

The Industry's First Automatic Hot-Tie Solution:

Keeping your power flow simple and uninterrupted, with reduced capital costs, heightened reliability and a cooler computer room.

It's axiomatic: the simpler the system, the better. It's true of most any system, and certainly so for a power system in which uninterrupted flow is critical. One less switch means one less juncture at which a failure could occur. And one less switch to purchase, to install, to test and to maintain – that's a good thing, assuming of course that removing that switch doesn't mean degradation in performance.

Consider then a power system solution that will allow you to eradicate perhaps a *dozen* or more series switches, to replace them with a single switch and to lower your capital costs. Consider a solution that will simplify the operation of your system and *improve* reliability.

Eaton now offers this exact opportunity, a Powerware solution that provides the industry's first automatic hot-tie capability, allowing two uninterruptible power systems (UPS) to automatically transfer loads from one system to the other whenever necessary. This custom solution consists of a pair of Powerware UPSs powering a dual-path distribution system using switchboards designed and built by Eaton. These switchboards include provisions to momentarily tie the two distribution paths together in order to transfer loads from one system to the other. The key to the innovation is a static switch that parallels the actual tie-breaker, eliminating the need for downstream static switches.

Cost-effective at any size.

Who was this solution designed for? Anyone for whom uninterrupted power is critical. It's an affordable solution for any power system from 50 kVA to beyond 3 mVA.

A UPS configured with dual-path or redundant power distribution has the potential to deliver the highest level of protected power to the connected load by virtually eliminating the possibility of quality power not reaching the load during normal operation or maintenance. Loads can be served by automatic switching devices fed by both distribution paths so that if one path is suddenly or necessarily shut down, the load is switched to the other power path. Some loads even have dual power supplies so they can be continually tied to both paths of power. However, when devices that must change operating state are added to a system an element of uncertainty is introduced, lowering the system mean time between failures. As a result, the system's ability to provide protected power at the load is diminished. In fact, loads with dual power supplies may not survive a shutdown of one supply.

In an effort to minimize deactivation of one of the power paths, a switchboard called a hot-tie was developed to allow the user to manually tie both power paths to one UPS while keeping both power paths active. This design keeps both power paths available to the load and reduces the chance of introducing additional problems into the system. However, since the system is manual or semi-automatic at best, its usefulness has been confined to planned maintenance or expansion.

Why a static auto-tie solution?

- The new static auto tie is a parallel device used in lieu of a traditional static switch, which is a series device. When it comes to increasing a system's reliability, a parallel solution allows for additional redundancies, while a series device doesn't. A series device always has lower availability on its output than its input. A parallel device does not.
- On average, the static auto-tie solution saves the customer 20 percent in equipment and installation costs over a traditional UPS and discreet static switch deployment.
- The static auto-tie solution offers operational, installation, engineering and testing simplicity by reducing overall component count by an average of 10 to 12 separate devices.

Now, with this industry-first automatic hot-tie system, Eaton doesn't limit the availability of dual power paths to scheduled maintenance; it's continuously available. The automatic hot-tie consists of a conventional three-breaker hot-tie system with a static switch paralleling the actual tie-breaker. When system-level monitoring detects a reason why the protected load in a dual power path system should be transferred to one UPS or the other, the static switch is fired. The tie-breaker is signaled to close in much the same way a UPS transfers the load to its internal bypass. The two systems are tied together momentarily until the appropriate isolation breaker opens, leaving one UPS isolated with no load and the other UPS supporting both power paths. The transfer is complete in no more than one quarter of a cycle.

Since both power paths to the load remain active, no transfer devices are activated, and dual power supply loads aren't challenged by shutting down one power supply. In fact, in the Eaton automatic hot-tie system, distribution transfer devices can be eliminated.

Moreover, the switch is intelligent. The static auto tie can actually make decisions on when *not* to close the switch, even when an undervoltage condition exists.

One such instance is on a faulted bus. The auto-tie controls can distinguish a fault by using an algorithm to compare the rate of change of current over a rate of change in time. If the current rise is outside the parameters programmed, the switch won't fire. This keeps the fault isolated to one side and doesn't permeate the fault.

The second condition is on magnetic inrushes from downstream transformers. Another algorithm compares the phase relationship between the voltage and the current. If the value is outside the calculated parameter, the transfer is not performed, allowing the inrush condition to stay isolated to the one side.

Less is more.

The math is simple. The cost of series switches runs into the millions of dollars. Installing them is time-consuming and costly. They most generally are installed close to the load, occupying computer-room space, the most expensive space in the facility. And they generate heat – a lot of heat – in a space that may already be generating all the heat it can withstand.

This last point is no small matter. Until very recently, the buzz at industry conferences was all about denser switches – how can we generate more capacity, more quickly, per square foot? Technology – most particularly in the form of blade servers – rose to the challenge in spades.

Custom made.

Issue: For a leading automotive credit center, power failures, and the consequent downtime, are simply unacceptable. And yet the company had experienced two failures in a span of six months. Obviously, there were inherent weaknesses in its power system, which involved a series of static transfer switches.

Solution: A PowerChain Management approach from Eaton delivered a better alternative. The Eaton team designed a cutting-edge distribution system with the industry's first automatic hot-tie capability, allowing two UPSs to automatically transfer loads from one system to the other whenever necessary. The custom solution consisted of a pair of Powerware 9315 3000 kVA UPSs powering a dual-path distribution system using switchboards designed and built by Eaton.

With this solution, the company was able to eliminate a dozen downstream switches from its power system, saving \$600,000 in future capital investment, while improving reliability. The solution also affords the company the ability to maintain load flexibility as the site profile changes in the future.

Today the buzz centers around keeping these servers cool. Ever-denser blade servers are of no use if you can't keep them sufficiently cool. Devices are shrinking, but their power consumption certainly is not, and a server rack is often generating perhaps four or five times as much heat as it was just a few years ago.

Therefore, less is more. The Powerware hot-tie solution allows you to turn multiple switches into one – and to place that switch in backroom space, which frequently runs about one-tenth the cost of raised-floor space – without sacrificing availability.

The integrated nature of this solution has multiple benefits. Racked into the switch gear, there's no new pipe or wire, nothing additional to maintain. And the device is tested at the factory, whereas series switches can't be.

A simpler system is also going to save you time and money on training and is going to reduce the chance of human error. In fact, in reducing the likelihood of human error, you may have just added another "9" to overall reliability. It's often said that once you approach the "five 9s" range, site personnel are the primary point of failure. It's generally believed that while you can reach four 9s with technology, human error is another story. Humans being just that...human...make mistakes like, for instance, pushing the wrong button. This is often what leads to mistakes and decreased "9s." Again, the math is simple: in downsizing from perhaps a dozen devices to one, you've created less room for error.

Making the difference.

So here's the question: You have a couple of Powerware UPSs installed, and they're virtually infallible. You're probably never going to see this hot-tie solution in action. Is the investment worth it?

For many businesses and other institutions, a single failure can be enormously destructive, even catastrophic. According to the Electric Power Research Institute, "Power related anomalies incurred in the U.S. cause \$188 billion in losses annually." A U.S. Department of Energy Distributed Energy Resources Program and Strategic Plan estimated that brokerage firms lose up to \$6.5 million per hour of downtime, credit card approval centers perhaps \$2.5 million.

What can adding another 9 of availability to your power system mean? A four-9s system means 52 minutes of downtime per year; a five-9s system, 5 minutes of downtime. The difference is clearly significant, and the Powerware auto-tie solution can be that difference.

Increases reliability

- Reduces system component count
- Reduces wiring
- Simplifies operation
- Simplifies power path

Reduces costs

- Fewer system components
- Basic distribution
- Lower installation cost
- Reduced maintenance

Allows for greater load flexibility

Powerware Static Auto Tie WP

Simply put.

Here's the rundown:

You have a series of downstream devices; not an optimal configuration, in that with each switch you're introducing a greater possibility of failure.

These are expensive devices.

They generate significant heat.

And they're occupying the most expensive space in your facility.

Powerware looked at the state of things and said, "There's a simple solution." They've taken these downstream devices and reduced them to one switch. Now if you have a failure on one side or the other, that single switch senses it and uses the active side to feed the load of the side that failed. And you've *increased* the reliability of your system by *decreasing* the amount of equipment.

The Powerware auto-tie solution is a cost-effective one for dual-path, three-wire distribution systems from 100 amps (50 kVA) to 4000 amps (3.3 mVA). Powerware 9315 and 9390 models can be configured with this exclusive hot-tie system.

The hot-tie control and switchboard – which are certified to UL891 for the overall design and to UL1778 as a UPS accessory – are designed to accommodate the user's choice of draw-out style circuit breakers. A color touch-control panel is included for manual control and system monitoring to complete the package.