

# **REDUCE ARC-FLASH EXPOSURE** and **INCREASE RELIABILITY**

etc.12



*Upgrade any 480/600V circuit breaker manufactured since 1930* 





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[ U.S. patent number 7612988 other patents pending ]

# **BASICS OF POWER BREAKER LIFE EXTENSION:**



Low-voltage "air" power circuit breakers were designed in the late 1930's. For the past seventy five years, and

even today, they have been used in virtually every industrial application. Between the 1930's and 1960's, these breakers utilized series overload devices to sense current and provide time delays. While the series overload is a robust and reliable design, it has several limitations. Specifically, overloads do not offer the precision and selectivity available with modern electronics, and certain protective functions, such as ground fault, are simply not available.

Despite these limitations, some new breaker designs used overloads into the 1980's. Around this time, numerous failures began to manifest due to the fact that many of the existing overloads were reaching the end of their useful life. Some of the biggest problems involved oil leaking from dashpots, and oil changing viscosity, affecting the time delay feature of the dashpots.

Because the old power breakers were well made and expected to have a long service life, they were frequently employed in critical applications that require continuous operation. Replacing a failed overload or older generation solid-state trip is often problematic because most OEMs no longer provide support for these systems. Commonly, OEMs recommend replacing the old breakers with the current production model. Not only is this approach

expensive, it often requires significant downtime as switchgear needs to be replaced along with the breakers.

To address these issues, Satin American developed the etc upgrade system in 1988. Using this system, any vintage of US manufactured breaker from pre-WWII to the present, can quickly and economically be upgraded. A properly remanufactured breaker is mechanically superior to those currently in production. The etc-12 allows these old breakers to be updated with advanced electronic controls and ensures that they will continue to function reliably for decades.

> Although most power circuit breakers that are presently in use have already been retrofitted with older generation solid state trip units, many users are choosing to upgrade these breakers with the state of the art etc-12. This is because the etc-12 provides more accurate metering and advanced selectivity, as well as, many features that are unavailable on lesser units. Most importantly, upgrading with the etc-12 significantly improves operator safety with features such as the remote mountable display, flashSAFE arcflash reducing

maintenance mode, and mechanical automatic reset actuators.





## **SYSTEM FEATURES:**

Satin American etc-12 upgrades are specifically designed for each low voltage air circuit breaker manufactured from the 1930's to the present. A typical upgrade includes an electronic trip unit with display module, current sensors, automatic reset actuator, wiring harness and any required mounting brackets or copper shunts. While complete systems for each breaker type are available, it is sometimes possible to utilize existing components to reduce cost. All major components are manufactured in the United States under exacting quality requirements. The following is an overview of the key components used in a typical upgrade:



### **ELECTRONIC TRIP UNIT AND DISPLAY:**

The etc-12/etd trip unit is unique because it is constructed as a two-piece design, with a digital breaker control module (the etc-12) and a breaker display module (the etd). These two modules can be nested together and mounted on the breaker as the functional equivalent of a traditional one piece trip unit, or the display can be mounted remotely for increased safety and convenience.



### MULTI-TAPPED CURRENT TRANSFORMERS:

Multi-tapped current transformers are standard with all etc-12 upgrades. This, coupled with the fact that the trip unit has the widest range of settings of any on the market, make a breaker outfitted with an etc-12 extremely versatile. All upgrades are equipped with full LSIG protection plus phase imbalance and flashSAFE maintenance mode, any of which can be defeated if not needed.



#### MECHANICAL AUTO-RESET ACTUATOR:

All etc-12 upgrades include a mechanical automatic reset actuator as a standard feature. These actuators are the best in the industry and do not require an operator to reach near energized bus or even open the cubicle door to reset.

### **SAFETY AND NFPA-70E**



An "electrically safe work condition" used to mean that a work area was free from shock and electrocution hazards. This traditional thinking ignores the fact that more than 80% of electrical workplace accidents are burns or injuries caused by the intense heat and blast associated with an arc-flash. Industry trends including the ever-increasing of loads, heightened reliance on on-site generation and further demands for continuous operation have increased the risk factor.

Statistically, five to ten arc-flash events occur daily in the United states. These incidents result in injury or death to personnel, unexpected downtime, damage to equipment as well as fines and legal fees. A 1999 EPRI study estimated that the cost of a single Flash event averages \$15.75 MILLION dollars. Moreover, legal obligations from such an incident can extend from the property owner to contractors, subcontractors and even individual engineers and managers. OSHA recognizes NFPA-70E as an accepted industry standard and, under the general duties clause, requires that all employers provide a safe work environment. This means that every commercial facility that uses electric power must assess electrical safety hazards and take steps to mitigate these risks. Often, solutions for addressing high hazard categories involve reducing time to trip or adding distance between the operator and the live bus. Standard features in all etc-12 upgrades such as the remote mountable display,

auto reset actuator and *flash*SAFE maintenance mode provide a simple and effective way to accomplish these tasks.





etc·12

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### **SAFETY FEATURES:**

The etc-12 is the first tripping system specifically designed around operator safety. Every retrofit kit is supplied with a remote mountable display and a fully functional flashSAFE maintenance mode. These features, coupled with the auto-reset actuator make the etc-12 an effective choice for NFPA-70E compliance.



#### **REMOTE MOUNTABLE DISPLAY**

The remote mountable display that is included with all etc-12 upgrades can be installed in a safe location outside of the switchgear so that workers no longer need to suit up to view loads, settings and trip history. The backlight display functions as an accurate 3-phase ammeter with the ability to display ground fault current in real time. Unlike other remote units, the etc-12 leaves no controls, redundant displays or batteries inside of the cubicle. This and the fact that all etc-12 upgrades are supplied with mechanical auto-reset actuators eliminates most of the instances where workers would need to open the door on racked-in breakers.



#### flashSAFE MAINTENANCE MODE:

NFPA-70E states that the amount of destructive heat energy contained in an arc-flash is directly proportional to the time duration of the fault. The built-in *flash*SAFE feature available on all etc-12 units can reduce the severity of an arc-flash by reducing the time that the upstream breaker takes to clear the fault. This is achieved by allowing the activation of temporary pick-up points for the instantaneous and/ or ground fault bands. These temporary settings can be much lower than the operational pick-ups an can be employed even if these bands are defeated during normal operation. flashSAFE can be activated through the remote mounted etd display, the optional lockout toggle or through the MODBUS interface.



# **UPGRADE ANY 480/600V CIRCUIT BREAKER**



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## **DIRECT REPLACEMENT TRIP UNITS**



Original equipment manufacturers introduced electronic trip units as an alternative to electromechanical overloads in the late 1960's. These first units are unsophisticated by today's standards but they offered many advantages over the available technology. Most of these early electronic trip units were dependable and have provided decades of reliable service.

Now that more than 40 years have passed since their introduction, the industry is beginning to experience end of life issues with many of these first generation electronic trip units. Common problems include leaking or other degradation of electrolytic capacitors. Many trip units depend on the discharging of this capacitor to fire the flux-trip solenoid which opens the breaker. Failure of these components can result in a breaker not tripping during an overload or fault. This situation can lead to a catastrophic failure costing tens or hundreds of thousands of dollars to repair and resulting in weeks of downtime. Aging trip units can also lose accuracy and trip at inappropriate times. Loss of coordinated protection can also result in equipment damage, and widespread downtime.

While failures due to aging electronics are a growing problem, other components used in the tripping system are often robust and exhibit no signs of deterioration. Specifically, current transformers, actuators and breaker wiring are often in serviceable condition.



Direct Replacements Conform to Original Form Factor



Most Direct Replacements Utilize the Same Connectors and Provide a Plug and Play Solution



Satin American offers an economical, easy to implement and environmentally friendly solution to these problems by offering several direct replacement trip units. These units re-use as many of the components of the original tripping system as possible. They are all use the proven etc-12 electronics and offer many advanced features and options that were not available on older generation trip units. Installation of these direct replacements can often be accomplished in less than 15 minutes and Satin can optionally supply newly manufactured replacements for components of the original tripping system found to be defective.



#### ETC-12 G SERIES

Plug-in replacement for General Electric RMS-9, RMS-9 Epic, Versa Trip, Micro Versa Trip, Micro Versa Trip Plus, Micro Versa Trip PM\* trip units. Defeatable LSIG protection and adaptable to all frame sizes without the need for rating plugs. Works with existing neutral sensor in 4-wire applications. Can also replace the SST and ECS with the purchases of a special adapter kit.



#### **ETC-12 S SERIES**

Replacement for Allis-Chalmers / Siemens LimiTrip, Static Trip I, II, and III, Carriere FB-600E, Joslyn OptiTrip I and II, Utility Relay AC-PRO. Compatible with existing neutral sensors in 4th wire applications. Depending on breaker, installation may require installation of new mounting bracket and minor wiring.



#### **ETC-12 E SERIES**

Plug-in replacement for all versions of Westinghouse Amptector trip units. Uses existing wiring harness and mounts with two screws in existing holes. LSIG protection supplied standard and unneeded bands can be disabled. Can be used with existing neutral sensor.



### **ETC-12 Q SERIES:**

Replacement for Square D / Merlin Gerin STR 28D, 38S and 58U trip units on MasterPact breakers. Compatible with neutral sensors in residual ground fault protection schemes. Adaptable to all frame sizes without the need for ratings plugs.



#### **AVAILABLE SETTINGS:**

All trip settings can be entered through the intuitive menu structure which provides prompts in clear and plain English. All pickup points are displayed both as a percentage, and in actual amps, making the transfer of settings from original trips fast and easy. The below table lists the functions and settings available with every etc-12 retrofit.

FUNCTION RANGE	PICK UP RANGE	DELAY RANGE	NOTES
Available current sensor tap ratings	N/A	N/A	40A, 70A, 80A, 100A, 120A, 150A, 200A, 225A, 300A, 400A, 600A, 800A, 1000A, 1200A, 1600A, 2000A, 2400A, 2500A, 3000A, 3200A, 4000A, 4200A, 5000A, 6000A
Long-time (overload) protection	From 25% to 110% of the current sensor tap rating	MIN (5 sec), INT (13 sec), MAX (27 sec) or custom value between 1 and 30 seconds. Delay is reverse l2t and defined by time to trip at 600% of the long-time pickup value.	For 100 mA inout, minimum pickup is 50% of tap rating
Short-time protection	From 150% to 1000% of the longtime pickup value.	Selectable constant or reverse l2t ramp with delays of .070, .100, .150, .200, .300, .400, or .500 seconds	Function can be defeated provided that the Instantaneous protection band is enabled. Delay can be selected either as a fixed delay or reverse l2t.
Instantaneous protection	From 150% to 1200% of the longtime pickup value	Initiates breaker trip in less than .050 seconds.	Function can be defeated provided that Short-time protection is enabled.
Ground Fault protection	From 10% to 200% of the sensor tap rating, provided that this value does not exceed 1200A. Increments are of 5% of the sensor tap rating up to 100% of tap rating. Above 100% of tap rating, increments are in 10% of tap rating.	Selectable constant or reverse l2t ramp with delays of .100, .150, .200, .300, .400 or .500 seconds.	Function can be defeated Delay can be selected either as a fixed delay or reverse l2t. For 100, 400, 500 mA inputs, minimum pickup is 20% of sensor tap.
Phase Imbalance protection.	From 15% to 50% ratio of minimum / maximum phase current	Between 1 and 90 seconds	Function can be defeated.
flashSAFE Instantaneous Pickup	Same as Instantaneous	Initiates breaker trip in less than .050 seconds.	May be defeated. Must be lower than the previously entered instantaneous pickup. May be enabled even if instantaneous is defeated.
flashSAFE Ground fault pickup.	Same as Ground Fault	Fixed at .100 seconds w/ no l2t ramp	May be defeated. Must be lower than the previously entered ground fault pickup. May be enabled even if ground fault is defeated.
Long-time thermal memory	ON or OFF	N/A	
Ground-fault thermal memory	ON or OFF	N/A	

COMMUNICATIONS CONFIGURATION			
PROTOCOL	MODBUS RTU		
PHYSICAL NETWORK	RS-485		
BAND RATE	9600		
DATA BITS	8		
STOP BITS	2		
PARITY	NONE		



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## **ADVANCED FEATURES AND OPTIONS:**

Several accessory modules are available for the etc-12 retrofit systems. All etc-12 units are preconfigured to accept these modules so that accessories can be added at any time without the necessity of changing major kit components or updating firmware. The following are brief descriptions of available accessories.



### **MODBUS COMMUNICATIONS:**

The etc-12 communicates on a MODBUS RTU protocol. A comprehensive list of addresses and commands is available from the factory which allows the end-user to easily integrate any etc-12 equipped breaker into any MMI or SCADA system that can address a MODBUS device.

### **LATCHING RELAY CONTACTS:**

Provides two sets of NO and NC relay contacts that change state and latch when the breaker trips. The relay is reset by pressing the "clear" button on the display, or by simply closing the breaker on a three phase circuit.

### **FLASHSAFE LOCKOUT BOX:**

Adds the ability to activate flashSAFE by operating a toggle that can be locked in either the ON or OFF position. The lockout box also provides a flashing LED to indicate flashSAFE activation, as well as a set of contacts that indicate flashSAFE status.

#### **REMOTE TRIP CONTACTS:**

Causes a breaker to trip when an external contact closes. This accessory may be employed in load shedding applications or other control applications.

### **FUSESAFE UPGRADE:**

Allows non-fused 225A through 1600A frame breakers to be upgraded with fuses without the need to modify the switchgear. Under normal conditions, the breaker will trip for low level overloads with fuses clearing only higher magnitude faults. When a fuse opens, the breaker will automatically trip open phase condition. FUSEsafe can more than triple the interrupting capacity of a breaker and reduce arc-flash incident energy by 500 times.

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# **satin**AMERICAN 40 Oliver Terrace | Shelton, CT 06484 800.272.7711 | **satinamerican.com**



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