

Too good to be true?

Intelligent circuit protection yields space savings,
powerful insights for data centers

Executive summary

With companies relying on IT more heavily than ever, data center capacity requirements are steadily increasing. Unfortunately, so are the costs associated with data center building, equipment and operations.

The drive to reduce power system footprints in data centers stems from a variety of factors, including: the need to maximize space for revenue-generating equipment, high construction costs, mounting energy costs and intense budgetary pressures. As a result, electrical equipment manufacturers are increasingly searching for ways to reduce the size of their solutions without compromising their capabilities.



Eaton's Power Defense MCCB circuit breaker portfolio

Monitoring is essential, but can add footprint

Power distribution units (PDUs) have been an integral part of data center power distribution architectures for decades. In traditional designs, PDUs for critical power applications include a main breaker, an individual branch breaker and a power monitoring system.

With this traditional design, each sub-feed circuit breaker requires three current transducers (CTs) wired to a central control board to support power monitoring. The CTs provide users with actionable data, but also increase enclosure footprint, adding manufacturing time and cost and additional setup wiring that often results in inflated commissioning expenses.

These monitoring components are critical for helping data center customers balance loads, reduce energy consumption and minimize unplanned downtime due to the failure of critical power, environmental, safety, or security systems—but what if a better solution was available?

Rethinking foundational components for space savings

Intelligent molded case circuit breakers (MCCBs) with electronic trip units incorporate communications to support a simpler design with fewer components, faster installation and enable more data-driven insights for facility managers. This transformation of a foundational power system solution can empower PDU manufacturers to use fewer components and a simplified design while keeping critical data center power systems connected and customers informed.

With the option for a second independent communications channel through an external module, there are new connectivity options. Namely, by integrating intelligent electronic trip units within traditional MCCB enclosures, PDUs can be designed to cover nearly any power distribution need. The integration of these intelligent breakers supports full programmability that enables customizability and flexibility along with the benefits of electronic trip units, and even simpler setup and coordination.



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This technology provides the embedded ability to accurately measure energy consumption with no additional meters or equipment, delivering critical data about the power distribution system and energy usage. The integrated trip units can even timestamp captured events and store vital data and waveforms associated with each event for fault analysis and forensic timeline reconstruction.

Further, electronic trip units are equipped with the latest microprocessor technology, including advanced algorithms that will notify customers when their power distribution system needs to be maintained. Customers and original equipment manufacturers can customize programmable relay alarms to provide the real-time situational awareness needed to preempt impending system failures, helping keep facilities on-line, safe and productive.

Some advanced MCCBs can even enhance safety by reducing dangerous and potential arc flash incident energy levels without altering the critical protection settings of the breaker. These systems can also be activated remotely, enabling personnel to remain a safe distance from equipment. Further, zone selective interlock (ZSI) technology integrated within these advanced MCCBs can add an additional layer of equipment protection by intelligently selecting faster trip times in coordinated systems.

Powerful intelligence into the power system and beyond

Recently, a large designer, engineer and manufacturer of data center PDUs was looking for a simpler design that reduced components, eased installation and offered more value to their customers.

Eaton's new Power Defense circuit breakers with Power Xpert® Release (PXR) electronic trip units were a natural fit for the application because they could meet all of the company's requirements and offer additional features that would benefit the end customer.

The PXR trip units had built-in metering, eliminating the need for the 48 CTs and the associated wiring. The breaker's metering functionality could be directly connected to the central control board without the need for additional components and associated wiring. As a result, each CT eliminated saved 10 square inches of space or 480 square inches total per PDU. Additionally, by replacing the CTs with Eaton's integrated solution, the manufacturer was able to achieve a total savings of \$1600 per PDU—a remarkable 25 percent cost reduction.

Additional benefits of integrated, intelligent monitoring

Many critical power customers are required to conduct annual equipment maintenance by their insurance agencies. Eaton's PXR trip units include Breaker Health, a feature that displays the overall health of the breaker. This allows companies to shift from a reactive to a proactive stance with predictive maintenance, and is of particular value to data center customers as it reduces the unnecessary requirement to turn equipment on and off. Less manual equipment manipulation reduces operating expenses and downtime and avoids unnecessary safety risks involved with the interaction with electrical equipment.

The manufacturer examined in the example above used CTs that were off-the-shelf and weren't specifically designed for the PDU application. The OEM was able to reduce the amount of these external, third-party attachments by replacing them with a breaker that integrates metering. This decrease in the number of attachments led to fewer wire connections to maintain and a reduced chance of miss-wiring.

Additionally, the manufacturer has a wide variety of customers with different system needs. With field-installable trip units and accessories, Eaton's Power Defense breakers provided a better value proposition for the OEMs by being able to quickly customize the PDU to meet end customer requirements. Furthermore, the flexibility provided by Eaton's Power Defense MCCBs allowed the OEM to continuously develop and improve their system capability without the need for drastic infrastructure changes and the costly engineering time associated with changes.

The company was also enthusiastic about forgoing costly InterNational Electrical Testing Association (NETA) testing that often required PDUs to be disassembled and reassembled. By providing instant, remote access to factory test reports, the new integrated MCCBs completely eliminated the need for third-party field testing, along with the risk and labor that is involved with complete disassembly and reassembly.

Addressing critical data center power system design considerations

Today's IT and facilities managers face a difficult bind: the cost per square foot of data center space and the price of critical supporting resources such as electricity and water are constantly escalating. Consequently, more and more equipment OEMs are attempting to shrink the size of critical data center power system components without impacting operating capacity to better meet their customers' needs.

Fortunately, modern advancements in MCCBs and embedded electronic trip units are allowing PDU equipment manufacturers to rethink these pieces of foundational data center equipment to achieve a simpler design with reduced components, eased installation and more value for customers.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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