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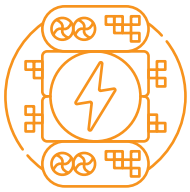
WHITE PAPER

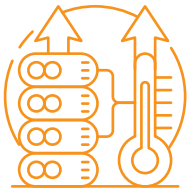
Power and Control Components Address Evolving Data Center Infrastructure Challenges

As data centers grow rapidly to support artificial intelligence (AI), internet of things (IoT), cryptocurrency and 5G technologies, they place ever-increasing workloads on their power and control systems. To meet these requirements, data center operators must address complex infrastructure challenges, including ensuring continuous power for energy-intensive high-density rack systems and deploying advanced cooling systems. Not only must power and control components deliver reliability, efficiency and redundancy, they also should be modular and scalable to allow for future growth.

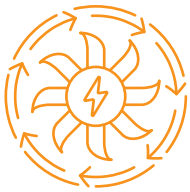
Here is an overview of essential power and control systems and components critical to reliable data center operations in a rapidly evolving industry, including energy monitoring, connectivity and circuit protection products. You'll learn about the trends that are driving these latest-generation products and their notable features, using Altech Corporation products and technologies as examples.



ENERGY CONSUMPTION

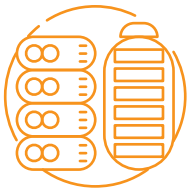


HEAT GENERATION

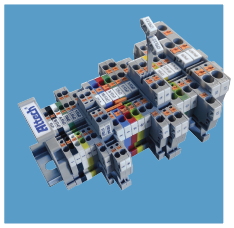


COOLING SYSTEMS

POWER SUPPLY



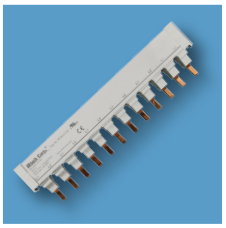
BACKUP ENERGY



Terminal Blocks

To keep up with the latest innovations, facilities must constantly add racks, switches, routers and sensors that require extensive cooling systems as well as control panels and power distribution units to manage it all. Terminal blocks offer safe, scalable means of organizing and routing the multitude of field wiring connections. Their benefits include easy connections and disconnections, and implementers can add new circuits without the burden of rewiring existing circuitry. This modularity and serviceability means faster equipment installations and less downtime for maintenance and troubleshooting.

Marshaling terminal blocks are particularly attractive for data centers, providing an intermediate connection point between field-wired devices and the control panel for optimal wire organization and easy changes. They combine the reliability of DIN rail mounting with the ease of push-in connections in a compact size. In fact, one such terminal block measures 9 millimeters wide and 120 millimeters long. Additionally, ultra-slim terminal blocks are ideal for achieving high connection density in space-constrained cabinets. Both types are among Altech's broad range of vibration-resistant terminal blocks available in screw-clamp, spring-clamp, push-in and pluggable styles, rated up to 600V for control panels, cooling and data transmission applications.



Busbars and Power Distribution Systems

With expansive amounts of equipment in data centers, facility managers need various means of distributing the power to the different circuits. In a large facility, integrators will deploy both busbars and power distribution blocks for effective end-to-end power routing.

Busbars often provide a simpler, more efficient way to distribute high currents than routing traditional point-to-point cables from circuit breakers anddisconnects to rack-level components. They also provide inherent

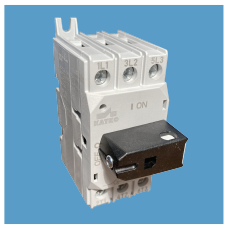
space savings and reconfiguration flexibility when rack layouts change. There are also UL 489 busbars that can interface with miniature circuit breakers such as those that protect critical cooling equipment in confined spaces. One such UL 489 busbar can jumper up to 57 poles. Another space-saving option, flexible busbars, can be bent to simplify routing or adapt to tight spaces during retrofitting.

And when it comes to getting mains power from a single feed to multiple racks and servers, power distribution blocks are used to gradually divide the current along the way. Highlights include Altech's UL 1953 Series featuring DIN-rail mounting, color-coded phase markers and finger-safe protection for up to 1000 V AC/DC. The company also offers a hybrid unit that combines a high-current screw input with spring-clamp outputs for space-constrained installations.

UL 489 Miniature Molded Case Circuit Breakers

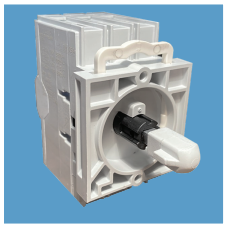
UL 489 miniature circuit breakers offer effective protection against overcurrents and are particularly important at the back end of the facility where the cooling fans, blowers and pump systems are powered and controlled. Molded case construction helps keep the footprint small, offers good insulating properties and can contain arcing between phases that may otherwise create a fire hazard.

One molded-case UL 489 family from Altech is available in AC versions rated to 32A at 480V/277V AC and 63A to 240V AC with one to three poles, and a DC version rated up to 63A at 125 and 250V, with two poles. Short circuit interrupt capacity is up to 10 kA. They snap directly on to standard DIN rails so systems get up and running quickly, and they feature specially designed screw doors for easy accessibility. The UL 489 miniature circuit breakers are part of a complete UL-rated family that also includes UL 508 and UL 1077 units.

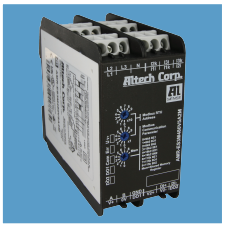


Disconnect Switches

Because data centers no longer rely exclusively on AC power, dual-rated AC/DC disconnect switches are an attractive choice for de-energizing a problematic circuit or component without disrupting the rest of the power infrastructure. And with data centers distributing power at 480V AC and panel systems increasingly operating at 48V DC, demand is growing for dual-rated disconnect switches built for high-power circuits. Other features to look for include durable, shock-resistant construction, silver contacts for excellent conductivity, a compact size for space-constrained panels and easy installation.



New 600V AC and 60V DC-rated motor disconnects offer these benefits and can be mounted several ways to suit the installation. For example, DIN rail- and base-mountable units from Altech are ideal for extended-handle applications, while through-door units can be installed through a standard 22.5-millimeter pushbutton hole and feature rear-facing terminals to make installation fast. In addition, high-power, dual-rated motor disconnects require few parts.



Alsense Energy Monitoring Relays

Data center managers are under constant pressure to optimize energy consumption while keeping operating costs under control. Energy monitoring relays can provide the real-time data needed to manage their extensive energy infrastructure. Altech's Alsense energy monitoring portfolio, for example, includes voltage, current, frequency and phase monitoring units. These devices typically monitor input signals and compare them to a predetermined value, alerting personnel to act on power abnormalities or potential circuit overloads.

With comprehensive energy monitoring, implementers can protect important hardware and prevent downtime, plan circuit capacities and harness information for audits, just to name just a few benefits. Altech's Alsense relays can interface with any logging platform, PLC, HMI or SCADA system and communicate via Modbus RTU/RS485 protocols.

DC UPS/ Ultracapacitor Technology

Continuously running data centers can't afford power dips or brownouts. Altech's CBI DC-UPS system is designed to both provide back-up power as well as predictive diagnostics and real-time communication to the data center operator. The unit combines a power supply, battery charger, backup module and battery care apparatus — everything necessary to keep control systems and panel equipment running safely and reliably — in one compact unit. It also provides a very high level of redundancy that data centers demand. For example, a CBI DC-UPS can create a small 3A backup system or back-up panels running on 48V. And when an event occurs, it alerts users to the problem via highly visible LED indicators, alarm notifications or remote warnings via email or text messages. Its built-in Ethernet interface supports Modbus, TCP/IP, SNMPv3 and HTTPS communications. Like power monitoring relays, the DC-UPS unit can also record data and generate reports.

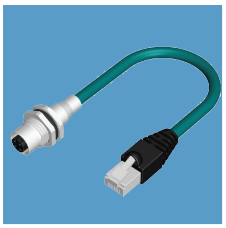
For operators that prefer an effective alternative to battery-based systems, Altech's ultracapacitor-based CAPTEC UPS provides straightforward, short-term power continuity.

20A, 30A and 60A Pin and Sleeve Connectors

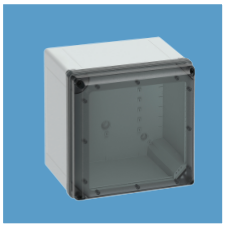
Pin and sleeve plugs and sockets are increasingly replacing NEMA-type connectors throughout the data center. But as AI, IoT and other technologies proliferate, pin and sleeve connectors must accommodate higher amperages and safely deliver the power to dense rack systems. For effective IEC 60309-compliant connections in high-power rack systems, look for rugged and secure construction plus features that prevent mismating. Altech's IEC 60309 Series II 20A, 30A and 60A pin and sleeve devices provide these attributes and more. The full lineup includes IP67-rated plugs with a patented strain relief and conductive brass pins, sockets that feature a secure cable nut gland and tool-free mounting, and easily identifiable screw terminals.

D- and X-Coded Sensor Cable Connectors

As AI and cloud computing drive sharply higher data rates and denser rack configurations, managing the growing volume of cabling has become critical. Cables must meet higher bandwidth demands while ensuring secure, reliable connections. X- and D-coded connectors are increasingly essential in data centers to meet these needs. D-coded connectors have a four-pin, M12 design, supporting fast Ethernet. They are backward-compatible with a wide range of existing field devices and sensors. X-coded connectors come in an eight-pin M12 arrangement and handle up to 10 Gbps.



Rugged and compact, both connectors work with CAT 6e cables. Their circular thread and screw-lock design ensures secure connections in dense racks and cooling systems where accidental disconnects may otherwise occur. X- and D-coded connectors are part of Altech's comprehensive sensor cable and connector lineup that also features IP67 protection and robust housings for reliability in less-than-ideal conditions.



Industrial Enclosures

Whether you're housing control components, DIN rail terminal blocks, circuit breakers, switches, meters, printed circuit boards, instruments or sensors, you can obtain an enclosure that will meet your application requirements. In fact, Altech offers 10 unique series and as many as 990 parts. Choosing the right one means matching the enclosure with the intended device and its operating conditions. Important selection criteria include, but are not limited to:

- **Construction.** Altech offers durable, impact-resistant non-metallic enclosure materials.
- **Fire safety.** Flame retardant polystyrene, ABS or glass filled polycarbonate materials meet UL 94 and VDE 0471 requirements.
- **Ingress ratings.** Protection up to IP67 (NEMA 4, 4X) can be attained depending on enclosure series and fittings.
- **Mounting needs.** Altech enclosures can be mounted directly onto a panel, frame or other surface.
- **Other.** Additional considerations include component visibility through transparent covers, lightweight construction and customization flexibility.

Choose an Ideal Component Partner

When considering component vendors, it's important to partner with a supplier that offers a holistic range of products for data center applications, has the expertise to answer your questions and provides custom products or assemblies when standard units don't fully meet your requirements. These factors will help you achieve a smooth installation and ensure an optimally performing system that will reliably meet your present and future data center application needs.

To discover more, please visit: altechcorp.com.