

**Modern Power
Distribution Systems
Best Practice Guide**





Modern Business Runs on 24/7 Power Distribution

Historically, engineers and architects have had to approach building design with the assumption that they would have to sacrifice uptime for safety. With increasing demand for 24/7 business operations, however, facilities managers face an impossible choice: shut off power in order to maintain or upgrade equipment and lose revenue or stay powered up, but risk dangerous consequences, such as an arc flash event. With advanced technology, builders no longer have to make the compromise between safety and uptime—as long as they consider smart technology capabilities at the beginning of building design or retrofit an existing system with today's advanced technologies.

Modern buildings are increasingly complex and connected systems composed of a variety of smart subsystems that work together to increase efficiency, safety, reliability and comfort for building occupants. Around the clock, these systems provide reliable data communications and storage to support e-commerce activity, regulate lighting and temperature to reduce power consumption, manage expensive machines used for manufacturing and process control to improve efficiency and safety, and implement secure building access and count on dependable electrical uptime as a foundation to deliver total system performance.

These 24/7 smart buildings rely on pervasive communications between subsystems to deliver the highest levels of efficiency. Intelligent lighting systems, for example, can detect when a conference room is unoccupied and automatically turn off overhead lights. Heating, ventilation and air conditioning systems can adapt to environmental conditions, perhaps adding passive methods for heating and cooling when they are available. Even the algorithms used for controlling motors in modern





buildings are getting smarter and use techniques like Power Factor Correction (PFC) equipment to dramatically improve power delivery efficiency and reliability. When investing in progressive, energy-efficient solutions, it makes sense to have the most advanced technologies at the foundation of your electrical system. Smart buildings aren't just smart about energy efficiency; they are designed wisely at their core to enhance energy availability.

Building occupants rely on all these types of systems working efficiently and reliably without interruption. Loss of electrical power may generate significant financial losses for businesses that rely on connections to clients and satellite facilities in a world increasingly driven by web commerce and automated transactions. Sales and inventory data must be reliably communicated, stored and managed to support real-time shipping requirements. Manufacturing facilities are also increasingly connected, and any interruptions in operation not only impacts manufacturing efficiency, but can also ruin work in progress or damage expensive equipment. Downtime related to damaged equipment could result in significant financial losses.

A 24/7 smart power distribution system must continuously protect workers from dangerous electrical events like arc flash

In addition to risks of financial losses, power service interruptions may create physical risks to workers, vendors and customers in the most critical building environments. In a chemical processing plant the failure of automated controls for temperature and pressure can put workers' lives at risk. Even a minor service outage in a hospital must be avoided to prevent life threatening situations. Today's smart buildings must start with the advanced electrical distribution system design as a foundation.

24/7 Power Distribution Means Always On

Uninterrupted operation with a smart power distribution system reduces the need to turn power off for maintenance or system modifications. However, keeping power on during maintenance activities can put workers at risk of encountering a dangerous electrical event, such as arc flash. Some approaches to mitigating arc flash risks require wearing additional cumbersome protective gear, or the use of special maintenance switch settings manually initiated by maintenance personnel. These methods can be effective, but are vulnerable to human errors that can put workers at risk. Additionally, if maintenance switches are not returned to the proper operating settings because the maintenance procedure wasn't followed correctly, inefficient system operations can result.



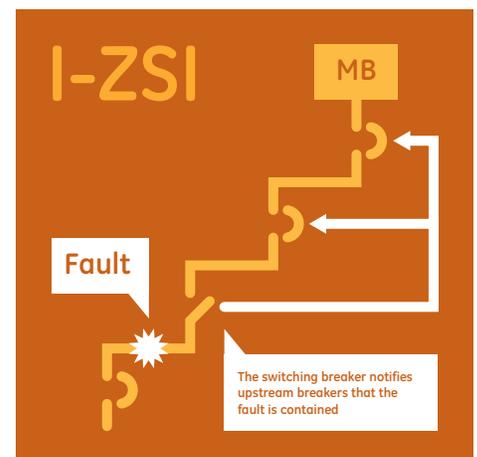
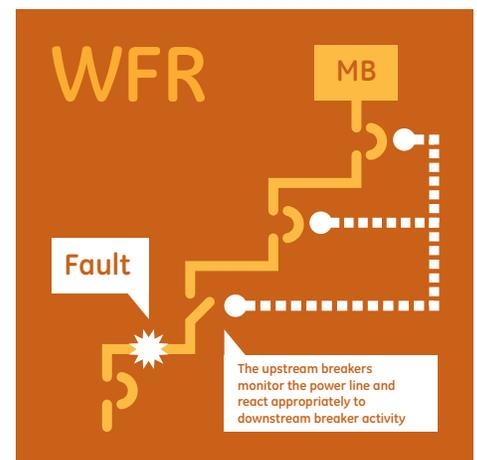
As a result, a 24/7 smart power distribution system must continuously protect workers from dangerous electrical events like arc flash. Workers can be more productive if the need for protective gear can be reduced significantly and the potential for human error is minimized. A smart system would also support flexibility in setting switches as well as in monitoring power system operations. A truly smart system would support these features remotely to further improve worker productivity.

Modern trip units, widely used in new construction and capable of upgrade on older systems, are embedded with communication capabilities to integrate seamlessly with a variety of modern building automation systems (BAS). BAS core functionality delivers smooth, reliable operations through monitoring performance, proactive failure alerts or alarms, enhancing efficiency and reducing maintenance costs across the mechanical, safety and security, HVAC and electrical guts of an intelligent building.

Smart Power Distribution Systems With GE ArcWatch*

With the use of smart equipment and techniques, modern electrical systems can greatly improve uptime and safety by signaling their responses to electrical events. For example, using waveform recognition (WFR) in an upstream circuit breaker, it automatically senses the fault current signature caused by a downstream current-limiting circuit breaker responding to a fault. This can help prevent an unnecessary trip and improves arc flash protection through intelligent selective coordination.

Zone selective interlocking (ZSI) is another smart technique that communicates automatically to coordinate protection between upstream and downstream breakers. Response time is automatically changed for different events, like a short-time event or a ground fault. This reduces the arc flash energy potential and allows the main circuit breaker to respond faster to arcing faults. Instantaneous ZSI (I-ZSI) breakers communicate fully to adapt and coordinate their response to small overloads or large faults, only operating when needed. Additionally, clearing arcing current at





instantaneous speed results in lower arc flash incident energy. ArcWatch is faster to trip when critically needed, maintaining uptime when it's safe to, and smart enough to know the difference.

Specific low-voltage GE trip units and circuit breakers employ GE ArcWatch technology that combines WFR and I-ZSI technologies. ArcWatch allows the circuit breakers to be set for better arc flash protection without sacrificing selective coordination since it maintains selective operation in the *instantaneous* region *even* when the time current curves overlap.

Using GE equipment with ArcWatch technology significantly raises the IQ of any power distribution system. With ArcWatch, 24/7 operation is possible since power systems improve worker protection from arc flash events when system downtime for maintenance is not an option. Error-prone human intervention isn't needed since the system works automatically. The low incident energy levels that result from using ArcWatch can also reduce the requirements for additional worker protective gear, helping to keep them productive and safe.

ArcWatch also provides additional flexibility when the power system needs to change in response to new build-outs or reconfigurations. Engineers can easily change settings for new requirements without the need for costly replacements or system downtime. Upgrades, retrofits or green field, ArcWatch-enabled circuit protection can provide safety and reliability on past, present and future electrical systems.

Systems installed 20 years ago or more, or as recently as five years ago or less, can take advantage of retrofit and upgrade kits to revitalize existing equipment at a fraction of the cost of an entirely new build-out. Use the EntelliGuard R retrofit or EntelliGuard G in your new construction facility and you can add remote racking capability for even greater safety when racking a breaker in or out for maintenance or troubleshooting. Layering technologies that deliver enhanced functionality and safety are the signature of smart building design.

GE Low-Voltage Equipment With GE ArcWatch* Technology

GE's EntelliGuard TU is the trip unit with the built-in flexibility required to match your system's needs, whether for optimum safety, increased system reliability, or both at the same time. Whether you're using all GE circuit breakers or a mixed system of breakers and fusible devices, the EntelliGuard TU will accommodate your needs with less compromise and greater functionality.

EntelliGuard G circuit breakers are the newest line of GE low-voltage circuit breakers, the next step in the evolution of a line known for its exceptional reliability and performance. They are available in 3- and 4-pole designs rated from 400A to 6000A, with fault interruption ratings up to 200kAIC.

Record Plus molded case circuit breakers are available up to 600A with interruption capacities up to 200kAIC, global approvals, dual AC/DC ratings, common internal accessories and improved external accessories—all in a compact size.

Spectra RMS Molded Case Circuit Breakers have a digital, solid state, RMS sensing trip system with field installable, front-mounted rating plugs to establish or change the breaker ampere rating. Adjustable instantaneous with tracking short-time is standard on all frames. The trip unit uses digital sampling to determine the RMS value of sinusoidal and non-sinusoidal currents.

TEY Circuit Breakers have dependable and effective thermal-magnetic trip units with time-current curves designed for easy coordination with upstream main devices. Multiple short circuit tiers allow greater cost effective ratings for the particular application.



Conclusion

Today, buildings are a collection of complex integrated systems that require 24/7 smart operation to support modern business operations. Web-commerce, complex or “lights-out” manufacturing and materials processing operations, efficient lighting and HVAC systems, just-in-time inventory management, and a host of similar operations all require 24/7 smart power distribution systems to operate reliably. A power distribution system utilizing ArcWatch technology can deliver 24/7 operation with always-on, full-time protection for workers from dangerous electrical events like arc flash. Additionally, ArcWatch supports the flexibility needed to easily adapt the power distribution system to the continuing growth and evolution a 24/7 smart building requires.