The Siemon Company offers a broad range of fiber optic cable assemblies for use in data centers to interconnect ports and transceivers that accept LC, mini-LC and MTP* fiber connectors. Siemon provides cost-effective solutions that can fulfill your needs for today and provide a means for upgrades in the future. This application guide will demonstrate how fiber optic cables are used to interconnect 10Gbps, 40Gbps and 100Gbps transceiver ports.

Data center equipment has either optical connectors or copper connectors on the ports. If they have optical ports, the ports will be designated by the industry standard terms LC, mini-LC, and MTP* (can be known as MPO).

If the equipment has copper connectors, these ports will be designated by the following industry-standard names: SFP+, QSFP+, CXP, and CFP. These ports allow the use of several different types of cables: passive copper or direct attach copper cables (DAC), active copper cables, active optical cables or optical transceivers with fiber cables attached between them.

Optical transceivers offer the advantage of long distance data transmission over optical fiber cables whereas the copper solutions are used for shorter runs (typically 7 meters or less.) The optical transceiver converts the electrical signals to optical signals which exit the transceiver via the fiber connector on the back that accepts the industry standard fiber optic cables (LC, mini-LC and MTP*).

Multimode optical fiber cables are typically used for distances up to 150 meters, whereas singlemode fibers can span several kilometers.

* MTP is a registered trademark of US Conec for their high performance MPO connector

**Applications**
- High-speed storage area networks
- High performance computer interconnects
- Switch and router backplane connections
- Telecom centers

**Applicable Standards**
- Ethernet (1, 10, 40, 100Gbe)
- InfiniBand SDR (4 x 1G), DDR (4 x 5G), QDR (4 x 10G), FDR (4 x 14G), EDR (4 x 25G), and 120G (12 x 10G)
- Fibre Channel
- SAS/SATA
- PCI-Express
10G Solutions

Currently, the demand for 10G solutions is very high. SFP+ 10G transceivers and ports have replaced SFP as the main interconnect in today’s data centers. Each SFP+ transceiver requires an LC fiber jumper to complete the link. The Siemon Company offers the following LC products:

**XGLO® LC Jumpers**

XGLO fiber optic cable assemblies are ideal for supporting 10 Gigabit fiber applications over extended distances. XGLO cable assemblies feature premium fiber that meets IEEE 802.3 10 Gigabit Ethernet Standard as well as IEC-60793-2-10 and TIA-492AAAC (OM3), TIA-492AAAD (OM4) specifications for laser bandwidth Differential Mode Delay (DMD) specifications.

**LC BladePatch®**

Siemon’s LC BladePatch duplex jumper offers a unique solution for high density fiber optic patching environments. It features a revolutionary and innovative push-pull boot design to control the latch, enabling easy access and removal in tight-fitting areas. The LC BladePatch provides low-loss performance for multimode and singlemode supporting the precise optical performance requirements for high speed networks and improving network performance. Siemon also offers LC BladePatch to MTP patch cords.

**Mini-LC**

Siemon’s Mini-LC duplex multimode cable assemblies are designed to operate with the Mini-SFP transceiver and enable higher density deployment of active devices. The Mini-LC has a reduced centerline pitch of 5.25mm compared to a standard LC pitch of 6.2mm. The smaller pitch minimizes the physical footprint and provides higher-density port count. Siemon’s fiber optic cable assemblies feature premium fiber that meets IEEE 802.3 10 Gigabit Ethernet Standard as well as IEC-60793-2-10 and TIA-492AAAC (OM3) and TIA-492AAAD (OM4). They are ideal for supporting 10 Gigabit fiber applications over extended distances.
40G Solutions

Many factors are contributing to needs for higher data rates, migrating from 10G to 40G. QSFP+ 40G transceivers are being used where more data needs to be pushed through a single port. A single QSFP+ module can take the place of 4 SFP+ modules. Each QSFP+ transceiver requires an MTP connection. The Siemon Company offers 40G solutions as depicted below:

MTP to LC

Siemon’s MTP to LC assemblies combine 12 fiber MTP connectors on one end with duplex LC connectors on the other. These assemblies are available in low loss versions allowing multiple mated pairs in 10, 40 & 100G applications. Several fiber types, including multimode and singlemode, are available with jacket ratings of riser, plenum and LSOH.

MTP to Mini-LC

Siemon also has the capability of producing Mini-LC to MTP cable assemblies. These are currently used exclusively in conjunction with switches that have the Mini-LC footprint.

MTP to MTP

Siemon offers MTP to MTP assemblies in several fiber types, including multimode and singlemode, with jacket ratings of riser, plenum and LSOH. Simple upgrade paths can be made to future 40G and 100G applications over multimode OM3 and OM4 50/125 laser optimized cable assemblies.
100G Solutions

As data rate requirements increase to 100G for core networking applications, high bandwidth applications, video on demand and other high performance computing, Siemon offers the products and expertise to support these requirements. Siemon provides 24 fiber MTP to MTP assemblies available in multimode 62.5/125, standard 50/125 and laser optimized 50/125 OM3/OM4 and singlemode OS1/OS2.

For applications requiring data rates of 100G, Siemon provides multiple solutions including those depicted below.
Ordering Information

10G Solutions

**XGLO® SFP+ to SFP+**
- FJ2-LCLC5L-(XX)AQ ............MM 10G OM3
- FJ2-LCLC5V-(XX)AQ ............MM 10G OM4
- FJ2-LCULCUL-(XX) ..............SM 10G OS2

**LC BladePatch® SFP+ to SFP+**
- FBP-LCLC5L-(XX)AQ ............MM 10G OM3
- FBP-LCLC5V-(XX)AQ ............MM 10G OM4
- FBP-LCULCUL-(XX) ..............SM 10G OS2

40G to 10G Solutions

**QSFP+ to X4 SFP+**
- TRNC5LMFLC(XXX)M ..............MM 10G OM3
- TRNC5VRMFLC(XXX)M ..............MM 10G OM4
- TRNSMRMFLC(XXX)M ..............SM 10G OS2

40G to 40G Solutions

**QSFP+ to QSFP+**
- FR12C-5LR(XXX)MB ..............MM 10G OM3
- FR12C-5VR(XXX)MB ..............MM 10G OM4
- FR12C-SMR(XXX)MB ..............SM 10G OS2

100G to 100G

**CXP/CFP to CXP/CFP**
- FS24MFMFLR(XXX)MA ..........MM 10G OM3
- FS24MFMFVR(XXX)MA ..........MM 10G OM4

100G to 10G

**CXP/CFP to X10 SFP+**
- TRP5LMFLC(XXX)M ..............MM 10G OM3
- TRP5VRMFLC(XXX)M ..............MM 10G OM4

Notes:
1) The part numbers listed above are for riser applications. Plenum and LSOH jackets are also available.
2) All MTP cable assemblies include a pulling eye. It is not recommended to include a pulling eye for cable assemblies that are 5 meters or less.
3) The listed part numbers are standard loss. Low-loss MTP fiber cable assemblies are also available.
4) Contact customer service for additional information on these options.

Established in 1903, The Siemon Company is a global industry leader in the development and delivery of high quality, high performance cabling solutions. With over 400 patents, Siemon invests heavily in R&D and development of industry standards, underlining the company’s long-term commitment to its customers and the industry.

Siemon’s Interconnect Solutions (SIS) business unit is a team of dedicated technical sales professionals supported by Siemon R & D lab, mechanical, electrical and signal integrity engineers committed to solving industry and customer driven interconnect challenges. We provide customized network infrastructure solutions to: OEM’s, Value-added Resellers, and System Integrators.
Transceiver Overview

The Siemon Company sells fiber optic cable assemblies which interface with optical transceivers available from the leading manufacturers. Below are examples of optical transceivers available from the market leaders.

**SFP+ Transceiver**

Small form-factor pluggable (SFP+) are compact, pluggable transceivers used for data communications and telecommunication applications. SFP+ transceivers are designed to support Gigabit Ethernet and other communications standards. SFP+ transceivers are available with several transmitter and receiver types, allowing users to select the appropriate transceiver for each link to provide the required optical reach over the optical fiber type (i.e. singlemode fiber or multimode fiber). SFP+ transceivers support data rates up to 5Gbit per second. SFP+ is an enhanced version of SFP+ that supports data rates up to 10 Gigabit Ethernet.

**40GBASE-SR4 QSFP+ Transceiver**

The quad small form factor pluggable (QSFP) is a compact, pluggable transceiver. QSFP+ transceivers support 40G Ethernet, 20G/40G Infiniband and other communications standards. QSFP+ modules increase port density by a factor of 4 times when compared to SFP transceivers.

**CXP Transceiver**

CXP transceivers provide twelve 10 gigabit per second lanes suitable for 100G Ethernet or a single 120 Gigabit Infiniband connection. These modules are more compact than CFP transceivers.

**100GBASE SR-10 CFP Transceiver**

CFP transceivers were designed after the SFP interface, but they are much larger to support 100 Gigabit per second. The electrical connection of a CFP uses 10 X 10 Gbit/s lanes in each direction (transmit and receive). The optical connection can support both 10 X 10 Gbit/s and 4 X 25 Gbit/s. (These are generally referred to as 100GBASE-LR10 and 100GBASE-LR4 in 10Km reach, and 100GBASE-ER10 and 100GBASE-ER4 in 40Km reach respectively.)