



Data Center Solutions

**Delivering Solutions to
Maximize Data Center
Efficiencies**

One Enterprise.
One Infrastructure.
One Partner.



Belden – Meeting the Critical Needs of the Data Center

Belden solutions meet the primary challenges of today's Data Center:



Cooling



Power



Density



Security

Today's Data Center is a dynamic environment with evolving systems, technologies, logical architectures and new business models, such as Cloud computing.

This adoption of evolving technologies and business models is a direct consequence of the push from businesses to better leverage their assets and improve their Return on Asset (ROA) utilization.

Operating within this environment, Data Center managers are required to ensure their infrastructure is highly available, scalable and flexible, while at the same time, control operating expenses.

These conflicting objectives have drawn attention to the performance of physical infrastructure elements including heating and cooling, rack-level power, bandwidth, and physical security management.

Data Center managers have recognized that these elements have an impact on infrastructure availability, and therefore, mission critical applications, with the latter linked to the Service Level Agreements (SLA) that the IT department has with the functional units in a business.

The challenge facing Data Center managers is that these elements – increasing bandwidth by maximizing processing capacity, while minimizing the Data Center's footprint, and reducing operational costs—typically tend to work against each other. For example, as the IT load is increased with high-density active equipment, the system's power and cooling requirements are increased and so are the energy costs.

Because these issues are directly interrelated, complications can arise from each system being manufactured, installed and supported by different vendors. That's why a systems approach for cost-effectively cooling the IT load, managing the use of power, and optimizing the use of available space is critical.

Belden can help maximize these cooling, power, density opportunities because Belden has expertise in all three areas – delivering the solutions for building a highly efficient, optimally performing Data Center.

Belden solutions effectively deal with the cooling, power and density paradox at the rack/enclosure level:

- Air flow, power distribution, and power and climate monitoring devices that effectively help with high-density computing environments.
- High-density racks, enclosures, cabling system components and cable management solutions, enable maximum bandwidth and availability in an efficient footprint for better air flow and optimal use of real estate.

As your Data Center partner, Belden offers the consultative assistance needed and the products required to create a properly balanced, optimized, and efficient Data Center. Belden will:

- Review the Data Center in terms of performance and efficient operation.
- Create a balance between power, cooling and density needs for optimum energy efficiencies and application/systems performance.
- Help make the most of your cabling infrastructure and thereby maximize the output of the IT investment.

MAXIMIZING
DATA CENTER
EFFICIENCIES



Belden understands the interplay between the three major issues facing today's Data Center: cooling, power and density – and can help you implement the right blend of technologies to maximize the efficiency of your Data Center in a manner that complements your system's performance requirements today and into the future.



Cooling, Power and Density



Cooling

The deployment of high-density IT equipment is pushing the average enclosure heat load into the 10-15Kw range, forcing a re-thinking of the hot aisle/cold aisle concept. Poor separation between the supply (cold) and return (hot) air has caused many Data Centers to be oversupplied with more than twice the amount of cold air than is necessary. Yet despite being vastly oversupplied, most Data Centers still experience “hot spot” issues. Cold air bypass and hot air recirculation – initiated by the lack of separation – are the cause.



Use of Belden's AEHC Airflow Management System allows for cabinet-level heat containment, optimizing airflow for higher-density blade servers and switches.



Belden Passive Chimney Containment is available with Through-Ceiling chimneys and Against-Ceiling chimneys for in-row heat extraction from cabinets.



Effectively monitor the environment within your Data Center with Belden's Climate Monitoring Devices.

Belden's Solution for Maximizing Cooling Efficiency

Belden offers passive chimney-based cabinet-level heat containment as well as active adaptive enclosure heat containment to mitigate thermal hotspots within rack or enclosure.

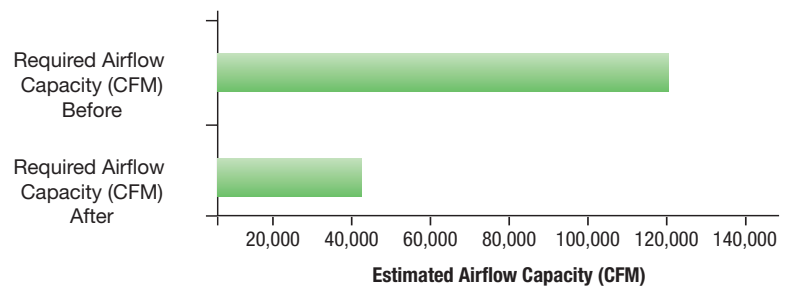
Belden Adaptive Enclosure Heat Containment (AEHC) Airflow Management System

- Eliminates hot spots throughout the Data Center by providing a high level of separation between supply and return air.
- Use of Belden's AEHC Airflow Management System allows for cabinet-level heat containment, optimizing airflow for higher-density blade servers and switches.
- Allows the lowering of the oversupply ratio from a typical 2.5 to 1.2 range, optimizing the use of available cooling to allow the deployment of more IT equipment within the same footprint.
- Pressure-based control system provides for real-time balancing of supply and return air.
- IP enabled, features monitoring and alarming features and can be easily integrated into DCIM software.
- Air flow monitoring features allow real time linkage between computing load and cooling plant; cooling capacity can be modulated to match computing load reducing OPEX.

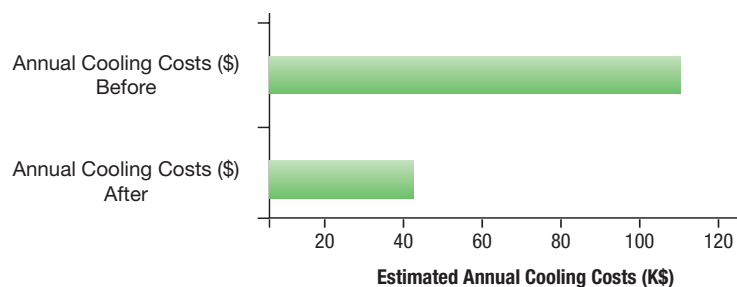
Belden Remote Climate Monitoring Devices

- Ascertain any environmental hazards related to temperature, air flow, humidity, dew point, door position, air pollution, smoke alarms and moisture, sending alarm notifications to designated cell phones and email addresses.

Estimated Savings in Airflow Capacity (CFM) by using AEHC



Estimated Savings in Annual Cooling Costs by using AEHC



Estimated savings and redeployable power amounts demonstrate parameters found in a typical Data Center. Talk to your Belden sales representative to discover the impact of Belden's cooling, power and density solutions within your Data Center.

Note: The above charts were generated from estimates using the AEHC ROI calculation tool, based on the assumption that prior to implementation the space was over supplied in cold air by a factor of 250% (2.5X). AEHC allowed to a reduction of over supply (elimination of bypass air) ratio to 20% (1.2X).

Cooling, Power and Density (continued)

Belden is able to assess your cooling, power and density needs to help maximize your processing capacity.



Power

In the past, power usage has been applied to overhead as a necessary operating expense — like the cost of the space itself. But continually rising power costs have brought this issue to the forefront, and with good reason: EPA reports attribute approximately 2% of U.S. electricity consumption to enterprise Data Centers. On-going concerns for Data Center managers include power reliability, supply and capacity, as well as the effect the cooling system has on power efficiency. It is estimated that cooling accounts for up to 40 percent of a Data Center's total energy consumption.

A Power Usage Effectiveness (PUE) ratio is used by many organizations to assess Data Center energy performance. PUE is calculated as the total power supplied to the Data Center divided by the power consumed by the IT equipment. The target is to get this ratio to equal 1; typical Data Centers have a PUE of 2.5, best-in-class Data Centers have a PUE of 1.6.

A key step toward lowering energy cost is the ability to understand how power is allocated. Monitoring of the power draw at the cabinet level using power distribution units (PDUs) with a remote monitoring feature allows real-time assessment and the opportunity to quickly correct undesirable environmental changes.

Belden's Solutions to Promote Power Efficiency

Belden Adaptive Enclosure Heat Containment (AEHC) Airflow Management System

- Optimal air flow separation allows the supply air temperature to be raised, and for the more frequent use of air side economizers.

This equates to a lower energy cost to run your Data Center and a better PUE.

- Provides up to a 50% reduction in electrical cooling costs.
- AEHC system combines as a highly capable environmental monitoring system and can be integrated into DCIM software.

Belden Power Distribution Units (PDUs)

- Basic PDUs offer simple, but highly reliable power distribution for equipment racks and other Data Center applications.
- Metered PDUs distribute power and provide real-time assessment of the current load via a local display; allowing for the identification of current fluctuations and quick troubleshooting.
- Metered/Remote PDUs provide all the benefits of basic and metered PDU's, while also allowing remote monitoring of the current draw via an Ethernet IP connection. With these PDUs, alarms can be set to warn when conditions exceed pre-determined thresholds and facilitate the monitoring of a Data Center's power usage effectiveness (PUE).
- PDUs can stand alone or easily be integrated into most DCIM software.

Belden Remote Climate Monitoring Devices

- Ascertain changes in the static pressure state, avoiding the potential power draw needed to correct variances in the Data Center's environment.

Vertical Mount PDU



Power Meter



Remote Current Monitoring





Cooling, Power and Density (continued)



Density

To increase processing capability in limited space, Data Centers are increasingly employing high-density IT equipment. Increased densities within the enclosure/racks. However, this can lead to "hot spots," causing potential harm to valuable IT equipment, and an increased power draw if the right blend of density, power and cooling is not employed.

Belden's Solutions to Promote Density/Space Efficiency

High-density/Space-efficient Cabling Components

- Ultra High-density Copper Patch Panels feature unique connector technology to enable double the port density of a traditional patch panel – 48 ports in 1U rack space.
- AngleFlex™ Patch Panels utilize angled inserts that eliminate the need for horizontal cable management devices – a 27% space savings per rack.
- 10GX® Pre-terminated Cabling Systems feature the only Category 6A RJ45 Coupler in the market and small, flexible cable assemblies that require considerably less space in the cable

pathways. Components provide an optimal plug-and-play deployment capability and are 100% reusable for an especially long product lifecycle.

Pre-terminated Cabling Systems offer the added benefit of up to 90% reduction in labor cost with easy-installation components.

The 3600 Pre-Terminated System is available for Category 6 applications.

- 10GX and GigaBIX IDC Systems are high-performance, space-efficient, modular connection systems with the flexibility to accommodate large, wall- and rack-mounted cross connects and interconnect systems – saving up to 45% of the floor space.
- FiberExpress® Ultra Patch Panels provide ultra high-density and trouble-free installation and maintenance. They can accommodate up to 96 fibers in a 1U space, or be wall-mounted to maximize floor space-savings.
- FiberExpress Pre-terminated Cable Assemblies include high-density multi-fiber assemblies and MPO cables. Reliability is assured with factory termination and testing and the assemblies can be re-deployed for a longer lifecycle investment.

High-density/Space-efficient Cable Management Components

- High-density Modular Racking System provides unmatched density, allowing for optimal use of precious Data Center floor space (up to a 60% reduction in floor space requirements). Combining the High-density Racking System with Belden's Ultra High-density or AngleFlex Patch Panels, delivers a density of 864 Category 6A ports per rack, without compromising the ability for easy deployment and future moves, adds and changes. Other combinations of density and manageability are possible, including configurations up to 1152 ports in a single rack.
- Drawing from our cable and connectivity expertise, Belden Rack and Enclosure Systems allow for hosting of servers and switches while maintaining best-in-class cable management features.

Belden's in-house design and manufacturing allows for quick turnaround on custom designed Enclosures/Racks in various footprints.



Belden — Your Single-Source End-to-End Infrastructure Solutions Provider



Extensive Security Portfolio



To help manage and control the activities and events that affect infrastructure availability and meeting SLAs, Data Center managers are seeking ways to restrict access to the Data Center to authorized personnel only and ensure that

no unapproved changes are made to the infrastructure. Belden offers a broad security solutions portfolio, ranging from IP-based access control offerings for enclosure doors to infrastructure solutions including switches, PoE, multiplexers, media converters and cabling solutions for visually monitoring DC aisles and PODs. Additionally, Belden can leverage its partner ecosystem to customize the solution to your requirements. These solutions can be deployed in environment-controlled Data Centers to closets in harsh environments close to the factory floor.



From the demarcation point in the entrance room, to the cross connect, to the equipment rack, and all the cabling in between, Belden solutions for the Data Center seamlessly integrate functional areas while maximizing efficiencies in cooling, power and density.

Unmatched Infrastructure Solutions

Belden is your single-source supplier for Data Center infrastructure solutions:

- Airflow Management Systems
- Power Distribution Units
- Climate/Power Monitoring Devices
- Copper & Fiber Cabling Systems
- Security Solutions including GarrettCom Active Devices
- Custom Racks, Enclosures and Cable Management

But Belden doesn't stop there. Beyond the Data Center, Belden offers total copper, fiber and wireless networking solutions to deliver voice and data to the office, meeting space or cafeteria. Our high-definition video and speaker cables deliver the best picture and sound to the network operation centers. Belden's specialty cables for CCTV, access control, building automation and fire alarm systems ensure safety, security and comfort throughout any facility.

From the demarcation point in the entrance room, to the cross connect, to the equipment rack, and all the cabling in between, Belden solutions for the Data Center seamlessly integrate functional areas while maximizing efficiencies in cooling, power and density.

In-House Custom Enclosure Capabilities

Belden has over 20+ years of experience in delivering support for your high-end technology needs. With in-house capabilities, this enables Belden to offer:

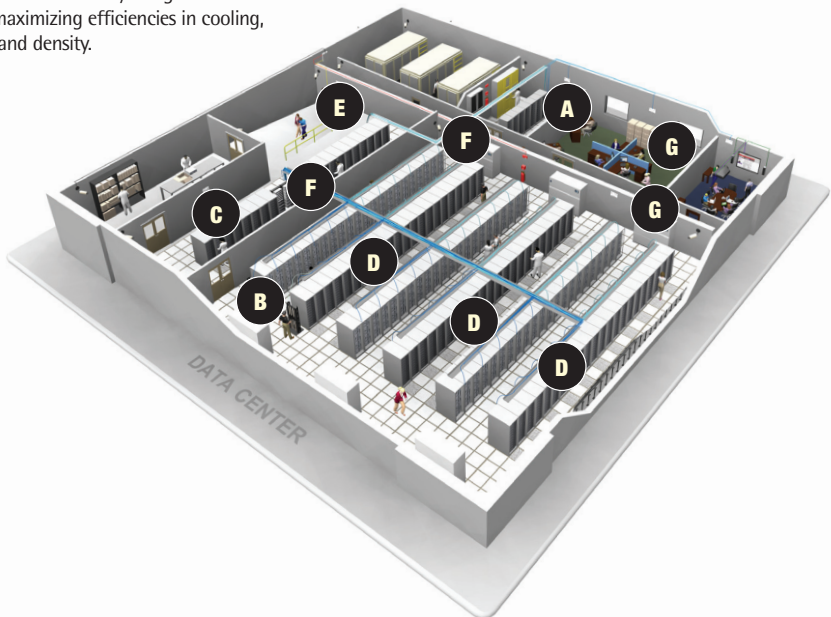
- engineering support during the design phase
- unparalleled customization of enclosures and racks
- short delivery lead times
- integration of racks and enclosures, cabling, connectivity, power and thermal management systems

Contact Belden Today!

With thousands of products available, Belden meets all your signal transmission needs for the Data Center and beyond.

To assist in the choice of the best product set and solutions for an infrastructure, Belden has released a new web-based configurator that can be found at www.belden.com/products/dc-solutions-configurator. This innovative tool provides quick, custom configuration of individual enclosures.

For more information on the exceptional Data Center solutions presented here, or on any high-quality Belden product, please call **1-800-BELDEN.1 (1-800-235-3361)**.



KEY

- = Cooling Products
- = Power Products
- = Density Products
- = Security Products



A Entrance/Telecommunications Room (TR)

The entrance room of the Data Center is the location for access provider equipment, demarcation points and interface with other campus locations. The TIA-942 standard recommends locating the entrance room outside of the computer room for security purposes. Specific Belden products found in the entrance room include:

- FiberExpress Ultra HD Cassettes and Patch Cords
- FiberExpress Brilliance® Fiber Connectors
- 10GX and GigaBIX IDC Systems
- 735 and 734 Series Coax Cables
- High-Density 2- and 4-Post Racking Systems
- Enclosures
- Power Distribution Units (PDUs)
- Surveillance (CCTV) Camera Cables
- Door Access (Access Control) Cables

Connected to the Data Center MDA through backbone cabling, TRs are spaces for housing equipment, cable terminations and cross connects that serve office areas on specific floors. In addition to voice, data, and wireless systems, TRs can house equipment for life safety/fire systems, security, and building automation systems. Belden offers a variety of products to support all of these systems within the TR:

- 10GX Pre-Term Coupler Patch Panels and Cable Assemblies
- 10GX Patch Panels and Modular Cords
- 3600 Pre-Term Coupler Patch Panels and Cable Assemblies
- CAT6+ Patch Panels and Modular Cords
- FiberExpress Ultra HD Pre-Term System
- FiberExpress Ultra HD Panels and Patch Cords
- FiberExpress Brilliance Fiber Connectors
- Equipment Cable Harnesses
- High-Density 2- and 4-Post Racking Systems
- Enclosures
- Power Distribution Units (PDUs)

B Zone Distribution Area (ZDA)

The optional ZDA acts as a consolidation point within the horizontal cabling run between the HDA and Equipment Distribution Area. The ZDA allows frequent reconfiguration and provides additional flexibility. Belden products typically deployed in the ZDA include the following:

- 10GX Ultra High-Density Patch Panels and Cords
- CAT6+ Ultra High-Density Patch Panels and Cords
- 10GX and GigaBIX IDC Systems

C Main Distribution Area (MDA) & Horizontal Distribution Area (HDA)

The MDA houses the main cross connect and the core routers and switches. The HDA houses cross-connects and active equipment (switches) for connecting to the equipment distribution area and storage area network (SAN). Per the TIA-942 standard, both the MDA and HDA require separate racks for fiber, UTP and coax cable. Several Belden products provide maximum performance, density and management in the MDA and HDA, including:

- 10GX Pre-Term Coupler Patch Panels and Cable Assemblies
- 10GX Patch Panels and Modular Cords
- 3600 Pre-Term Coupler Patch Panels and Cable Assemblies
- CAT6+ Patch Panels and Modular Cords
- FiberExpress Ultra HD Pre-Term System
- FiberExpress Ultra HD Panels and Patch Cords
- FiberExpress Brilliance Fiber Connectors
- Equipment Cable Harnesses
- High-Density 2- and 4-Post Racking Systems
- Switch Enclosures
- Side-to-side Airflow Managers
- Enclosure Power Distribution Units with Monitoring
- Climate Monitoring Solutions
- GarrettCom Active Devices
- Rack-Level Access Control

D Equipment Distribution Area (EDA)

The EDA is where equipment enclosures and racks house the servers and where the horizontal cabling from the HDA is terminated at patch panels. In the EDA, racks and cabinets should be arranged in a hot aisle/cold aisle configuration along with airflow systems that maintain proper separation of supply (cold) and exhaust (hot) air. Belden offers a variety of products for the EDA, including our high-end freestanding enclosures that help provide optimal airflow and ease of management:

- 10GX Pre-Term Coupler Patch Panels and Cable Assemblies
- 10GX Patch Panels and Modular Cords
- 3600 Pre-Term Coupler Patch Panels and Cable Assemblies
- CAT6+ Patch Panels and Modular Cords
- FiberExpress Ultra HD Pre-Term System
- FiberExpress Ultra HD Panels and Patch Cords
- FiberExpress Ultra HD Cassettes and Patch Cords
- FiberExpress Brilliance Fiber Connectors
- Server Enclosures
- Airflow Management Systems
- Enclosure Power Distribution Units with Monitoring
- Climate Monitoring Solutions
- GarrettCom Active Devices
- Rack-Level Access Control

E Storage Area Network (SAN)

The SAN houses all data storage devices such as disk arrays, tape libraries and high-capacity optical disk libraries for applications like video surveillance. The use of a separate SAN eliminates the need to store data directly on servers, which provides better network capacity. Access to stored data must be fast, requiring high-speed connections from the HDA. Belden products for the SAN include:

- FiberExpress Ultra HD Pre-Term System
- FiberExpress MPO Cables
- FiberExpress Patch Cords
- High-Density 2- and 4-Post Racking Systems
- Enclosures
- Power Distribution Units (PDUs)
- Airflow Management Systems
- Surveillance (CCTV) Camera Cabling
- Door Access (Access Control) Cabling
- Rack-Level Access Control

F Backbone Cabling & Horizontal Cabling

The backbone cabling within the Data Center provides the critical connections between the entrance room, MDA and HDA. The backbone cabling in many of today's Data Centers supports 10 Gigabit transmission speeds for current and future applications. The horizontal cabling within the Data Center provides the connection between the HDA and EDA and SAN, including the optional ZDA. Belden products for the backbone and horizontal cabling include:

- 850 nm Laser-Optimized 50/125µm Multimode OM3 and OM4 FiberExpress Cables
- 10 Gigabit 4-Pair UTP Belden 10GX Cables
- Belden IBDN Category 6 Cables
- FiberExpress MPO Cables

G Support Offices and Open Areas

Whether it's cubicles, conference rooms, hallways or cafeterias, there are many areas throughout a facility or campus where people conduct day-to-day activities. From wired and wireless voice and data systems to fire alarm and security surveillance, Belden offers a variety of products that deliver these systems to where it matters most.

- KeyConnect Workstation Outlets and MediaFlex Outlets
- Belden IBDN Cables
- Surveillance (CCTV) Camera Cabling
- Door Access (Access Control) Cabling
- 2-Hour EVAC Systems Cabling
- Wall-Mount Racks and Enclosures

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