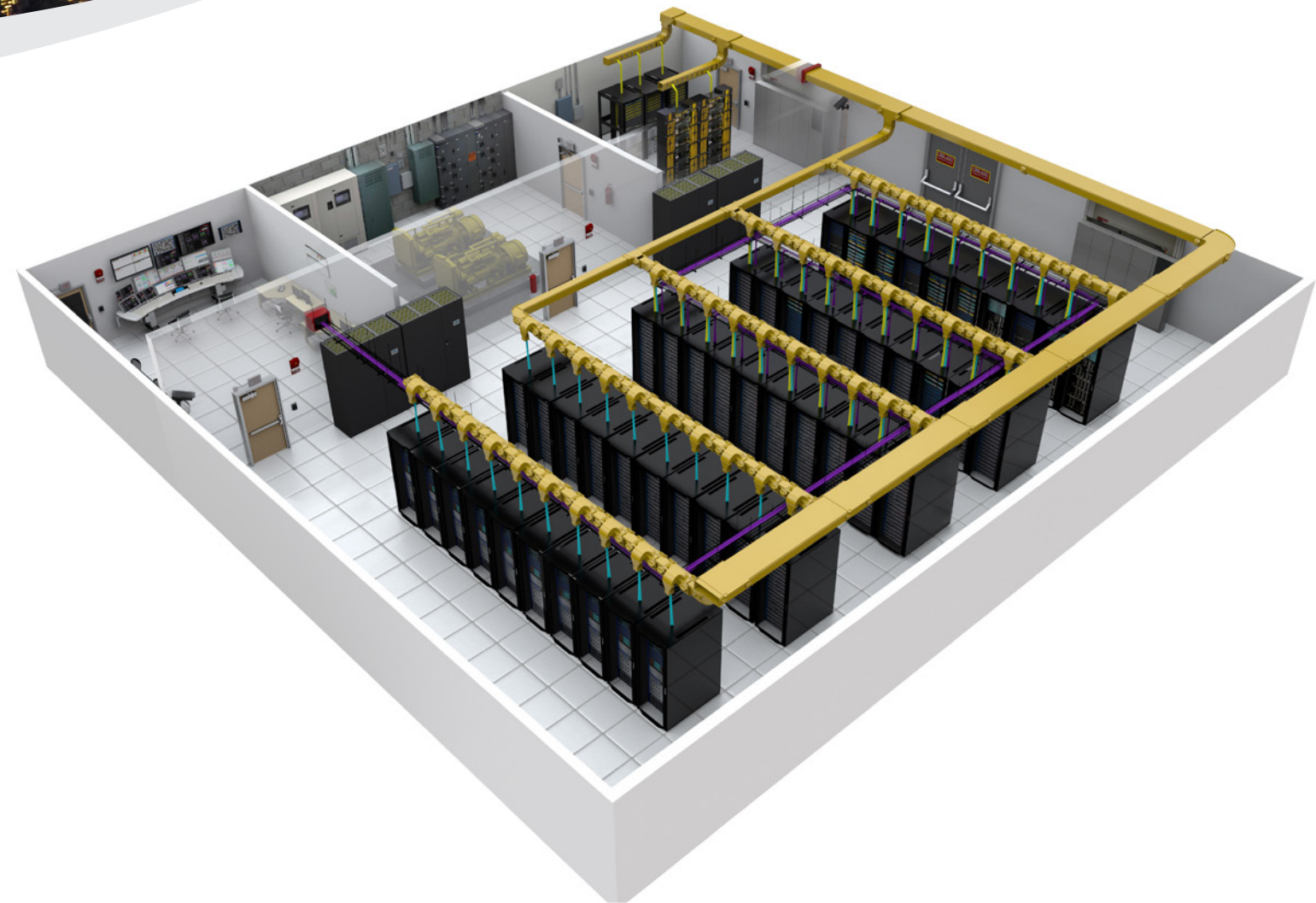# Advanced Data Center Solutions

Application & Product Guide

Data Center Infrastructure That You Can Trust

SIEMON™

Connecting Today's Data Centers to a Higher Standard

Data centers have become the fulcrum for critical operations for organizations around the world. As technology continues to advance and drive demand for greater bandwidth, low-latency transmission, compute and storage that places ever-increasing requirements on data center environments, it's more important than ever to have the correct physical infrastructure in place.

Whether it's an enterprise organization embarking on a Digital Transformation project or a cloud provider looking to migrate to next-generation 400G / 800G speeds to support emerging applications and meet consumer demand, data centers need trusted infrastructure that delivers top-level availability, performance and scalability.

At Siemon we pride ourselves on our engineering heritage, innovation and our data center pedigree. We've taken this passion and focused it into our portfolio of Advanced Data Center Solutions which have been designed from the ground up to support your data center requirements for now and the future. All backed-up by Siemon's industry-leading quality, performance and reliability they combine to help you reduce risk, maximize uptime and successfully deliver new applications and services.

The Evolving Data Center Landscape

The rise of connected technologies and the changing patterns of our day-to-day lives is driving significant change in the data center landscape. As data centers of all types and sizes evolve to support the ever-increasing demand and volume of data, the industry is experiencing the following key trends:

▶ Increased cloud adoption, hyperscale investment, and the growth of colocation and managed services provision.

▶ Implementation of data center interconnect (DCI) technology, distributed cloud and full-mesh switch fabric architecture in highly-virtualized environments.

▶ Migration to 400/800G Ethernet with low-latency 50/100G per second (Gb/s) server connections and cost-effective aggregation.

▶ 5G and Edge data center buildouts on premises, at access/cellular sites and within central offices and colocation spaces.

▶ Greater focus on reducing costs and improving operational efficiency, sustainability and security via a range of innovations such as: white-box networking, software-defined networking and automation.

Data centers are constantly evolving and adapting to support more efficient operations; and there is no end in sight.

## Growing Adoption of Spine-Leaf Architectures

To improve performance, resource availability and reduce cost, data centers are becoming increasingly virtualized with compute resources able to reside anywhere. Virtualization combined with the need to reduce latency are fueling a rapid migration from traditional three-tier switch architecture to leaf-spine full mesh switch fabrics.

Traditional 3-Tier Architecture   **2-Tier Leaf Spine Architecture**
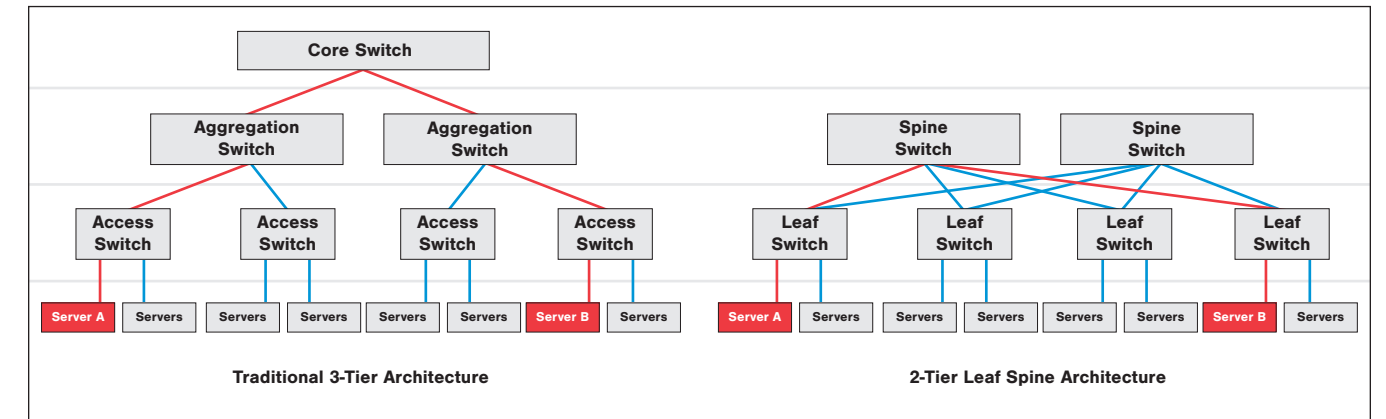
Unlike a traditional hierarchical architecture, where data transmits in a north-south direction through multiple switch tiers that adds latency, leaf-spine is a 2-tier architecture that's better for more east-west network traffic between servers than north-south traffic between switches. A spine-leaf aids this by ensuring traffic is always the same number of hops from its next destination, so latency is lower and predictable. This approach keeps the topology consistent, avoiding unnecessary paths. It also better supports scalability as additional leaf or spine switches can easily be added to support additional hosts, devices or bandwidth requirements as needed without changing the underlying design.

Cloud Providers Adopting Super-Spine Designs

In large cloud data centers, multiple spine-leaf networks (i.e., pods) can be interconnected via second level spine switches. This optimized super-spine architecture is used to create separate functional areas within a single data center or data center interconnects where multiple dispersed data centers are connected via high-speed fiber links.

Pod or Data Center   **Pod or Data Center**
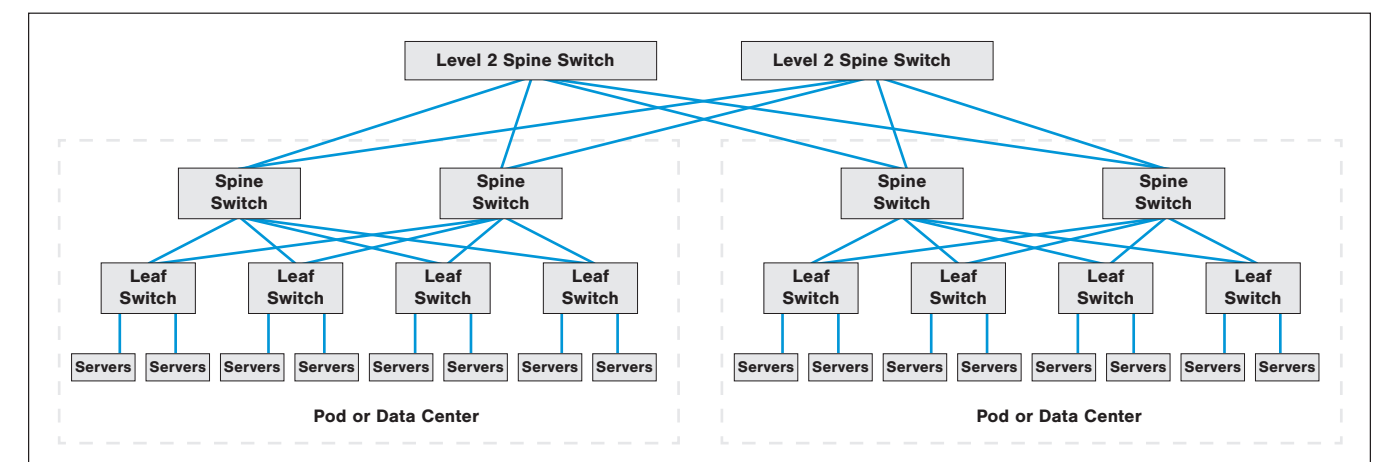
As super-spines build upon the modular approach utilized in spine-leaf, they are easily replicated in a modular manner, which allows them to be highly scalable and enable faster turn-up to meet exploding demand for services while retaining a consistent design throughout.

An Increase in High-Density Complex Fiber Links

Increasing data, compute resources and bandwidth demand have significantly increased the number of fiber links in the data center.

Other factors increasing density and complexity of fiber links include:

▶ **Leaf-Spine Architecture -** More fiber links are required to connect every leaf switch to every spine switch and ensure a non-blocking architecture.

▶ **Aggregated Links -** Aggregation that optimizes port utilization and space, such as connecting a single 100 gigabit switch port to four 25 gigabit servers with a hybrid fiber breakout assembly, further increases fiber density.

As a result, managing these critical fiber connections and accessing individual fiber ports in these tight spaces calls for specialized solutions, including:

▶ **Smaller Diameter Cables and Assemblies -** these save pathway space in and between racks and enable smaller bend radius while also maximizing airflow.

▶ **High-Density Fiber Enclosures** – Offering easy front and rear access to connections and support higher capacities while maintaining proper fiber bend radius and manageability.

Increased Migration to 100G, 400G and 800G

Trends in Digital Transformation and bandwidth-intensive applications has led hyperscale and large cloud providers to migrate to next-generation 400 and 800G speeds. These speeds are made possible via advancements in four-level pulse amplitude modulation (PAM-4) encoding technology that supports higher bit rate than previous encoding technology, enabling 25, 50 and 100 Gb/s electrical lanes that offer the following benefits:

• Reduces the number of electrical lanes and associated cabling

• Leverages existing MPO connectivity and fiber cabling technology

• Offers a more efficient gigabit migration path: 25-50-100-200-400-800G

• Enables cost-effective aggregation schemes

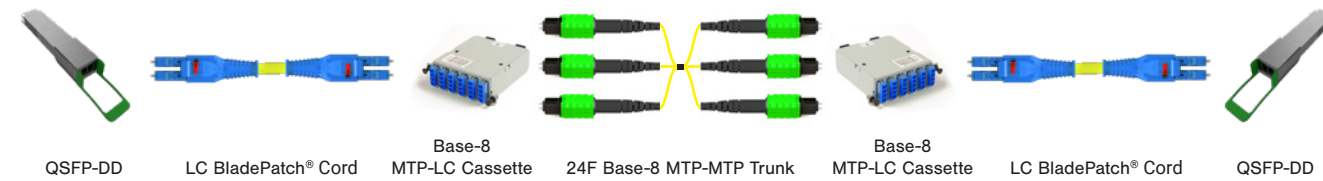|	Enterprise Data Centers		Cloud Data Centers	
	Server	Uplinks	Server	Uplinks
Current	⬇ 1/10G	⬆ 10/40G	⬇ 10/25G	⬆ 40/100G
Future	⬇ 25G	⬆ 100G	⬇ 50G	⬆ 200G
	OR		OR	
	⬇ 50G	⬆ 200G	⬇ 100G	⬆ 400G
	OR		OR	
	⬇ 100G	⬆ 400G	⬇ 200G	⬆ 800G

Many enterprise data centers are already beginning to migrate to 25 and 50G speeds for server connections and 100 and 400G speeds for uplinks between leaf and spine switches over multimode fiber cabling. Cloud data centers have several options to increase their bandwidth via singlemode fiber cabling as they migrate to 50 and 100G connections for servers and 200, 400 and 800G uplinks between switch layers.
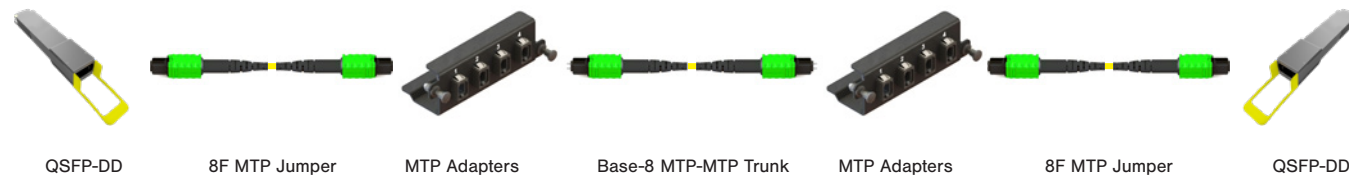
LC BladePatch®

Switch-to-Switch Example of 400G-FR4 Channel:

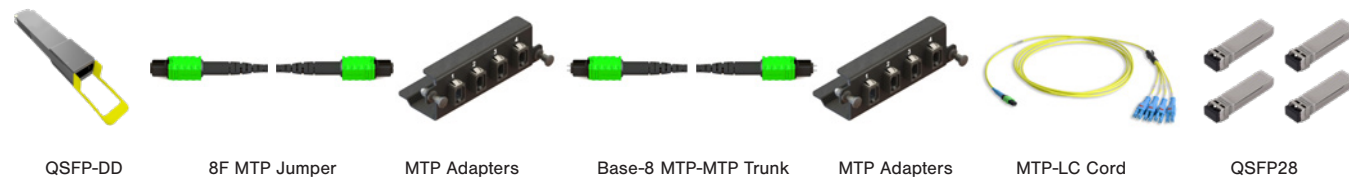2-fiber singlemode Channel will support 10G, 40G, 100G & 400G

QSFP-DD   LC BladePatch® Cord   Base-8 MTP-LC Cassette   24F Base-8 MTP-MTP Trunk   Base-8 MTP-LC Cassette   LC BladePatch® Cord   QSFP-DD

Switch-to-Switch Example of 400G-DR4 Channel:

8-fiber singlemode Channel will support 40G, 100G & 400G

QSFP-DD   8F MTP Jumper   MTP Adapters   Base-8 MTP-MTP Trunk   MTP Adapters   8F MTP Jumper   QSFP-DD

Switch-to-Switch Example of 400G-DR4 to 4x100G-DR Channel:

8-fiber singlemode Channel will support breakout to 10, 25, 50 & 100G lanes

QSFP-DD   8F MTP Jumper   MTP Adapters   Base-8 MTP-MTP Trunk   MTP Adapters   MTP-LC Cord   QSFP28

Switch-to-Server Example of Downlinks for 100G to 4x25G Channel with DACs:

QSFP28 to 4xSFP28 passive direct attach cable copper assemblies

Switch   QSFP28 (100G)   4xSFP28 (25G)   Server
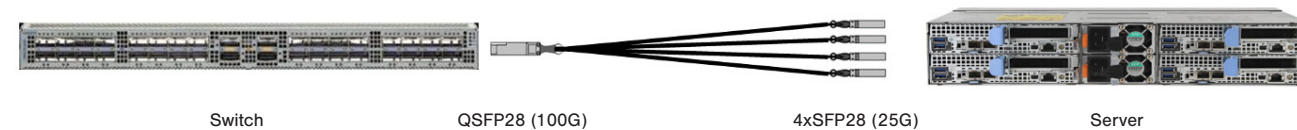
Current Standards-Based 400G Options

Several IEEE standards for both multimode and singlemode fiber have already been defined for 400G data center applications using 50 or 100 Gb/s per lane PAM-4 technology, with 400GBASE-DR4 and 400GBASE-FR4 showing most market potential for cloud data centers and 400GBASE-SR8 and 400GBASE-SR4.2 showing solid potential for enterprise data centers. At the time of this publication, there is still a large amount of standards activities going on for 400 & 800G applications. Below is a list of the commercially available options, plus a couple that are expected in the near term.

Transceiver	STD	Commercially Available	Form Factor	Breakout Option	Fiber Type	Distance (meters)	# of Fibers	Connector
400G-FR4	IEEE802.3cu/MSA	Yes	QSFP-DD,QSFP	No	OS2	2000	2	LC
400G-DR4	IEEE802.3bs	Yes	QSFP-DD,QSFP	Yes	OS2	500	8	12F MTP
400G-SR8	IEEE802.3cm	Yes	QSFP-DD,QSFP	Yes	OM3/OM4	70/100	16	16F/24F MTP
400G-SR4.2(BD)	IEEE802.3cm/MSA	Q1-2022	QSFP-DD	Yes	OM3/OM4/OM5	70/100/150	8	12F MTP
400G-VR4*	802.3cu	Q2-2022	TBD	Yes	OM3/OM4	30/50	8	12F MTP
400G-SR4*	802.3db	Q2-2022	TBD	Yes	OM3/OM4	70/100	8	12F MTP

Coming Soon

A Format for Future Growth

Base-8 MPO plug and play fiber that has long supported 8-fiber 40 and 100G applications now also supports 400G multimode and singlemode applications.

As encoding technology advances to 100 and future 200 Gb/s electrical lanes to reduce the number of fibers, Base-8 connectivity is expected to eventually support 800G and 1.6 Terabit applications.

To provide an easy migration path and take advantage of 400G technologies, it is recommended that enterprise data centers deploy familiar Base-8 MPO OM4 cabling solutions. Cloud data centers will likely continue to deploy Base-8 MPO singlemode cabling solutions for easy migration to 400 and 800 Gb/s speeds and beyond. Siemon offers a wide range of multimode, and singlemode Base-8 plug and play MPO solutions using elite US Conec MTP® connector technology.

High Quality Solutions for Data Centers
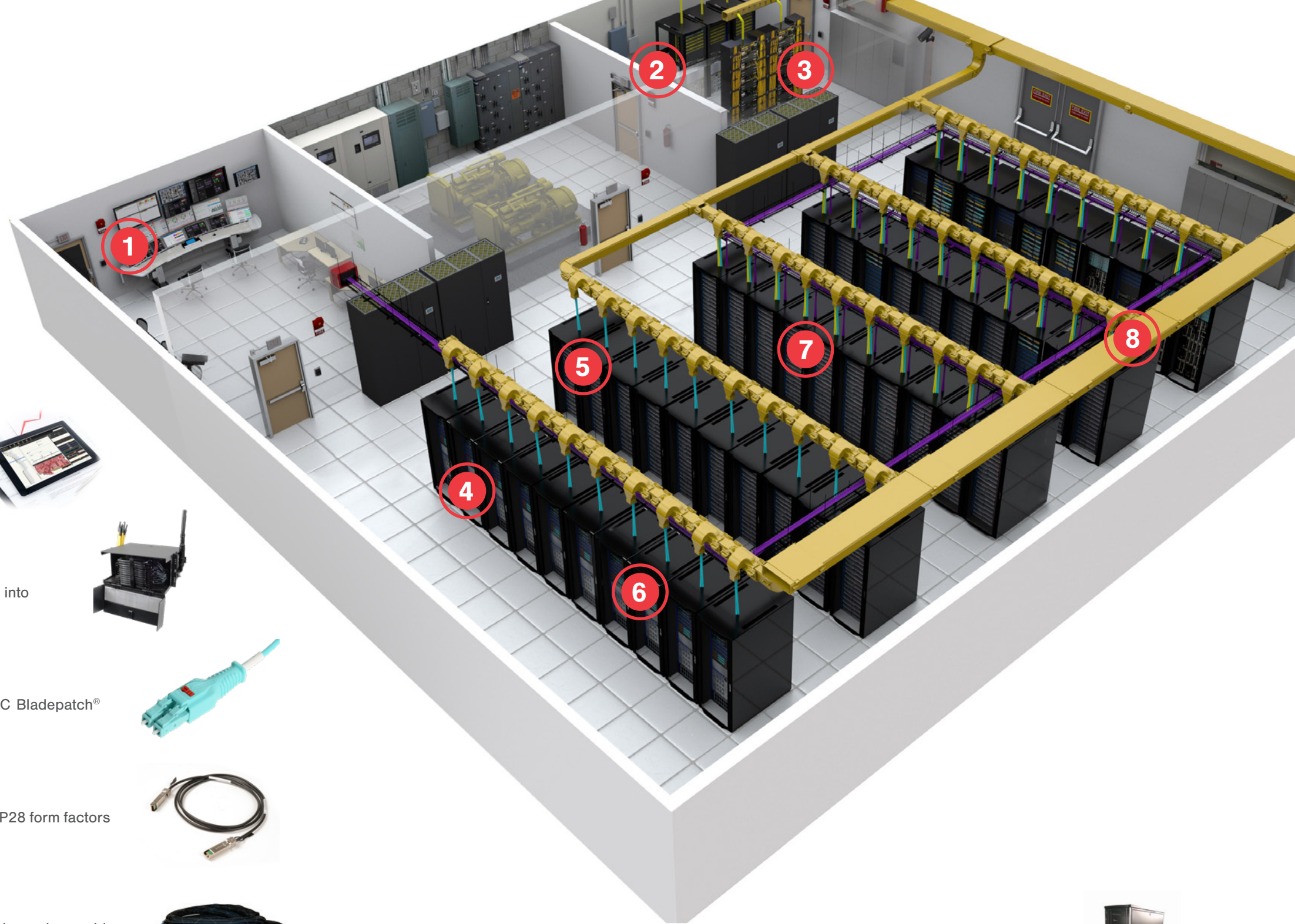
1 **Automated Infrastructure Management (AIM)**
The MapIT® G2 AIM solution enables remote monitoring and real-time view of data center connections and tracks available switch and copper and fiber patch panel ports.

2 **High Density Splicing Solutions**
Fiber Splice Enclosures handle up to 1,728 fibers from Service Providers into the entrance facility.

3 **Fiber Cross-Connects**
High density fiber patching and cross-connect spaces utilize low-profile LC Bladepatch® cords with push-pull access.

4 **Direct Attach Cables and Active Optical Cables**
High speed interconnect assemblies available in SFP+, SFP28, QSFP+, QSFP28 form factors for switch-to-server downlink connections.

5 **Category 6A Shielded Twisted-Pair System**
Category 6A shielded patch panels, pre-terminated assemblies and patch cords provide flexibility for 10 gigabit server or console management connections in end-of-row and middle-of-row configurations.

6 **Pre-Terminated Fiber Solutions and High Density Patching**
Base-8 and Base-12 singlemode and multimode MTP trunks, cassettes and MTP jumpers with high density fiber enclosures that support uplinks from leaf-to-spine and server connections.

7 **Cabinets, Racks & Vertical Cable Management***
800mm and 600mm wide network and server cabinets, 2 and 4-post racks and range of cable management.

8 **Fiber Pathways and Routing***
The LightWays™ Fiber Routing System is manufactured from halogen-free, flame-retardant UL94/V0 plastic and includes a toolless joiner, revolutionary waterfall outlet as well as a variety of duct, elbows, tees, crosses and reducers ideal for protecting and routing your fiber cabling.

*Cabinets and LightWays are available in limited geographies.
Visit www.siemon.com for availability.

A True Data Center Leader

At Siemon we pride ourselves on our engineering heritage, innovation and our data center pedigree. We've taken this passion and focused it into our portfolio of Advanced Data Center Solutions which have been designed from the ground up to support your data center requirements for now and the future. All backed-up by Siemon's industry-leading quality, performance and reliability they combine to help you reduce risk, maximize uptime and successfully deliver new applications and services.

A Rich History of Innovation

Every year, Siemon develops innovative new solutions for data centers, intelligent buildings, and LANs - spanning customer-focused product advances; elevating installed system performance; application standards and testing updates; educational resources; and much more. With over 400 patents specific to structured cabling and world class ISO-certified manufacturing, Siemon invests heavily in research and development, underlining our company's long-term commitment to our customers and the industry. But we don't just innovate for innovation's sake - voice of customer drives every facet of our operations. Within the past 5 years alone, we have released hundreds of new products to fit customer needs and applications across the globe. We are a global leader in IT infrastructure solutions, and that leadership is built on Siemon innovation.

Connecting the World to a Higher Standard Since 1903

Committed to Industry Leadership

As a Technology Leader Siemon is focused on driving the industry forward, and as a result we continue to be active participants in many of the world's largest industry standards bodies for structured cabling. These alliances allow us to continually design and deliver quality solutions that are ready to support our customers' needs today, while also providing a foundation for the future.

Global Manufacturing, Installation and Logistics Support

As a truly global organization we have manufacturing capabilities around the world, which are all ISO 14001 certified. These locations combine with our comprehensive network of Certified Installers and logistics capabilities to allow us to deliver for our clients consistently, keeping their projects on budget and on time from design through implementation and delivery.

Siemon Data Center Services

Supporting organizations to harness the true potential of their data center environments.

Whether you're a service provider entrusted with multiple clients' IT and delivering on SLAs, or an organization investing in Digital Transformation to accelerate your business, your ability to thrive and grow is only as good as your data center's underlying network infrastructure.

Your data center's cabling infrastructure is at the very core of meeting internal and external customer expectations for top-level availability and performance. Your teams also need worry-free uptime, reliability and scalability assurance so they can focus not on what it takes to become digital, but on what it takes to be successful.

How Can We Support You?

We've focused our data center expertise into a global service network, designed to guide you through the process of selecting and designing the underlying physical infrastructure you need to realize the full potential of your data center, while offering you the on-going support you need to respond quickly to changing needs, prevent downtime and maintain peak performance.

Data Center Cabling Audits

Get a comprehensive snapshot of your current cabling infrastructure strategies, as well as detailed analysis and guidance on improvements that can be made and potential savings that can be achieved.
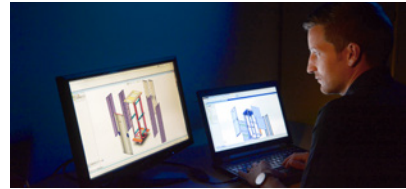
Data Center Design Services

Are you looking to design, deploy or upgrade a data center space and need expert advice and assistance to help you thrvough the process? Our team of DC Design experts are ready to support you.

Technical Support Services

Our expert technical support teams are available around the world to support our clients throughout their Siemon experience. Whether its day 1, or 3,001 our teams are with you every step of the way.

Supported by Industry Leading Partnerships

Over the years we've developed an ecosystem of data center partners who are all specialists in what they do. Siemon prides itself on partnering with global leaders that provide complementary products and services which combine with our own best-in-class IT infrastructure solutions to deliver additional value and support to our customers.

The World's Leading Organizations Rely on Siemon

Some of our customers:

"By working with Siemon to deliver innovative products, IBM has been able to provide clients with a flexible and efficient data center solution, closer to clients, manufacturing sites and remote operations."

"Testing revealed that the Siemon solution performed far better than the competition, so the technological decision was easy. When we considered other factors, such as experience, warranty, field support, and simplicity of maintenance, we came to the conclusion that Siemon offered the best overall value for CSFB's network infrastructure."

"100 Gb/s is our standard today and we are looking to migrate more of our services from 10 to 100Gb/s. Siemon's high-performance cabling solutions have certainly enabled us to achieve this."

Siemon Advanced Data Center Solutions
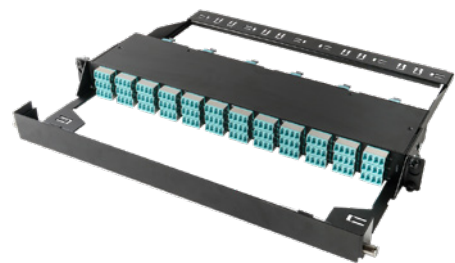
Ultra High-Density Plug and Play System

Available for regions outside of North America, the LightStack™ Ultra High-Density (UHD) enclosure with Base-8 or Base-12 singlemode or multimode modules or adapter plates supports 144 LC fibers or 864 MTP fibers in 1U with superior port access and cable management.

go.siemon.com/DCUltraHighDensity

High-Density Fiber Enclosure System

Siemon's high-density FCP3 plug and play System includes the HD FCP3 enclosure and snap-in MTP-to-LC modules and MTP and LC adapter plates to support singlemode and multimode duplex, parallel optics and breakout applications from 10 to 400G and beyond.

go.siemon.com/DCHighDensity

High-Density Fiber Jumpers

Siemon's LC BladePatch® singlemode and multimode duplex jumpers offer a unique solution for high-density fiber optic patching environments with a revolutionary push-pull UniClick™ boot design to control the latch, enabling easy access and removal in tight-fitting areas.

go.siemon.com/DCFiberJumpers

Fiber Splice Cassettes and Enclosures

Siemon's Fiber Splice Enclosure offers one of the highest fiber densities in the industry with a capacity of 1,728 fibers in a 5U footprint. The enclosure can handle incoming high fiber count ribbon fiber cables of 864 & 1,728 that are transitioning to lower count cables.

go.siemon.com/DCFiberSplice

Standard Density Fiber Enclosure System

Siemon offers a wide range of options for standard density fiber deployments, including the Rack Mount Interconnect Center (RIC3) and the Fiber Connect Panel/Drawer (FCP3-DWR). Available in 2U, 3U and 4U options, the RIC3 supports up to 144 LC fibers or 576 MTP fiber in 2U and the FCP3-DWR supports up to 72 LC fibers or 288 MTP fibers in 1U.
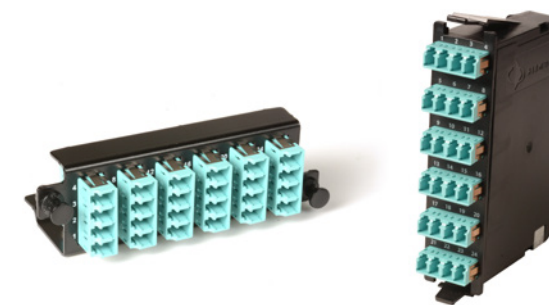
go.siemon.com/DCStandardDensity

Plug and Play Fiber Trunks and Assemblies

Siemon's wide range of singlemode and multimode plug and play trunks and assemblies include Base-8 or Base-12 MTP-to-MTP trunks in a variety of fiber counts, hybrid MTP-to-LC trunks, MTP conversion cords, MTP jumpers and LC or SC duplex and simplex breakout assemblies.

go.siemon.com/DCTrunks

PnP Modules and Adapter Plates

Siemon LC-to-MTP and SC-to-MTP plug and play modules provide a quick and efficient way to deploy up to 24 LC or 12 SC fibers in a single module. These adapter plates are designed for simple, snap-in deployment within the high-density FCP3 fiber connect panel.

go.siemon.com/DCPnP

Z-MAX® Category 6A Modular Patch Cords

Ideal for facilitating connections to surveillance cameras from a service outlet or for patching in the telecommunications room, Siemon Z-MAX Category 6A UTP and shielded cords offer the unparalleled performance of an exclusive PCB-based smart plug, alien crosstalk resistant construction and a host of innovative end-user features.

go.siemon.com/DCZMAX
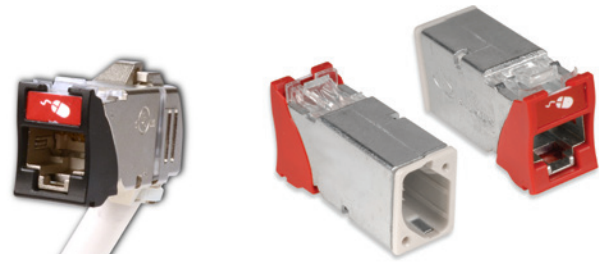
Z-MAX® UTP and Shielded Outlets

Z-MAX Category 6A shielded and unshielded outlets combine exceptional performance with best-in-class termination time. All Z-MAX products features PowerGUARD™ technology to prevent erosion due to arcing when a plug is unmated while under DC remote power load.

go.siemon.com/DCOutlets

TERA-MAX® and Z-MAX Patch Panels

Available in flat and angled versions, TERA-MAX patch panels provide outstanding performance and reliability in a modular solution for equipment rooms. Shielded and UTP Z-MAX modules can be easily configured in the TERA-MAX and Z-MAX panels.
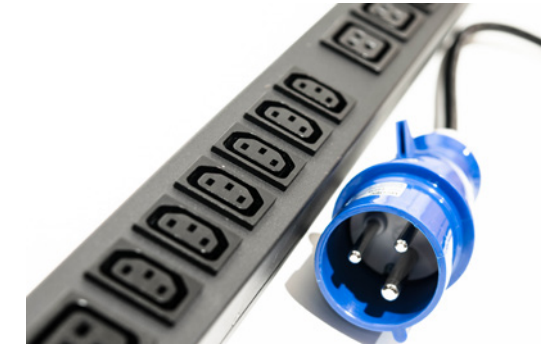
go.siemon.com/DCPanels

Automated Infrastructure Management (AIM)

Developed specifically to eliminate the complexity seen with other AIM solutions, Siemon's MapIT® G2 solution integrates smart patch panels, singlemode and multimode fiber enclosures, user-friendly master and distribution control panels with EagleEye™ Connect software.

go.siemon.com/DCAIM

Power Distribution Units

Siemon's PowerMax™ line of horizontal and vertical PDUs range from basic and metered for simple and cost-effective power distribution, to a full line of intelligent PDUs that deliver real time power information with varying degrees of intelligent functionality.

*PowerMax PDUs are available in limited geographies. Visit www.siemon.com for availability.*

go.siemon.com/DCPDU

High Speed Interconnect Assemblies

Ideal for high-speed direct attach connections (DAC) in the AV equipment room, Siemon High Speed Interconnects and active optical cables (AOC) are available in a variety of QSFP28, SFP28, QSFP+, SFP+ form factors, and they come in ½ meter increments from 0.5m to 10m and in multiple colors.

go.siemon.com/DCHighSpeedAssemblies
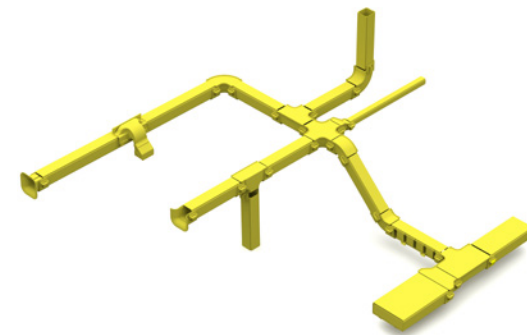
Fiber Raceway System

Manufactured from halogen free, flame-retardant UL94/V0 plastic and available in four different sizes. LightWays™ is easy to assemble and includes a wide variety of straight duct, elbows, tees, crosses, reducers and innovative outlets ideal for designing a system that meets the precise needs of your data center space.

LightWays is available in limited geographies. Visit www.siemon.com for availability.

go.siemon.com/DCFiberRouting

Data Center Network Cabinet Solutions

To house and secure active equipment and passive components throughout the data center, Siemon offers a wide range of robust 800mm and 600mm wide cabinets available in multiple widths, depths and heights.

Siemon Cabinets are available in limited geographies. Visit www.siemon.com for availability.

go.siemon.com/DCCabinets

Racks and Cable Management

Siemon offers a wide range of racks, vertical and horizontal cable management and accessories to meet a variety of data center needs.

go.siemon.com/DCRacks

Want to Learn More About our Data Center Solutions?

Visit our Advanced Data Center Solutions page: go.siemon.com/DCSolutions

Contact our 24/7 Customer Support Team: Customer_Service@siemon.com

Phone: (1) 860 945 4200
Customer Service: (1) 866 548 5814 (toll-free US)

Find your local Siemon distributor: go.siemon.com/DCDistributors

Because we continuously improve our products, Siemon reserves the right to change specifications and availability without prior notice.

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