEVICE. FAILURE TO DO SO WILL RESULT IN THE SPRING BEING LOST OR DAMAGED.**
- 5.5. Remove the two wires connecting the programmer to the flux trip device and discard the flux trip device.
- 5.6. Install the new flux trip using the hardware retained in step 5.3 and the reset spring retained in step 5.4, taking care to properly align the reset arm of the flux trip with the main breaker reset bar. There is a small arm welded to the main reset bar that mates with the reset arm of the flux.

5.7. Route flux trip wires to the programmer terminal block. Be sure to avoid moving parts. The flux device is polarity sensitive and the black wire must connect to the *OP* while the white wire connects to *ON*. Additional flux trip wire and knife connectors are supplied with the kit for situations where provided lead lengths are insufficient.

5.8. Verify proper operation of the flux by firing repeatedly with a 9-volt battery.

6.0 Installing the escutcheon plate:

Two versions of the escutcheon plate are available. The windowed version is designed to allow the *etd* display unit to be nested into the *etc-12* controller. The solid version is intended completely cover the original opening to allow for the remote mounting of the *etd* display unit. The procedure for mounting these plates is the same regardless of which version is used.

- 6.1. Using the plate as a template, mark and drill four 7/32 inch (.218) diameter holes.
- 6.2. Attach plate with hardware provided.
- 6.3. If the *etd* is to be remote-mounted, route the display cable through the grommet in the plate. Route cable away from moving parts and be sure to leave enough slack to account for the motion of the breaker when it is being racked. Shorten cable or securely tie-off any excess.



FIGURE 5, etd Installed with windowed escutcheon plate

7.0 Re-Assembling the Beaker:

- 7.1. Attach the original front cover plate onto the breaker using the hardware retained in step 3.2.
- 7.2. Install the closing handle onto the front of the circuit breaker by reusing the hardware retained in step 3.1.
- 7.3. Verify proper mechanical operation by opening and closing several times.

8.0 Testing:

- 8.1. It is recommended that all testing be performed in *Test Mode*. Ground fault, short-time, instantaneous and phase imbalance protection bands can be temporarily disabled if they interfere with other functions during test.
- 8.2. Refer to the *etc-12/etd Section II* manual for specific test procedures and further information regarding *Test Mode*.
- 8.3. The programmer can be tested using one of three methods:
 - a) Primary Injection
 - b) Secondary injection using a *Westinghouse Amptector* test set.

- c) Secondary injection testing using a *Satin American etc-pts* test set with the *pts adaptor*.

Primary Injection Testing:

- 8.4. No special considerations are required for primary injection testing a breaker equipped with this retrofit kit.

Testing using the *Westinghouse Amptector* test set:

- 8.5. The connector on the *Westinghouse Amptector* test set mates with the terminals on the interposing *CT* assembly on the *Satin e series* kit.
- 8.6. Some versions of the *Westinghouse Amptector* test set are unable to supply more than 400% current to the *etc-12*. It may be necessary to temporarily lower settings on the *etc-12* in order to verify performance. It is recommended that the *etc-12* be placed in *Test Mode* before making these modifications. Upon exiting *Test Mode*, the original settings will be restored.



FIGURE 6, etc-12/etd Undergoing Test with *Westinghouse Amptector* Test Set

Testing using the Satin American *etc-pts* and the *pts adaptor*:

- 8.7. When the *etc-12* trip unit is tested using the *etc-pts* and *pts adaptor*, the interposing CT assembly is bypassed and the test current is injected directly into the *etc-12* controller.
- 8.8. Remove the front cover of the breaker and the *etd* display, slide the aluminum connecter cover upwards to access the *etc-12* harness. This harness shall be unplugged from the *etc-12* and connected to the appropriate harness originating from the *PTS adaptor*.
- 8.9. If the *etc-12* trip unit is being tested off of the breaker, either the “*Trip Breaker / Programmer*” switch on the *etc-pts* must be in the “*Trip Breaker*” position or the *PTS adaptor* breaker cable must be connected to a flux trip device.



FIGURE 8, *etc-12* Undergoing Test with the Satin American *etc/pts* with the *pts adaptor*

NOTE: The *Amptector*, *Digitrip* and *DS* series breakers are products of the *Westinghouse / Eaton / Cutler Hammer* Corporations