Fault Trapper

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In 1879 Thomas Edison described the functionality of what he called a “circuit interruption device”. This was the first documented description of what we now know as circuit breakers that are used throughout electrical systems of all types, globally. Today, circuit breakers are a part of our lives and sit within electrical systems from transmission and distribution to businesses and residential electrical panels, even individual electrical components that are plugged into the electrical source.

The circuit breaker is designed to “sense” some form of electrical disturbance, quickly open up the circuit it is wired into, prevent the event from moving from the electrical panel or outlet into the components and equipment that is wired into the electrical panel itself. Essentially, the circuit breaker acts as an automatic switch that shuts down the energy and keeps it from doing any more damage to motors, equipment and components wired into the lines that go to the circuit breaker in the electrical panel.

Over the course of the last 140 years there have been dozens of different methods used to build circuit breakers that are more sensitive in an attempt to make their use safer. Various functions have been added like re-closing capability, Ground Fault Indicators (GFI), etc. However, there has been no way for any circuit breaker to “see” the events and be able to tell an end user what it might be. For example open, short, or arc fault and where it occurred among the source of the electricity at the breaker and the load on the other end.

There are over 100,000 estimated home and building fires determined to be “electrically” caused. The forensics is so lousy after a big fire that this is probably understated. The major reason for these fires might possibly be the lack of transparency and visibility within the electrical system at the electrical panel location to see events that are degrading cables and leading to fires. To be able to tell **WHY** something happened, you have to know **WHEN** it happened, and **WHERE** it happened. All three of these data points are crucial to make sure an electrical line is safe and will not combust due to arc faults or intermittent shorting conditions. As of right now, that is not possible with existing electrical equipment. That is about to change.

The new **Fault Trapper** is the first electrical device capable of monitoring a live energized electrical circuit that leads to a circuit breaker, detects, characterizes AND locates where a fault occurred. This is made possible by using a technology called Spread Spectrum Time Domain Reflectometry (SSTDR).

SSTDR is designed to be able to see within an electrical line, ignoring the ambient noise created by the power being delivered and see impedance discontinuities that are created with electrical faults like opens, shorts and arc faults. Patented algorithms and unique methods of application make SSTDR the only technology on earth capable of getting the vision necessary within a live cable/circuit to find faults and show where they are originating from.

Recent innovations like **G**round **F**ault **I**nterrupter circuits (GFI) have attempted to add functionality to circuit breakers to mitigate the chance of injury. The only action that is taken by the circuit breaker is its only real capability and that is to open the circuit breaker quickly. No data is added to be able to figure out what happened and where.

In June 2014, Underwriters Laboratory have issued a new requirement - UL1699/B, which specifies the broadened usage of a new type of sensor called an **A**rc **F**ault **C**ircuit **I**nterrupter (AFCI). This contains circuitry designed to detect arcing in a branch circuit.

UL expects the AFCI capability to be built not only into circuit breakers but like GFIs as well, to be put into wall outlets in residences and businesses. To add an AFCI function to these devices requires a very new level of sensitivity to be able to see the "signature" of an arc fault. Unfortunately, an arc fault can generate an electrical signature that can be duplicated by some vacuum cleaners, electric lawn mowers, electric saws, routers and other types of electrical appliances commonly used. Thus, the increased potential for false indications and tripping of devices that have AFCI capability.

Arc faults are high power discharges of electricity between two or more conductors. The discharge translates into heat which breaks down the wire insulation and can trigger an electrical fire. Devilishly hard to detect and characterize, as well as very tough to find since they are mostly quite short in duration and mostly hidden within cable insulation or conduit.

The addition of AFCI capability in circuit breakers and wall outlets is a good start. But in order for these relatively simple devices to reliably recognize all types of arc faults, many compromises had to be made creating an entire sub culture of complaints over their implementation and installation in the field. Unreliability and consistency of recognition vary widely and does not take into account all of the variables that occur in every electrical system installation.

Google "Arc fault breaker tripping problems" and take a look at some of the 66,000 hits that come up regarding this issue.

It will take only a few minutes of visiting some of the sites listed in the first few pages to determine that the new UL1699 requirement to put AFCI's in virtually every circuit run in residential and industrial buildings is the catalyst for trying to find a new way to know more about what happens when the breaker trips. Fault Trapper is the solution for this condition. Without more information on why, when and where arc faults occur, new devices are not solving the root of the problem which is identifying and finding arc faults and fixing them.
Despite the advanced technology of SSTDR, the Fault Finder will not be able to see every event that might trip a very sensitive AFCI breaker. It has been shown that even RF energy from a local source is capable of this as well as noisy motors or switches that generate noise. These types of events do not generate enough energy for Fault Trapper to detect and they are not "dangerous" to the electrical system as such. So, AFCI breakers may trip without any detectable energy that can be measured and caught. Once again, the internet is full of stories on this very fact. What Fault Trapper does do is apply a floor of safety to detect any sufficient energy that **IS** generated on an energized line. If it is a dangerous or unsafe event, the Fault Trapper will likely see it.

As we gather more field information on AFCI issues and begin to characterize different manufacturer's products, Fault Trapper will be updated and upgraded to catch and keep more subtle events that do not now qualify for its detection capabilities.

SSTDR is being applied to a new product that shows a proof of concept on how to enhance the information a contractor can access for the first time ever. Problems can be fixed quicker and easier than ever before. And it all comes down to a revolutionary new product that will change the way electricians will work to find and fix electrical faults of all kinds.

Fault Trapper is easy to install, no cutting or stripping of wires. It can be installed in less than 2 minutes. Once set, it will monitor an electrical line of up to 500 feet in length, and capture any event that happens along the line or at the load. Even if the breaker does not trip, any energy event will be recorded so that the contractor can see what occurred even though the circuit breaker did not get enough energy to trip itself.

The Fault Trapper gives new information to a contractor that is not available now and will help to eliminate many of the irritating **N**o **F**ault **F**ound (NFF) scenarios that costs so much time and money. For the first time in 140 years, some important and potentially lifesaving information will be delivered so that more intelligent decisions can be made to fix the situation before it grows out of control.

Eventually SSTDR will reside in circuit breakers, "smart "meters, power transformers, switchgear and possibly everyday appliances and entertainment devices. The result will be a safer and more transparent electrical system that will save lives and make electricity easier to use from all sources.

P/N TFT100 Fault Trapper

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