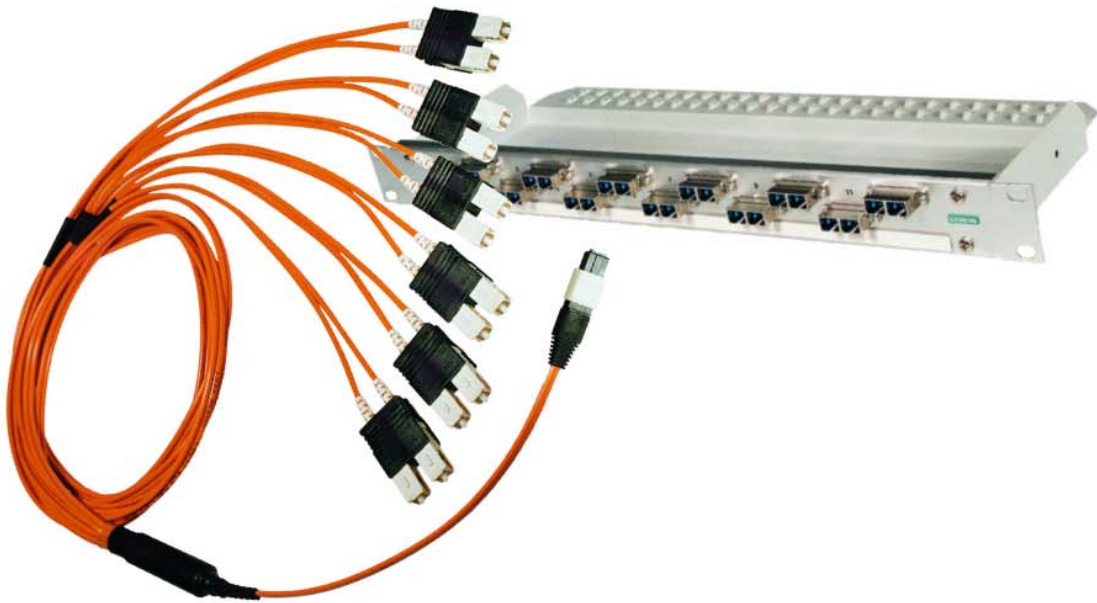




OPTICAL CONNECTIVITY PLANNING & DESIGN GUIDE

SAN & NAS NETWORKS



WINTER, 2002

NUMBER 5005





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Section 1. (Fiber Optic Cabling)

Introduction

Storage Area Network (SAN) Defined

The basic assumption is that the SAN supports the connection of computing and storage devices using the serial SCSI protocol. This protocol can be transmitted using the traditional Fibre Channel connections or the new iSCSI protocol. Today the SAN and LAN are separate networks supporting different tasks. The SAN is designed to optimize the connection of mass storage systems to computers connected to the network. When iSCSI is deployed the SAN and LAN functions can coexist on the same network.

The development of the serial SCSI protocol used over the Fibre Channel connection solves many of the limitations of the original parallel SCSI connections. The parallel SCSI protocol has been used to connect computers (servers) to the mass storage systems. When connecting to the storage systems using parallel SCSI there is a limit to the number of computers that can be connected and the distances supported. The serial SCSI protocol used in Fibre Channel networks has removed these limitations

SAN / NAS Cabling Considerations

When planning for the installation of a new optical network, serious consideration should be given to installing the fiber optic network with 50/125 μm optical fiber. SAN networks historically use 50/125 glass fiber while LAN structures historically have used 62.5/125 glass. When connecting 62.5/125 μm and 50/125 μm fiber wiring systems, as could happen when SAN and NAS applications are using the same installed fiber network there is added loss and reduced bandwidth. If the network is installed with 50 μm fiber only then both the SAN and NAS applications will have the same network structure and will benefit from the improved performance of 50 μm fiber.

While it is technically possible to use both 62.5/125 and 50/125 glass together in one network, it is our recommendation that mixing optical glass sizes should be avoided wherever possible. We recommend that Fibre Channel optical cabling guidelines be followed.

Fiber Optic Equipment and Patching Cables

When installing a new Host Bus Adapter (HBA), you will need to select the right cable to connect the HBA to the network. Table (1) describes the two types of duplex connectors that are typically used on the HBA products. Depending on the HBA option, you will need to connect using either an SC or LC type duplex cable to interface the HBA port. Figures 1 and 2 show two examples of network connections that will need to be made.



You will need to know what connector type is used at the other end of the cable. This guide is intended to help you select the right cable.

Starting on page (14) of this guide, you will find a listing of the fiber optic cables that are available from Optical Connectivity, Emerson Network Power. You will need to consider the following when selecting the cable:

- The connector type on the HUB, Fabric Switch or Director
- The connector used on the HBA
- The fiber type i.e., 50/125 μm , 62.5/125 μm multimode fiber or 8.3/125 μm singlemode.
 - Remember that it is necessary to match the fiber size to the fiber used in the network to avoid adding loss to the interconnect system.
- Distance limitations of the installed fiber.
 - This may limit the length of the cable you select and the placement of active equipment.

Fiber Optic Speed/Distance Characteristics

Fiber Optic Cable	Maximum Length
62.5/125 μm (multimode)	300 meters at 1.0625 Gb/s 150 meters at 2.125 Gb/s
50/125 μm (multimode)	500 meters at 1.0625 Gb/s 300 meters at 2.125 Gb/s
8.3/125 μm (single mode)	10,000 meters at 1.0625 Gb/s 10,000 meters at 2.125 Gb/s

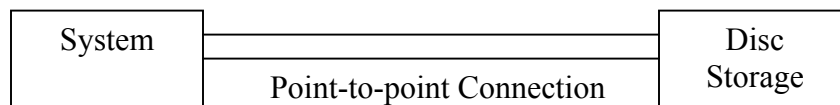
Optical Fiber Bandwidth Versus Distance

When transmitting digital information through a multimode graded index fiber, the signal is affected by modal-dispersion. This causes the digital impulse to spread out as it travels through the fiber. At some point, the adjacent bits begin to interfere and information is lost. This is why the maximum lengths depicted in the table on this page show that the fiber lengths are reduced as the signal rate increases. Notice also that 62.5 μm fiber cable supports shorter distances than 50 μm fiber. This is because the modal path and other causes of dispersion are greater in the 62.5 μm fiber than in 50 μm fiber. 62.5/125 μm glass has higher dispersion and therefore has lower bandwidth per kilometer of fiber and typically higher attenuation. 50/125 glass on average performs better than 62.5/125 glass at the 850 nm wavelength which is the wavelength of the VCSELs (Vertical Cavity Surface Emitting Lasers) used in many Fibre Channel links. For these reasons, 50/125 μm glass is commonly used in Fibre Channel applications and should be considered when planning your network.

Fibre Channel Topologies

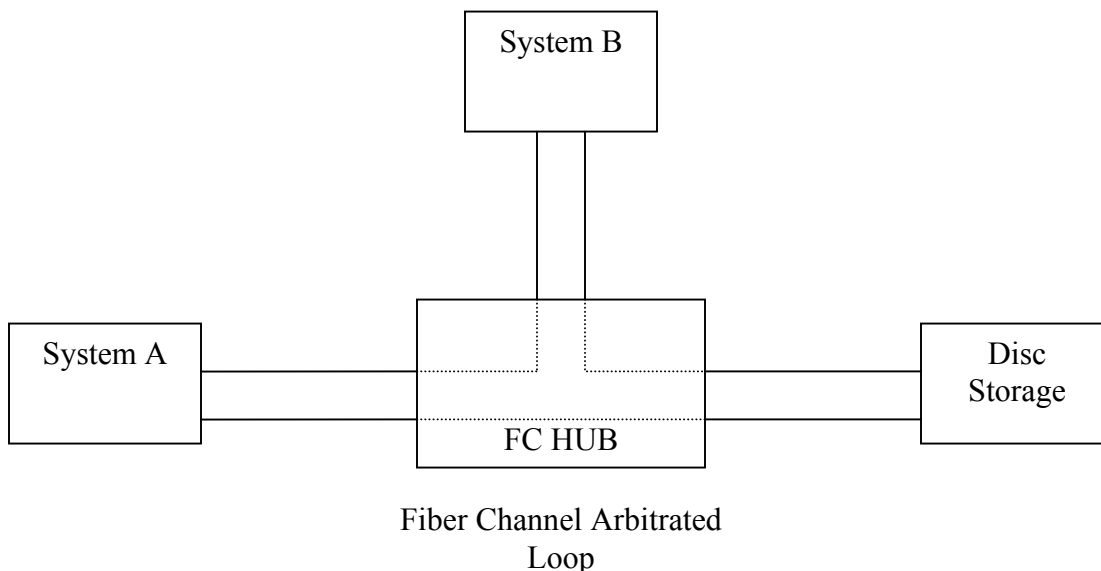
Point-to-Point

Allows the connection of an N_Port on one device to a corresponding N_Port on a second device to form the simplest Fibre Channel network.



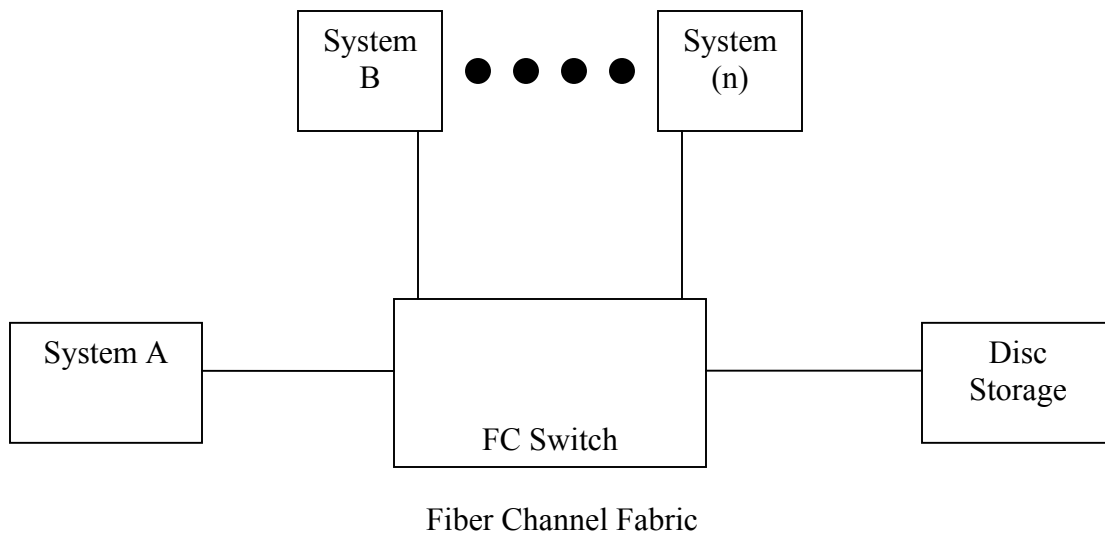
Arbitrated Loop

This configuration was added to the topology to lower the cost of connecting multiple systems into the Fibre Channel network. The connection between systems is via the NL_Port and another NL_Port on a second device or the FL_Port of a Fiber Channel switch or NL_Port of a HUB. The wiring used when connecting through a FC HUB is referred to as "star" wiring. In the Arbitrated Loop all attached devices share the same medium therefore each device must arbitrate for access to the network. Every node in the Arbitrated Loop must share the bandwidth of the channel that it connects to; therefore the performance is limited by the number of devices on the network. A maximum of 126 nodes can be connected to the loop.



Fabric

Systems connected into the Fabric topology connect from an N_Port of the device to an F_Port of the Fabric Switch. Each device is assigned a 24 bit address and can operate at the full speed of the Fibre Channel port. In theory up to 16 million nodes could be connected to the fabric.



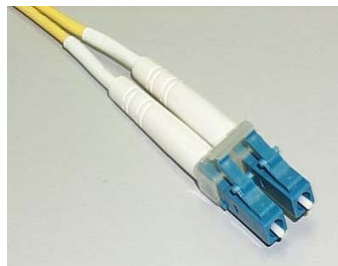
Section 2. (Planning Considerations)

Typical Connector Types used in Fibre Channel Networks



SC styles:

Originally developed by NTT, the SC connector has a push/pull snap fit. The duplex SC connector uses the same mating profile as the simplex design. A number of SC suppliers actually clip simplex SC connectors together to form the duplex version.



LC style:

a small form factor ceramic based connector developed by Lucent

Exhibit 1.

SC & LC Fiber Optic Connector Types Predominantly Used in Storage Area Networks

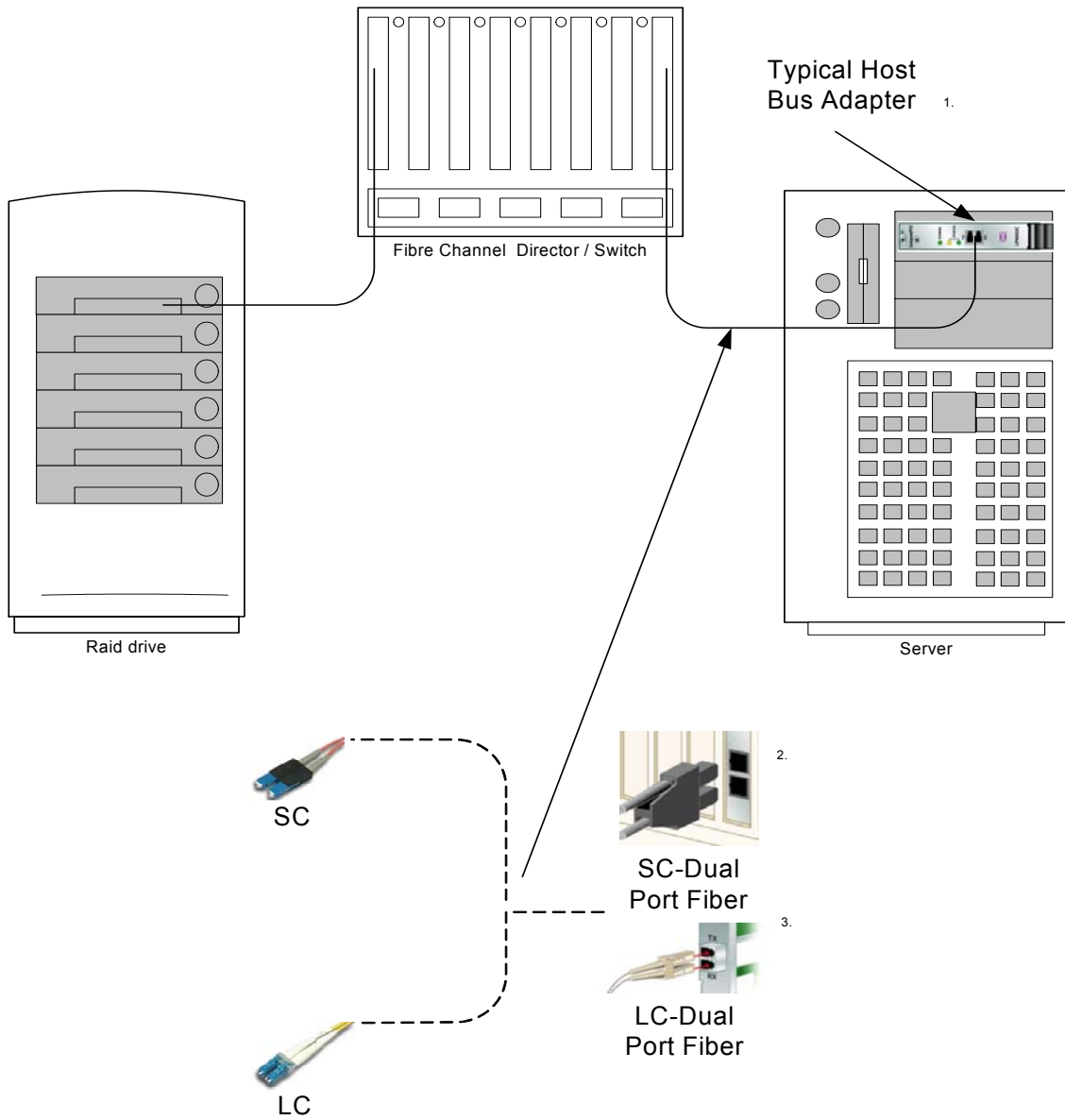


Figure 1.

HBA - Fibre Channel Logical Diagram

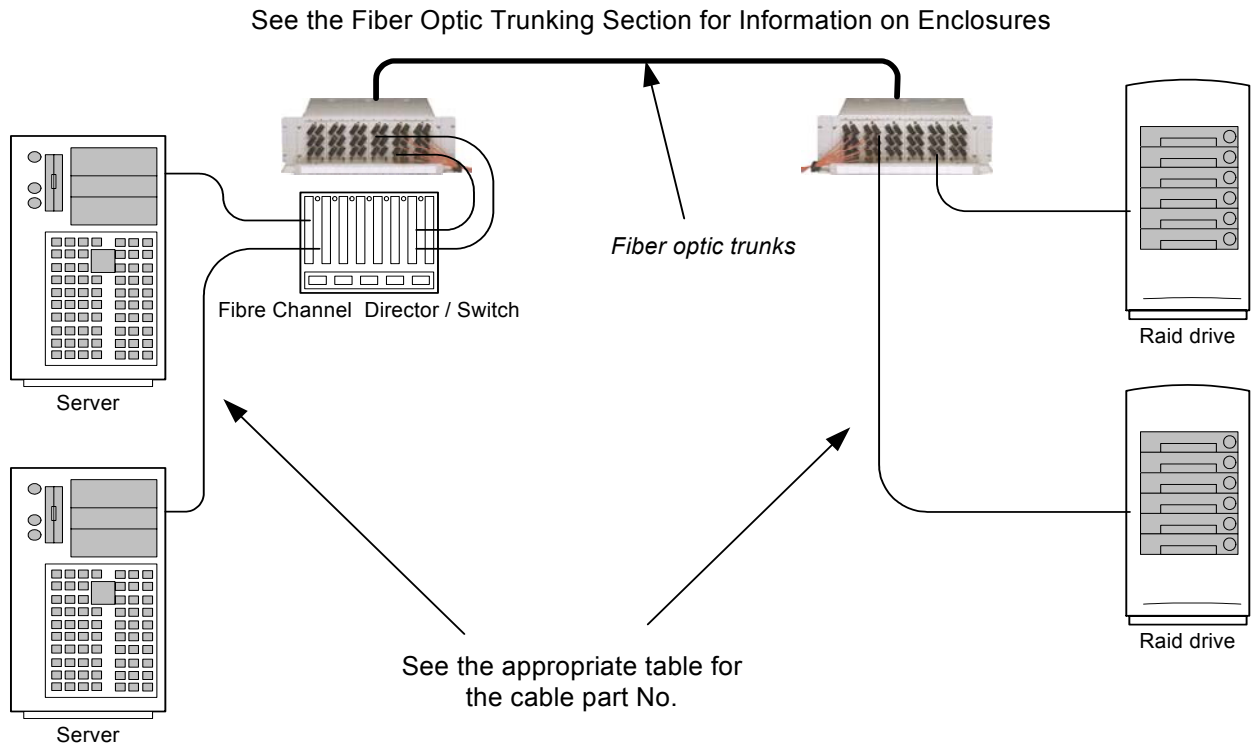


Figure 2.

Example Network Diagram

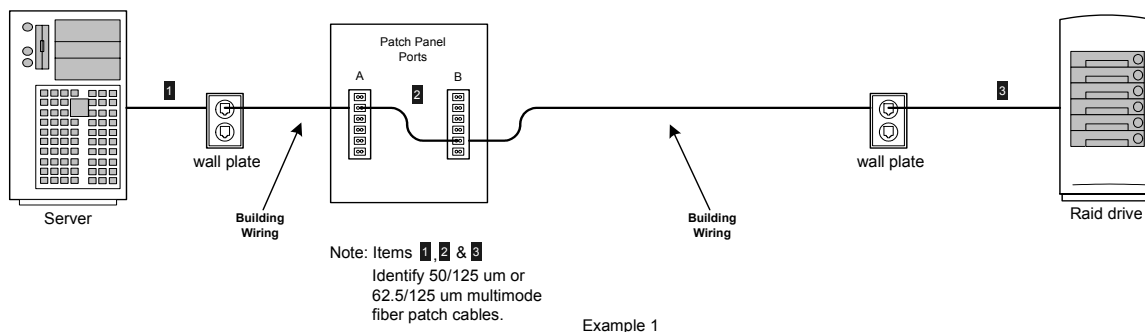
Fiber Optic Cabling

How Many Cables are needed?

Refer to Figures 1 & 2 on pages (10) & (11). Figure 1 depicts a simplified logical diagram. This type of diagrams shows the connections but not the detail needed to plan for your cabling needs. As stated earlier you need to understand what connectors are used at every interface so that the correct cables can be ordered. Figure 2 shows more detail and because it is a network design drawing it should identify every connector interface in the system. Your network documentation should list the distances and fiber type for every point-to-point link in the network. Now that you know the type of fiber and the installed cable length you can determine if there is a channel available for you to use and how much cable can be added to the link without exceeding the maximum length. If equipment is being added to support your server or storage device then there may be more patching and equipment cables required to make the connections to the network.

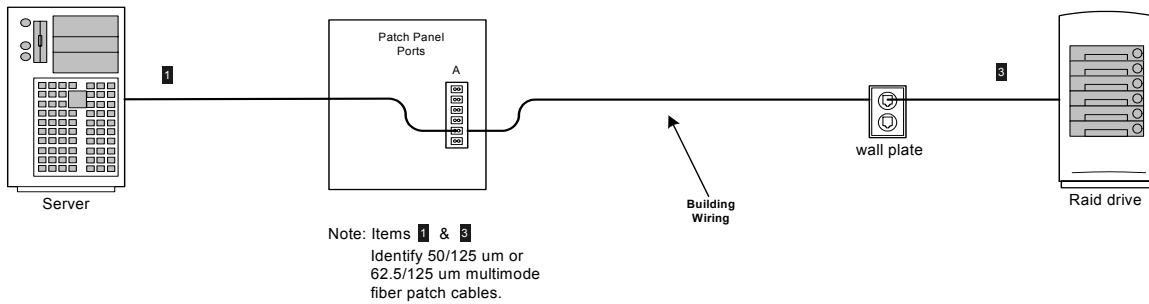
Example Link Configurations

Refer to the following examples showing some of the configurations that may be used in your Fibre Channel network. Reviewing these examples will highlight some of the things that need to be considered when ordering the cables that you need to connect your system components.



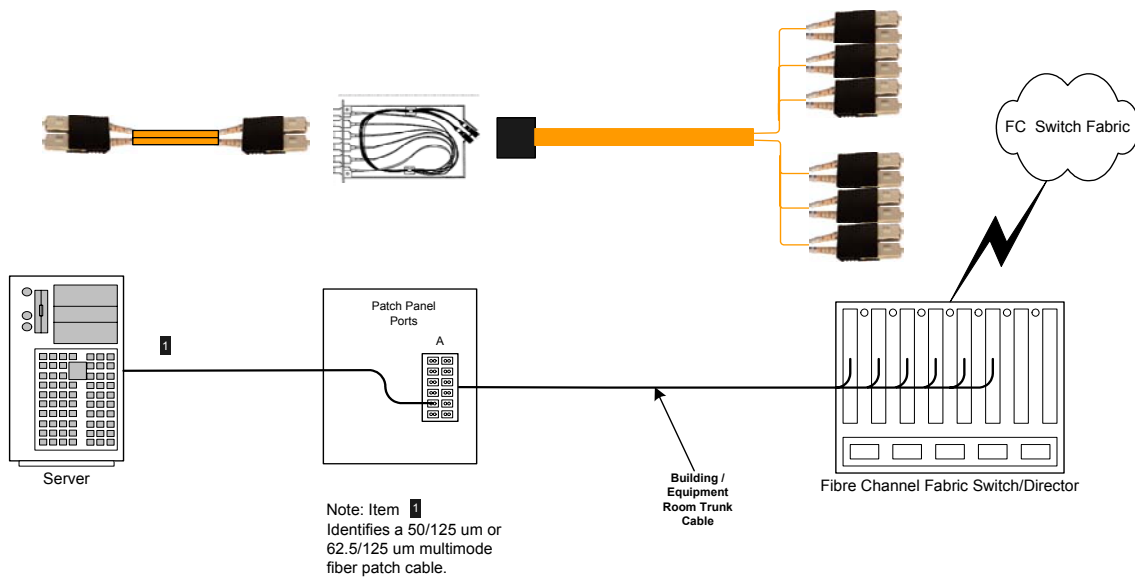
Example (1) shows a configuration where the server is not located near the storage device and therefore the connection must be made using the building wiring. This is a point-to-point connection, which is the simplest Fibre Channel network type. Notice that there is a patch panel field used in this configuration. This allows the building wiring on the floor to be terminated and managed with a patch cable (2) being used to complete the point-to-point connection. In this example you will need three fiber optic patch cable assemblies to connect the systems. The connectors used on the patch cables must match

the connectors at each connector interface. It is important to survey your specific network to be sure that the correct cables are ordered.



Example 2

Example (2) shows another point-to-point Fibre Channel network but in this case the server is located near the patch panel and therefore can connect directly to the panel using a fiber optic patch cable. In this example the storage device is located in another room and the building wiring is used to make the connection. Notice that two patch cords are required (1 & 3).



Example 3

The final example, example 3, shows a Fibre Channel network built using a fabric switch. This is the most versatile FC network and can in theory connect millions of nodes. In this example the connection to the switch is accomplished using a fiber optic trunk cable. The trunk cable shown in this diagram supports twelve fibers (six duplex fiber connections). Fiber optic trunk cables and associated termination hardware systems are also available.



Optical Connectivity (Cable Assembly Lists)

SC Cable Assemblies:

Part Number

LC-SC 50µm Multimode Fiber	Length in Meters	Type
JZ2-050LS002C	2	Riser
JZ2-050LS003C	3	Riser
JZ2-050LS005C	5	Riser
JZ2-050LS007C	7	Riser
JZ2-050LS010C	10	Riser
JZ2-050LS015PC	15	Plenum
JZ2-050LS020PC	20	Plenum
JZ2-050LS025PC	25	Plenum

LC-SC 62.5µm Multimode Fiber	Length in Meters	Type
JZ2-062LS002C	2	Riser
JZ2-062LS003C	3	Riser
JZ2-062LS005C	5	Riser
JZ2-062LS007C	7	Riser
JZ2-062LS010C	10	Riser
JZ2-062LS015PC	15	Plenum
JZ2-062LS020PC	20	Plenum
JZ2-062LS025PC	25	Plenum

LC-SC 8.3µm Singlemode Fiber	Length in Meters	Type
JZ2-010LS002C	2	Riser
JZ2-010LS003C	3	Riser
JZ2-010LS005C	5	Riser
JZ2-010LS007C	7	Riser
JZ2-010LS010C	10	Riser
JZ2-010LS015PC	15	Plenum
JZ2-010LS020PC	20	Plenum
JZ2-010LS025PC	25	Plenum



SC-SC 50µm Multimode Fiber	Length in Meters	Type
JZ-050SS002C	2	Riser
JZ-050SS003C	3	Riser
JZ-050SS005C	5	Riser
JZ-050SS007C	7	Riser
JZ-050SS010C	10	Riser
JZ-050SS015PC	15	Plenum
JZ-050SS020PC	20	Plenum
JZ-050SS025PC	25	Plenum

SC-SC 62.5µm Multimode Fiber	Length in Meters	Type
JZ-062SS002C	2	Riser
JZ-062SS003C	3	Riser
JZ-062SS005C	5	Riser
JZ-062SS007C	7	Riser
JZ-062SS010C	10	Riser
JZ-062SS015PC	15	Plenum
JZ-062SS020PC	20	Plenum
JZ-062SS025PC	25	Plenum

SC-SC 8.3µm Singlemode Fiber	Length in Meters	Type
JZ-062SS002C	2	Riser
JZ-062SS003C	3	Riser
JZ-062SS005C	5	Riser
JZ-062SS007C	7	Riser
JZ-062SS010C	10	Riser
JZ-062SS015PC	15	Plenum
JZ-062SS020PC	20	Plenum
JZ-062SS025PC	25	Plenum



LC Cable Assemblies:

Part Number

LC-SC 50µm Multimode Fiber	Length in Meters	Type
JZ2-050LS002C	2	Riser
JZ2-050LS003C	3	Riser
JZ2-050LS005C	5	Riser
JZ2-050LS007C	7	Riser
JZ2-050LS010C	10	Riser
JZ2-050LS015PC	15	Plenum
JZ2-050LS020PC	20	Plenum
JZ2-050LS025PC	25	Plenum

LC-SC 62.5µm Multimode Fiber	Length in Meters	Type
JZ2-062LS002C	2	Riser
JZ2-062LS003C	3	Riser
JZ2-062LS005C	5	Riser
JZ2-062LS007C	7	Riser
JZ2-062LS010C	10	Riser
JZ2-062LS015PC	15	Plenum
JZ2-062LS020PC	20	Plenum
JZ2-062LS025PC	25	Plenum

LC-SC 8.3µm Singlemode Fiber	Length in Meters	Type
JZ2-010LS002C	2	Riser
JZ2-010LS003C	3	Riser
JZ2-010LS005C	5	Riser
JZ2-010LS007C	7	Riser
JZ2-010LS010C	10	Riser
JZ2-010LS015PC	15	Plenum
JZ2-010LS020PC	20	Plenum
JZ2-010LS025PC	25	Plenum



LC-LC 50µm Multimode Fiber	Length in Meters	Type
JZ2-050LL002	2	Riser
JZ2-050LL003	3	Riser
JZ2-050LL005	5	Riser
JZ2-050LL007	7	Riser
JZ2-050LL010	10	Riser
JZ2-050LL015P	15	Plenum
JZ2-050LL020P	20	Plenum
JZ2-050LL025P	25	Plenum

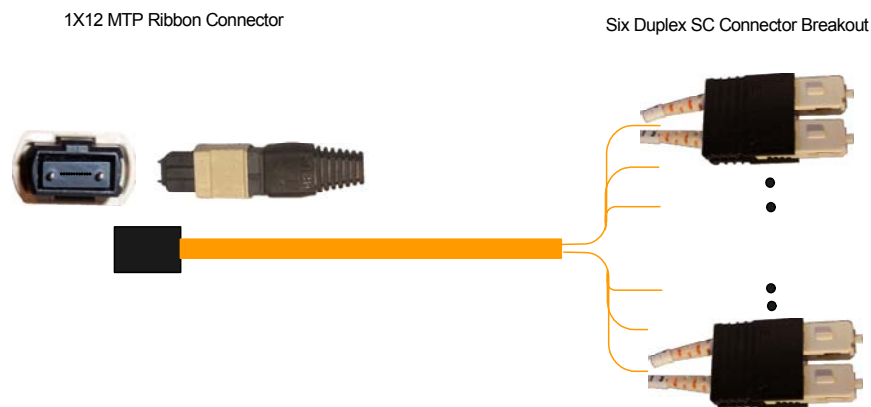
LC-LC 62.5µm Multimode Fiber	Length in Meters	Type
JZ-062LL002C	2	Riser
JZ-062LL003C	3	Riser
JZ-062LL005C	5	Riser
JZ-062LL007C	7	Riser
JZ-062LLS010C	10	Riser
JZ-062LL015PC	15	Plenum
JZ-062LL020PC	20	Plenum
JZ-062LL025PC	25	Plenum

LC-LC 8.3µm Singlemode Fiber	Length in Meters	Type
JZ2-010LL002	2	Riser
JZ2-010LL003	3	Riser
JZ2-010LL005	5	Riser
JZ2-010LL007	7	Riser
JZ2-010LL010	10	Riser
JZ2-010LL015P	15	Plenum
JZ2-010LL020P	20	Plenum
JZ2-010LL025P	25	Plenum

Fiber Optic Trunking

Page (9) shows an example of a system designed to use fiber optic trunking. This is an ideal way to build a network with preinstalled connectors for a plug-and-play environment. It assures maximum performance with minimum onsite labor required to install the network. Refer to the following pages for a list of some of the available cable assembly products used to build this type of system. There are many more products and options available from Connectivity-Solution, Emerson Network Power. For additional information and design support contact our LoDan Totowa, NJ office.

MTP-SC Fiber Trunk Cable Example



Contact Information:

LoDan Totowa
20-F Commerce Way
Totowa, NJ 07512
USA
Tel: 973-890-1606
Fax: 973-890-1610

<http://www.conn-solutions.com/solutions.htm>



Fiber Trunks: MTP® - MTP® Multimode - 50/125

Part No.	Description	Length
J72-050MM050F	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J72-050MM050PF	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
J144-050MM050F	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J144-050MM050PF	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
J144-050MM100PF	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J144-050MM100F	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-050MM100PF	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J72-050MM100F	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-050MM150F	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J72-050MM150PF	MTP®-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet
J144-050MM150F	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J144-050MM150PF	MTP®-MTP® 72 Channel/144 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet

Fiber Trunks: SC - MTP® Multimode - 50/125

Part No.	Description	Length
J72-050MS050CF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J72-050MS050PCF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
J72-050MS100PCF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J72-050MS100CF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-050MS150CF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J72-050MS150PCF	SC-MTP® 36 Channel/72 Fiber 50/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet



Fiber Trunks: MTP® - SC Direct Attach Multimode - 50/125

Part No.	Description	Length
J12-050SM008.5CFX	MTP®-SC DIRECT ATTACHED HARNESS 50/125u RISER Leadtime: Typically 3 weeks.	8.5 feet
J12-050SM012CFX	MTP®-SC DIRECT ATTACHED HARNESS 50/125u RISER Leadtime: Typically 3 weeks.	12 feet

Fiber Trunks: MTP® - MTP® Multimode - 62.5/125

Part No.	Description	Length
J72-062MM050F	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J72-062MM050PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
J144-062MM050F	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J144-062MM050PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
JR72-062MM050PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	50 feet
JR144-062MM050PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	50 feet
JR144-062MM100PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	100 feet
JR72-062MM100PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	100 feet
J144-062MM100PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J144-062MM100F	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-062MM100PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J72-062MM100F	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-062MM150F	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J72-062MM150PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet



Part No.	Description	Length
J144-062MM150F	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J144-062MM150PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet
JR72-062MM150PF	MTP®-MTP® 36 Channel/72 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	150 feet
JR144-062MM150PF	MTP®-MTP® 72 Channel/144 Fiber 62.5/125u RIBBON Plenum Leadtime: Typically 3 weeks.	150 feet

Fiber Trunks: SC - MTP® Multimode - 62.5/125

Part No.	Description	Length
J72-062MS050CF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	50 feet
J72-062MS050PCF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	50 feet
J72-062MS100PCF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	100 feet
J72-062MS100CF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	100 feet
J72-062MS150CF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic RISER Leadtime: Typically 3 weeks.	150 feet
J72-062MS150PCF	SC-MTP® 36 Channel/72 Fiber 62.5/125u Mic Plenum Leadtime: Typically 3 weeks.	150 feet

Fiber Trunks: MTP® - SC Direct Attach Multimode - 62.5/125





Part No.	Description	Length
J12-062SM008.5CFX	MTP®-SC DIRECT ATTACHED HARNESS 62.5/125u RISER Leadtime: Typically 3 weeks.	8.5 feet
J12-062SM012CFX	MTP®-SC DIRECT ATTACHED HARNESS 62.5/125u RISER Leadtime: Typically 3 weeks.	12 feet

Note: See the Emerson Network Power, Connectivity Solutions – Optical Division WEB Site for information on fiber trunks and harnesses used with the enclosure system.

www.conn-solutions.com/catalog/index.asp

Mechanical Systems

Fiber Enclosure 6-U

	Part No. Description
	<p>FB6-ENCL Fiber Enclosure 6U high, not loaded Leadtime: Typically 1 week.</p>
	<p>FB6-MOD-QN-62 Module, 6U high, loaded with (1) 6 ESCON to 1 MTP® male internal harness, 62.5/125um Leadtime: Typically 1 week.</p>
	<p>FB6-MOD-KN-62 Module, 6U high, 12 MTRJ male to 2 MTP® male internal harnesses, 62.5/125um Leadtime: Typically 1 week.</p>
	<p>FB6-Blank Blank Faceplate Leadtime: Typically 1 week.</p>

Fiber Enclosure 6-U (Continued)

No Picture Available	FB6-MOD-QN-50 Module, 6U high, 6 ESCON to 1 MTP® male internal harness, 50/125um Leadtime: Typically 1 week
No Picture Available	FB6-MOD-KN-50 Module, 6U high, 12 MTRJ male to 2 MTP® male internal harnesses, 50/125um Leadtime: Typically 1 week
No Picture Available	FB6-MOD-LN-62 Module, 6U high, 12 LC to 2 MTP® male harnesses, 62.5/125um Leadtime: Typically 1 week
No Picture Available	FB6-MOD-LN-50 Module, 6U high, 12 LC to 2 MTP® male internal harnesses, 50/125um Leadtime: Typically 1 week
No Picture Available	FB6-MOD-SN-62 Module, 6U high, 6 SC duplex to 1 MTP® male internal harness, 62.5/125um Leadtime: Typically 1 week
No Picture Available	FB6-MOD-SN-50 Module, 6U high, 6 SC duplex to 1 MTP® male internal harness, 50/125um Leadtime: Typically 1 week







6U Faceplates

	Part No. Description
No Picture Available	FB6-QQ-MM Faceplate, 6U high, 6 ESCON to ESCON multimode adapters Leadtime: Typically 1 week
No Picture Available	FB6-QT-MM Faceplate, 6U high, 6 ESCON to ST multimode adapters Leadtime: Typically 1 week
No Picture Available	FB6-SS-MM Faceplate, 6U high, 6 SC duplex to SC duplex multimode adapters Leadtime: Typically 1 week
No Picture Available	FB6-SS-SM Faceplate, 6U high, 6 SC duplex to SC duplex singlemode adapters Leadtime: Typically 1 week
No Picture Available	FB6-ST-MM Faceplate, 6U high, 6 SC duplex to ST multimode adapters Leadtime: Typically 1 week
No Picture Available	FB6-LL-MM Faceplate, 6U high, 12 LC duplex to LC duplex multimode adapters Leadtime: Typically 1 week
No Picture Available	FB6-LL-SM Faceplate, 6U high, 12 LC duplex to LC duplex singlemode adapters Leadtime: Typically 1 week
No Picture Available	FB6-RR-MM Faceplate, 6U high, 12 MTRJ to MTRJ multimode adapters Leadtime: Typically 1 week

Fiber Enclosure 4-U

	Part No. Description
	<p>FB4-ENCL Enclosure, 4U high, not loaded Leadtime: Typically 1 week.</p>
	<p>FB4-MOD-QN-62 Module, 4U high, 6 ESCON to 1 MTP® male internal harness, 62.5/125um Leadtime: Typically 1 week.</p>
	<p>FB4-MOD-QN-50 Module, 4U high, 6 ESCON to 1 MTP® male internal harness, 50/125m Leadtime: Typically 1 week.</p>
	<p>FB4-MOD-SN-62 Module, 4U high, 6 SC duplex to 1 MTP® male internal harness, 62.5/125um Leadtime: Typically 1 week.</p>
	<p>FB4-MOD-LN-62 Module, 4U high, 12 LC duplex to 2 MTP® male internal harnesses, 62.5/125um Leadtime: Typically 1 week.</p>

Fiber Enclosure 4-U (Continued)

	<p>FB4-MOD-SN-50 Module, 4U high, 6 SC duplex to 1 MTP® male internal harness, 50/125um Leadtime: Typically 1 week.</p>
	<p>FB4-MOD-KN-62 Module, 4U high, 12 MTRJ male to 2 MTP® male internal harnesses, 62.5/125um Leadtime: Typically 1 week.</p>
	<p>FB4-QT-MM Escon-ST multimode Faceplate 6 Channel Leadtime: Typically 1 week.</p>
	<p>FB4-QQ-MM Escon-Escon multimode Faceplate 6 Channel Leadtime: Typically 1 week.</p>
	<p>FB4-ST-MM SC Duplex-ST multimode Faceplate 6 Channel Leadtime: Typically 1 week.</p>
	<p>FB4-ST-SM SC duplex-ST singlemode Faceplate 6 Channel Leadtime: Typically 1 week.</p>

Fiber Enclosure 4-U (Continued)



FB4-Blank
Blank Faceplate
Leadtime: Typically 1 week.





Fiber Enclosure 1-U

	Part No. Description
	FB1-EN-TOUM-24 1U Enclosure (24) SC to ST Duplex Adapters MM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-SOUM-24 1U Enclosure (24) SC to SC Duplex Adapters MM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-LOUM-24 1U Enclosure (24) LC to LC Duplex Adapters MM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-ROUM-24 1U Enclosure (24) MTRJ to MTRJ Adapters MM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-TOUS-24 1U Enclosure (24) SC to ST Duplex Adapters SM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-SOUS-24 1U Enclosure (24) SC to SC Duplex Adapters SM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.
	FB1-EN-LOUS-24 1U Enclosure (24) LC to LC Duplex Adapters SM Unloaded, No MPO Couplers Or Harnesses Included Leadtime: Typically 1 week.



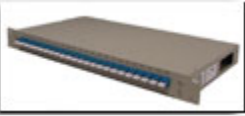
1U Faceplate Panels

	Part No. Description
	<p>FB1-FP-TM-24 Faceplate Only 24 Channel SC to ST Duplex Adapters Multimode, 50/125 or 62.5/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-SM-24 Faceplate Only 24 Channel SC to SC Duplex Adapters Multimode 50/125 or 62.5/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-LM-24 Faceplate Only 24 Channel LC to LC Duplex Adapters Multimode, 50/125 or 62.5/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-RR-24 Faceplate Only 24 Channel MTRJ to MTRJ Duplex Adapters Multimode, 50/125 or 62.5/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-TS-24 Faceplate Only 24 Channel SC to ST Duplex Adapters Singlemode, 8.3~10/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-SS-24 Faceplate Only 24 Channel SC to SC Duplex Adapters Singlemode, 8.3~10/125 Leadtime: Typically 1 week.</p>
	<p>FB1-FP-LS-24 Faceplate Only 24 Channel LC to LC Duplex Adapters Singlemode, 8.3~10/125 Leadtime: Typically 1 week.</p>

Prewired Fiber Enclosure 1U

	Part No. Description
	<p>FB1-EN-CTMLM 1U fiber enclosure, (12) SC to (2) MTP®, loaded w/(2) 62.5/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-CQMLM 1U fiber enclosure, (12) ESCON to (2) MTP®, loaded w/(2) 62.5/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-BTMLM 1U fiber enclosure, (12) SC to (2) MTP®, loaded w/(2) 50/125um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-CTMLM-24 1U fiber enclosure, (24) SC to (4) MTP®, loaded w/(4) 62.5/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-CLMLM-24 1U fiber enclosure, (24) LC to (4) MTP®, loaded w/(4) 62.5/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-CRMLM-24 1U fiber enclosure, (24) MTRJ to (4) MTP®, loaded w/(4) 62.5/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-BTMLM-24 1U fiber enclosure, (24) SC to (4) MTP®, loaded w/(4) 50/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-BLMLM-24 1U fiber enclosure, (24) LC to (4) MTP®, loaded w/(4) 50/125 um harnesses Leadtime: Typically 1 week.</p>

Prewired Fiber Enclosure 1U (Continued)

	<p>FB1-EN-BRMLM-24 1U fiber enclosure, (24) MTRJ to (4) MTP®, loaded w/(4) 50/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-ATMLS-24 1U fiber enclosure, (24) SC to (4) MTP®, loaded w/(4) 10/125 um harnesses Leadtime: Typically 1 week.</p>
	<p>FB1-EN-ALMLS-24 1U fiber enclosure, (24) LC to (4) MTP®, loaded w/(4) 10/125 um harnesses Leadtime: Typically 1 week.</p>