Intelligent circuit protection for panelboards and switchboards

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Introduction

Intelligent circuit protection for panelboards and switchboards creates foundation for accurate, actionable data.

Nearly every industry is in a constant battle to meet challenging and sometimes competing demands. In our increasingly digital world, success depends on “always on” power and the ability to adapt to continuous pressure to create smarter, more responsive systems.

In fact, businesses spent an estimated $964 billion on connected hardware in 2017. By 2020, analysts indicate that an estimated 31 billion “things” will be connected to the internet. The data provided by these billions of connected devices can be used in commercial and industrial settings to establish newfound system visibility and predictive diagnostics to support previously unavailable fail-safe systems and functionalities.

The intelligent power opportunity

Today, there is a powerful opportunity to improve upon the foundational electrical components found within nearly every electrical distribution system across the world. For example, panelboards and switchboards are used in nearly every electrical system and perform a fundamental function to safely and efficiently distribute power to support energy demand across entire buildings and facilities. This equipment relies on an overcurrent protective device for each circuit within the assembly to provide protection for internal wiring, downstream equipment and personnel.

By incorporating the latest innovations in intelligent circuit protection, these pieces of equipment are now also on the frontier of intelligent power management. This paper will examine how the integration of intelligent circuit protection can yield significant improvements in productivity, dramatic increases in uptime, reductions in electricity consumption and improved equipment safety.

Panelboards and switchboards are used to safely and efficiently distribute power in data centers, healthcare, commercial buildings, institutions and much more.
Reimagining the fundamental role of circuit protection

In today’s advanced technology world, the fundamental function of the circuit breakers embedded within panelboards and switchboards has evolved to not only provide personnel and equipment protection, but also support higher-level system visibility and predictive diagnostics.

Recent innovations at Eaton have yielded a new generation of intelligent panelboards and switchboards with integrated Eaton Power Defense™ molded case circuit breakers (MCCBs). These intelligent circuit breakers feature internal sensors and embedded connectivity to support continuous monitoring and metering. With self-diagnosing Power Xpert® Release (PXR) electronic trip units, these circuit breakers can also measure a variety of performance parameters in real time to provide better indication of when a component needs to be replaced before a problem occurs.

By integrating this technology directly into panelboards and switchboards, data generated by the breakers can be used to monitor and trend energy usage. This intelligent circuit protection can be used to contribute to improvements in equipment utilization and the condition of electrical system components, leading to more informed and predictive maintenance and lower operating costs.

Integrating intelligence into power distribution

The breaker health algorithms and instant diagnostics provided through the breakers empower maintenance personnel to proactively target their efforts toward specific points across the power distribution system, rather than taking the time and effort required to inspect all the circuit breakers in a facility or system. This innovation can yield dramatic reductions in maintenance costs and improved overall system reliability.

These intelligent circuit breakers also allow building management teams to gain visibility into individual load consumption and aggregation with a single device that supports easier connectivity, more functionality and diagnostic communications. This can generate additional savings compared to the traditional tactic of applying individual metering devices at each desired point of measurement.

Nearly every electrical system incorporates solutions from multiple manufacturers. Thus, any component added to an interconnected system needs to support the existing protocols the end-user incorporates into their facilities and processes. Eaton’s intelligent circuit protection technology provides almost endless options for connectivity using industry-standard protocols (as opposed to proprietary ones) to aggregate and disseminate data, so that data can be easily incorporated into existing building management and distributed control systems (DCS).

For further analysis, Eaton’s Power Xpert Protection Manager (PXPM) provides a clean, intuitive user interface enabling unmatched setup, control, testing and troubleshooting. The software is free to download and can run on any PC. Settings and tests are communicated to trip units via micro USB or through connected networks, with no special test equipment required.

This innovative platform greatly simplifies troubleshooting using historical event summaries and real-time data provided by the Power Xpert Release trip units to save labor and money. Eaton’s PXPM also allows users to perform secondary injection and test reporting with no additional hardware to further reduce costs.

How do intelligent circuit breakers impact panelboard and switchboard performance?

By applying real-time monitoring and communications within the panelboards or switchboards that operate at the heart of an electrical system, end-users can collect data, learn more about their system and generate actionable insights. Users can also leverage that knowledge to optimize power usage, improve system continuity and uptime, and lower operational costs.

When integrated within panelboards and switchboards, Eaton Power Defense MCCBs create a more intelligent power distribution assembly that offers more detailed levels of system visibility and enables predictive diagnostics, alongside other powerful system advantages including:

- An Arcflash Reduction Maintenance System™ (ARMS) that helps protect workers by reducing dangerous and potential arc flash incident energy levels and enabling workers to activate this system from a safe distance without altering critical protection settings of the breaker Zone Selective Interlock (ZSI) technology that protects equipment by intelligently selecting faster trip times in coordinated systems, an advantage that ensures operator safety and productivity
- Fully programmable relay alarms that provide situational awareness to preempt impending system failures, keeping your facility online, safe and productive

How can the intelligent panelboards and switchboards help improve uptime?

The new and powerful breaker health algorithms integrated within intelligent panelboards and switchboards provide all the diagnostic indicators needed to monitor the status or health of connected systems, which is vital in applications where uptime is critical. In a hospital, for example, the cost of an unexpected outage ranges from $800,000 to $1 million each day.

Through this innovative technology, facility and system operators are able to track the health of fundamental electrical system components in real time and through historically saved data. Analysis can be performed through the algorithm in the trip unit to get a sense of the device and system health. This data can then be communicated through Eaton’s PXR trip unit to the building management system, facility control system or the cloud.

Furthermore, these intelligent circuit breakers provide a new level of insight on the devices that are connected to the power distribution system, including critical information that can be used for predictive maintenance. By leveraging this actionable data, facilities can intervene proactively to perform critical maintenance before there is a failure, improving their productivity and cutting their operational cost.

For example, in a connected factory, intelligent power management technologies like Power Defense MCCBs provide the real-time visibility needed to proactively mitigate unplanned downtime and manufacturing inefficiencies. This can have a major impact on the competitiveness of businesses, as studies show that the annual cost of unplanned downtime for manufacturers is in the range of $50 billion. Digitizing factories to create a unified network of intelligent and connected devices can drive actionable outcomes in terms of preventive maintenance, training, production planning, quality, energy savings and more.
How can I use the data collected from intelligent circuit breakers to improve my operations?

Eaton’s intelligent panelboards and switchboards integrated with Power Defense circuit breakers and Power Xpert Release electronic trip units feature built-in communications allowing users to use fewer components and a simplified design while keeping critical systems connected. With an optional second independent communications channel through an external module, the solution provides nearly unprecedented connectivity options.

Eaton’s approach to connectivity utilizes industry-standard protocols to aggregate and disseminate data, so critical information can be easily incorporated into existing building management and distributed control systems (DCS).

This open, scalable and secure approach to communications can transform the way systems, devices, people and processes interact while reducing project startup time and associated costs. This also supports compatibility with devices from multiple manufacturers to reduce the costs of getting components online.

If web-based metering is desired, the panelboards and switchboards can be quickly connected to highly secure, cloud-based big-data analytics engines for the highest levels of information and analytical performance. Alternatively, localized fog computing environments offer physical layer security while still providing a level of analytical benefits and reporting beyond what is available from disconnected equipment.

Over time, the data collected from the panelboards and switchboards can provide trend information to improve new and existing electrical system architecture and drive new levels of reliability and reduce maintenance. Each device can also be accessed remotely to keep personnel a safe distance from electrified equipment or to improve productivity through centralized facility management.

And, with a full range of customizable alarms, management teams receive remote alarm notifications immediately to reduce potential downtime, equipment damage and related costs. Even small fluctuations in equipment performance can be used to predict failure and enable personnel to protectively address future issues.

More broadly, this remote and decentralized access to real-time monitoring of equipment and building systems helps:

- **Keep personnel informed** with critical data through a secure dashboard
- **Provide real-time notifications** and enable personnel to address issues remotely
- **Help spot energy usage anomalies**, identify and enable personnel to adjust equipment
- **Enhance safety** by avoiding unnecessary, calendar-based maintenance of all breakers that could expose electricians to shock hazards
- **Provide detailed forensic data** to determine the root cause of power problems
- **Deliver long-term power and energy usage information** needed to make smart capital investment decisions

Support projects with confidence

At Eaton, we’ve embraced the digital world and our place in it to rethink innovation. We’re leveraging technology to improve our customers’ power distribution systems with digital tools that drive productivity, safety, reliability and energy savings. Now, we’ve incorporated intelligence and communications within our Pow-R-Line Xpert™ series of panelboards and switchboards to help users make smarter operating decisions, each and every day.

Eaton has a heritage of innovation in circuit protection that dates back to 1914, and continues to invest in research and development to solve our customers’ most difficult power management challenges with industry-leading solutions. This commitment has resulted in the development of integrated circuit protection for panelboards and switchboards that goes beyond the traditional capabilities of most power distribution equipment with the integration of automated metering, communication and predictive maintenance features.

You can support your power systems confidently with Eaton’s decades of experience providing custom solutions for a wide range of customer applications and strategically located satellite facilities across North America, which offer proven expertise for your local market needs and shorter lead times.

About the author

Manny Alexander is the product manager for Eaton’s Pow-R-Line Xpert series of panelboards and switchboards. In this role, he helps customers solve energy management challenges with power distribution innovations that help advance efficiency, reliability and safety. He has more than eight years of sales and engineering experience at Eaton across multiple regions of the United States. Manny holds a Bachelor of Arts in physics from Duquesne University, a Bachelor of Science in mechanical engineering from the University of Pittsburgh and a Master of Business Administration from Boston University.
Eaton Pow-R-Line panelboards and switchboards are built to your requirements at our world-class manufacturing plants in Sumter, SC, El Paso, TX, and Juarez, Mexico. In addition, Eaton has 16 regional satellite facilities located across the country to meet your panelboard and switchboard service needs.

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