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This document provides data information for some EMC SAN products, including descriptions, system architecture, and management.

E-Lab would like to thank all the contributors to this document, including EMC engineers, EMC field personnel, and partners. Your contributions are invaluable.

As part of an effort to improve and enhance the performance and capabilities of its product lines, EMC periodically releases revisions of its hardware and software. Therefore, some functions described in this document may not be supported by all versions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes. If a product does not function properly or does not function as described in this document, please contact your EMC representative.

Audience

This material is intended for technical consultants, solutions architects, implementation specialists, end users, or anyone interested in learning more about the features of the EMC Connectrix director and switches.

For the most up-to-date information, always consult the EMC Support Matrix (ESM), available through E-Lab Interoperability Navigator (ELN), at http://elabnavigator.EMC.com.

All of the matrices, including the ESM (which does not include most software), are subsets of the E-Lab Interoperability Navigator database. Included are:

- The EMC Support Matrix, a complete guide to interoperable, and supportable, configurations.
Host connectivity guides for complete, authoritative information on how to configure hosts effectively for various storage environments.

Consult the Internet Protocol pdf for EMC’s policies and requirements for the **EMC Support Matrix**.

Related documents include:

- The following documents, including this one, are available through the E-Lab Interoperability Navigator at [http://elabnavigator.EMC.com](http://elabnavigator.EMC.com).

These documents are also available at the following location:


- **Backup and Recovery in a SAN TechBook**
- **Building Secure SANs TechBook**
- **Extended Distance Technologies TechBook**
- **Fibre Channel over Ethernet (FCoE) Data Center Bridging (DCB) Case Studies TechBook**
- **Fibre Channel over Ethernet (FCoE) Data Center Bridging (DCB) Concepts and Protocols TechBook**
- **Fibre Channel SAN Topologies TechBook**
- **iSCSI SAN Topologies TechBook**
- **Networked Storage Concepts and Protocols TechBook**
- **Networking for Storage Virtualization and RecoverPoint TechBook**
- **WAN Optimization Controller Technologies TechBook**
- **Legacy SAN Technologies Reference Manual**
- **Non-EMC SAN Products Data Reference Manual**

- **EMC Support Matrix**, available through E-Lab Interoperability Navigator at [http://elabnavigator.EMC.com](http://elabnavigator.EMC.com)

- RSA security solutions documentation, which can be found at [http://RSA.com](http://RSA.com) > Content Library

All Connectrix documentation and release notes can be found at EMC Online Support at [https://support.emc.com](https://support.emc.com).

For Cisco, Brocade, and HP documentation, refer to the vendor’s website.

- [http://cisco.com](http://cisco.com)
- [http://brocade.com](http://brocade.com)
EMC uses the following conventions for special notices:

**IMPORTANT**
An important notice contains information essential to software or hardware operation.

**Note:** A note presents information that is important, but not hazard-related.

**Typographical conventions**
EMC uses the following type style conventions in this document.

- **Normal**
  - Used in running (nonprocedural) text for:
    - Names of interface elements, such as names of windows, dialog boxes, buttons, fields, and menus
    - Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, functions, and utilities
    - URLs, pathnames, filenames, directory names, computer names, links, groups, service keys, file systems, and notifications

- **Bold**
  - Used in running (nonprocedural) text for names of commands, daemons, options, programs, processes, services, applications, utilities, kernels, notifications, system calls, and man pages
  - Used in procedures for:
    - Names of interface elements, such as names of windows, dialog boxes, buttons, fields, and menus
    - What the user specifically selects, clicks, presses, or types

- **Italic**
  - Used in all text (including procedures) for:
    - Full titles of publications referenced in text
    - Emphasis, for example, a new term
    - Variables

- **Courier**
  - Used for:
    - System output, such as an error message or script
    - URLs, complete paths, filenames, prompts, and syntax when shown outside of running text

- **Courier bold**
  - Used for specific user input, such as commands
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The Support by Product web pages offer quick links to Documentation, White Papers, Advisories (such as frequently used Knowledgebase articles), and Downloads, as well as more dynamic content, such as presentations, discussion, relevant Customer Support Forum entries, and a link to EMC Live Chat.

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techpubcomments@emc.com
This chapter contains data on the Connectrix B Series application platform, directors, and switches.

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Switch and blade ID numbers

This section includes the switch and blade ID numbers for the Connectrix B Series Directors and switches. Table 1 on page 22 lists the switch ID numbers. Table 2 on page 23 lists the blade ID numbers.

Each Connectrix B Series Director, switch and blade type can be identified by its ID number. To locate the Director or switch ID number, use the `switchshow` command. The ID is shown next to "switchType". To determine the blade type installed in director class products, use the `slotshow` command. The ID number is shown in the type column. Once the ID number has been located, use Table 1 and Table 2 on page 23 to decode it.

### Table 1  Switch ID numbers

<table>
<thead>
<tr>
<th>Switch ID</th>
<th>EMC switch model</th>
<th>Brocade switch model</th>
<th>ASIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1000</td>
<td>Stitch/Flannel</td>
</tr>
<tr>
<td>26</td>
<td>D-16B3</td>
<td>3850</td>
<td>Bloom2</td>
</tr>
<tr>
<td>27</td>
<td>DS-8B3</td>
<td>3250</td>
<td>Bloom2</td>
</tr>
<tr>
<td>32</td>
<td>DS-4100B</td>
<td>4100</td>
<td>Condor</td>
</tr>
<tr>
<td>34</td>
<td>DS-220B</td>
<td>200E</td>
<td>Goldeneye</td>
</tr>
<tr>
<td>38</td>
<td>AP-7420B</td>
<td>AP7420 Multi-protocol router</td>
<td>Figero</td>
</tr>
<tr>
<td>42</td>
<td>ED-48000B</td>
<td>48000</td>
<td>Condor</td>
</tr>
<tr>
<td>44</td>
<td>DS-4900B</td>
<td>4900</td>
<td>Condor</td>
</tr>
<tr>
<td>46</td>
<td>MP-7500B</td>
<td>7500</td>
<td>Condor</td>
</tr>
<tr>
<td>55.2</td>
<td>AP-7600B</td>
<td>7600</td>
<td>Condor</td>
</tr>
<tr>
<td>58</td>
<td>DS-5000B</td>
<td>5000</td>
<td>Condor</td>
</tr>
<tr>
<td>62.3</td>
<td>ED-DCX-B</td>
<td>DCX</td>
<td>Condor2</td>
</tr>
<tr>
<td>64</td>
<td>DS-5300B</td>
<td>5300</td>
<td>Condor2</td>
</tr>
<tr>
<td>66</td>
<td>DS-5100B</td>
<td>5100</td>
<td>Condor2</td>
</tr>
<tr>
<td>71</td>
<td>DS-300B</td>
<td>300</td>
<td>Condor2</td>
</tr>
</tbody>
</table>
Table 2 Blade ID numbers

<table>
<thead>
<tr>
<th>Blade ID</th>
<th>EMC blade name</th>
<th>Brocade blade name</th>
<th>Description</th>
<th>EMC Director</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CP1</td>
<td></td>
<td>Control Processor</td>
<td>ED-12000B</td>
</tr>
<tr>
<td>5</td>
<td>CP2</td>
<td></td>
<td>Control Processor</td>
<td>ED-24000B</td>
</tr>
<tr>
<td>16</td>
<td>CP4</td>
<td></td>
<td>Control Processor</td>
<td>ED-48000B</td>
</tr>
<tr>
<td>2</td>
<td>FC-16</td>
<td></td>
<td>16 port 2 GB FC</td>
<td>ED-12000B/24000B</td>
</tr>
<tr>
<td>4</td>
<td>FC2-16</td>
<td></td>
<td>16 port 2 GB FC</td>
<td>ED-24000B/48000B</td>
</tr>
<tr>
<td>17</td>
<td>FC4-16</td>
<td></td>
<td>16 port 4 GB FC</td>
<td>ED-24000B/48000B</td>
</tr>
<tr>
<td>18</td>
<td>FC4-32</td>
<td></td>
<td>32 port 4 GB FC</td>
<td>ED-48000B</td>
</tr>
<tr>
<td>24</td>
<td>PB-48K-18i</td>
<td>FR4-18i</td>
<td>16 FC 4 GB/2 GigE</td>
<td>ED-48000B</td>
</tr>
<tr>
<td>31</td>
<td>PB-48K-16IP</td>
<td>FC4-16IP</td>
<td>iSCSI 8 4 GB/8 GigE</td>
<td>ED-48000B</td>
</tr>
<tr>
<td>36</td>
<td>PB-48K-48</td>
<td>FC4-48</td>
<td>48 port 4 GB FC</td>
<td>ED-48000B</td>
</tr>
<tr>
<td>33</td>
<td>PB-48K-AP</td>
<td>FA-18</td>
<td>Application Blade</td>
<td>ED-48000B</td>
</tr>
</tbody>
</table>
The ED-DCX8510 Family is a Backbone product line built on Condor3 ASIC technology. It consists of two products lines:

- 8-slot chassis, ED-DCX8510-8B, further described in this section
- 4-slot chassis, ED-DCX8510-4B, further described in “ED-DCX8510-4B” on page 34

Both chassis share the same CP with the exception of the 16 Gb core blades. The ED-DCX8510 Family also leverages lot of components from DCX family. The ED-DCX8510 is designed to be a cloud optimized platform especially targeting large to mid enterprises building private clouds.

In addition to providing base features like multi-tenancy (Virtual Fabric, Integrated Routing), SLA-driven SAN (Adaptive Networking and QoS) end-to-end and dynamic services (extension, encryption), it provides mainly four buckets of features:

- Hyper-scale fabric (scale out ICL, 128 Gb of Trunking)
- Built in metro connectivity (integrated 10 Gb FC for DWDM/CWDM, in-flight encryption, and compression with resiliency built in)
- Operational simplicity (cable and optic diagnostic features, real time power monitoring)
- Cloud optimized performance (traffic engineering 2.0, higher IOPS and bandwidth)

### Key features

Major product features of DCX8510-8 include:

- 384-port chassis with 8 usable port blades (in addition to 2 16 Gb Core, 2 CP blades)
- 32 64 Gb QSFP optical inter chassis links (ICL) enabled with 2 ICL POD licenses
- 8.2 Tb/s of aggregate BW (bandwidth) including 2 Tb/s of ICL BW
- 384x 16 Gb/s + 32x 64 Gb/s
◆ 16 Gb Core Blade (CR16-8) with switching logic for 8 blades
   (unique to DCX8510-8)
◆ Based on Brocade’s seventh-generation ‘Condor3’ ASIC
   technology, supporting 2, 4, 8, 16 Gb auto sensing Fibre Channel
   ports and 10 Gb Fibre Channel ports. 10 Gb FC ports will require
   10 Gb FC SFP+
◆ 32-port 16 Gb and 48-port 16 Gb port blades
   • FC16-32 - 32 x 16/10/8/4/2 Gb Port blade
   • FC16-48 - 48 x 16/10/8/4/2 Gb Port blade
◆ All the 8 Gb application and CP blades as shown below are
   supported. 8 Gb port blades are not supported in FOS 7.0 release
   but many of them will be supported in the ensuing release. For
   more details, please refer to the blade matrix
   • CP8 – 2 x Control Processor blade for DCX-4S

Note: This spec is focused on hardware features and specifications.
All software implications and interoperability/compatibility is
outlined in the Fabric OS 7.0 External Functional Spec.

◆ FS8-18 -16x8/4/2/1 Gb Encryption blade with 2 GE ports for
   HA clustering
◆ FX8-24- Extension blades
◆ Following 4 Gb Condor1 based blades are NOT supported in
   DCX8510 Family as Condor3 based platforms (i.e., DCX8510
   Family) is only one generation backward compatible. For more
   details, please refer to the blade matrix
   • FA4-18 Fabric application blade
   • FR4-18i Routing and Fibre Channel over IP blade
   • FC10-6 10 Gb Fibre Channel Port blade
◆ Almost no oversubscription in real-world SAN and Data Center
   with 8 Gb/16 Gb/10 Gb speeds. Similar to that of DCX family,
   advanced systems architecture of DCX8510 family enables all
   ports to operate with a worse case oversubscription of 1.5:1 at 16
   Gb/s
◆ Local switching is also available on all 16 Gb port blades.
   Blade-local switching and general real-world Fibre Channel
   traffic patterns assure virtually no oversubscription in the chassis.
   High bandwidth performance with low oversubscription ensures
   efficient, maintainable network designs with high resilience.
Dual redundant control processors and core switching blades provide enhanced high availability and enable non-disruptive software upgrades.

The multi-protocol design of DCX8510 supports other blades such as 10 Gb FC-IP Extension (FX8-24) blade.

64 Gb QSFP based optical ICLs allow connecting up to 5 DCX8510 chassis without wasting ports in port blades and helps build Scale out modular only SAN. It allows flexible topologies like core edge and full mesh topologies.

Integrated 10Gb FC interface for DWDM and CWDM connectivity. Requires 10 Gb FC SFP+ optic

In-flight encryption for 4 E-Ports or 64 Gb BW per 16 Gb port blade

In-flight compression for 4 E-Ports or 128 Gb BW per 16 Gb port blade

Inter-Switch Link (ISL) Trunking allows up to eight ports between a pair of switches to be combined to form a single, logical ISL with an aggregate speed of up to 128 Gb for optimal bandwidth utilization.

Dynamic Path Selection can evenly balance up to 8 equal cost paths; this includes trunks and ISLs at speeds from 2 Gb to 16 Gb. With this, two DCX-4Ss can have up to 1024 Gbit/sec (8 x 8 x 16 Gb/s) of H/W load balanced paths.

Universal ports self-configure as E, F, M, EX, D ports.

Brocade extended distance support leads the industry, enabling full performance for native Fibre Channel extension with the support of up to 5000km (or up to 10,000 km when credit linking is enabled in FOS) for native Fibre Channel at 2 Gb speed.

Hardware zoning (implemented via firmware-accessible table per output port) permits or denies delivery of frames to any particular destination port address.

Unicast and broadcast data traffic types are supported.

Small Form-Factor Pluggable (SFP) and SFP+ optical transceivers support any combination of Brocade Short Wavelength (SWL), Long Wavelength (LWL) and Extended Long Wavelength (ELWL) optical media on a single port blade.
Brocade Fabric Operating system (FOS) delivers distributed intelligence throughout the network and enables a wide range of value-added applications provided in the Enterprise Software Bundle

- Both ED-DCX8510-8B base chassis and ED-DCX 8510-4B base chassis comes with Advanced Zoning (AZ), Web Tools (WT) and Enhanced Group Management (EGM) without any extra licensing—EGM provides the built in functionality needed for BNA

- ED-DCX8510-8B and ED-DCX 8510-4B: Enterprise Software Bundle (consisting of value-added applications: Adaptive Networking, Server Application Optimization, Extended Fabrics, Advanced Performance Monitoring, Trunking and Fabric Watch) will be part of base chassis similar to existing DCX

- Virtual Fabric features (Logical switch and Logical fabric offered in FOS 6.2) are also offered part of base chassis without requiring purchase of licensing

- Customers will also have option to purchase above licenses as a la-carte as well. Integrated Routing, FICON CUP, Hi-Performance Extension for FC-IP, Encryption Upgrade, Brocade Accelerator for FICON are also available as separate value-added software offering.

- High availability redundant design, extensive diagnostics, and system monitoring capabilities integrated with Fabric OS management tools deliver unprecedented Reliability, Availability, and Serviceability (RAS)

**Core switching blade**

The ED-DCX8510-8B has a new core switching blade that is designed to support 8 slots, as shown in Figure 1 on page 28.
Supported features

- SSH v2
- HTTP/HTTPS
- SNMP v1/v3
- Telnet
- SNMP (FE MIB, FC Management MIB)
- Web Tools
- Fabric Watch
- SMI-S
- RADIUS
For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

### Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

### System architecture

#### Fibre Channel ports
- 384 ports (E, F, M, EX, D)
- Up to four 32 or 48-port 16 Gb or 64-port 8 Gb Fibre Channel blades

#### Performance
Performance features include:
- Autosensing of 2, 4, 8, 16 Gb and 10 Gb port speeds
- Optionally programmable to fixed port speed
- Speed matching between 12, 4, 8, 16 Gb ports

#### Port types
- F_Port, M_Port (Mirror Port), E_Port, EX_Port, D_Port; self-discovery based on switch type (U_Port); optional port type control

#### Control processor
- Redundant (active/standby) control processor blades

#### Scalability
- Full fabric architecture: 239 switches maximum

#### Hardware trunking
- Up to 8, 16 Gb ports per ISL trunk; Up to 128 Gb per ISL trunk
- Maximum deviation without performance degradation for cable lengths in a hardware trunk is 400m cable-to-cable

#### Inter-chassis links
- 32 64 Gb QSFP (licensed feature)
Dynamic path selection
- Up to 64 equal cost paths (ISLs or trunks) up to 1024 Gb/s balanced path

Aggregate bandwidth
- 8.2 Tb/s end-to-end

Slot bandwidth
- 512 GB/s

Inter-chassis links bandwidth
- 2 Tb/s

Frame buffers
- 2048 per 16-port group on the 16/32-port blades and up to 2048 per 24-port group on the 48-port blade, dynamically allocated

Data traffic type
- Fabric switches supporting unicast, multicast (255 groups), and broadcast

USB
- 1 USB port per Control Processor for firmwareDownload and for supportSave

Media types
- Hot-pluggable, industry-standard Small form-factor pluggable (SFP) and Quad Small Form Factor Pluggable (WSF) media types, LC connector
- Short-wave laser (SWL)
- Long-wave laser (LWL)
- Extended long wave (ELWL)

Distance depends on fiber optic cable and port speed.

Maximum size frame
- 2112-byte payload FC

Fabric latency
- Locally switched ports 800 ns (add additional 400ns for E_Port to E_Port traffic as Forward Error Correction is enabled by default)
- Blade to blade latency is 2.4 micro-seconds (add 400ns for E_Port to E_Port traffic Forward Error Correction is enabled by default)

Class of service
- Class 2, Class 3, Class F (interswitch frames)
Fabric services
Simple Name Server (SNS); Registered State Change Notification (RSCN); NTP v3; Reliable Commit Service (RCS); Dynamic Path Selection (DPS); Brocade Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning); NPIV; N_Port Trunking; FDMI; Management Server; FSPF; Fabric Watch; Extended Fabrics; ISL Trunking; Advanced Performance Monitoring; Adaptive Networking (per data flow QoS, Ingress Rate Limiting, Traffic Isolation, Top Talkers; licensing varies); IPoFC, Integrated Routing (FR4-18i SAN Extension blade not required for routing only); Frame Redirection; Port Fencing; BB credit recovery

Management

Management access
◆ 10/100/1000 Ethernet port (RJ-45), in-band over Fibre Channel
◆ Serial ports (RJ-45) and one USB per Control Processor blade
◆ Call-home integration through Connectrix Manager
◆ EMC Connectrix Manager

Diagnostics
◆ POST and embedded online/offline diagnostics, including FCping, Pathinfo (FCtraceroute), etc.

Mechanical specifications
◆ Width = 17.22 inches (43.74 cm)
◆ Height = 14U
◆ Depth = 24.09 inches (61.19 cm)
◆ Weight = 223 pounds (101.3 kg); 384 port fully populated

Environment
◆ Temperature
  • Operating: 0° C to 40° C outsides switch (32° to 104 F°)
  • Non-operating: -25° to +70° outside switch (-13° to 158° F)
◆ Humidity
  • Operating: 5% to 85% RH, noncondensing at 40° C, with maximum gradient of 10% per hour
  • Non-operating and storage (non-condensing): 10% to 90% RH, noncondensing at 70° C,
◆ Altitude
  • Operating: 0 to 3 km (10,000 ft) above sea level
  • Non-operating: 0 to 12 km (40,000 ft) above sea level
**Shock**  
- Operating: 20 G, 6 ms, half-sine wave  
- Non-operating: 33 G, 11 ms duration, half-sine wave

**Vibration**  
- Operating: 0.5 G p-p. 5-500 Hz at 1.0 octave/minute  
- Non-operating: 2.0 G p-p. 5-500 Hz at 1.0 octave/minute

**Heat dissipation**  
- Operating: 384 port configuration (fully loaded w/ QSFPs), 2242W, 7654 BTU/hr  
- Non-operating: N/A

**Power**  
- Two 2000 W AC power supply modules (100 to 240 V auto-sensing), 2N redundancy; Brocade DCX 8510-8 supports two additional power modules.

**High Availability**  
- **Control Processor**  
  - Redundant (active/standby) Control Processor Blades; Automatic failover  
  - Non-disruptive software upgrades  
  - Dual-flash memory on each Control Processor to store two software images
- **Core Blade**  
  - Redundant (active/active) Core Switching blade with two ICL connectors
- **Port Blades**  
  - Hot-swappable
- **Backplane**  
  - Fully passive
- **WWN card**  
  - Redundant
- **Operating voltage**  
  - Nominal: 200 to 240 VAC, single phase
- **Input frequency range**  
  - 47 – 63 Hz
- **Chassis power**  
  - Four (4) AC-DC power supply modules, 2+2 redundant
- **Cooling**  
  - Three blower assembly modules (three operational required)
Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.
The ED-DCX8510 Family is a Backbone product line built on Condor3 ASIC technology. It consists of two products lines:

- 8-slot chassis, ED-DCX8510-8B, described in “ED-DCX8510-8B” on page 24
- 4-slot chassis, ED-DCX8510-4B, described in this section.

Both chassis share the same CP with the exception of the 16 Gb core blades. The ED-DCX8510 Family also leverages lot of components from DCX family. The ED-DCX8510 is designed to be a cloud optimized platform especially targeting large to mid enterprises building private clouds.

In addition to providing base features like multi-tenancy (Virtual Fabric, Integrated Routing), SLA-driven SAN (Adaptive Networking and QoS) end-to-end and dynamic services (extension, encryption), it provides mainly four buckets of features:

- Hyper-scale fabric (scale out ICL, 128 Gb of Trunking)
- Built in metro connectivity (integrated10 Gb FC for DWDM/CWDM, in-flight encryption, and compression with resiliency built in)
- Operational simplicity (cable and optic diagnostic features, real time power monitoring)
- Cloud optimized performance (traffic engineering 2.0, higher IOPS and bandwidth)

**Key features**

Major product features of DCX8510-8 include:

- 192-port chassis with 4 usable port blades (in addition to 2 16 Gb core, 2 CP blades)
- 16 64 Gb QSFP optical inter chassis links (ICL) enabled with a single ICL POD license
- 4.1 Tb/s of aggregate BW (bandwidth) including 2 Tb/s of ICL BW
  - 192x 16 Gb/s + 16x 64 Gb/s
◆ 16 Gb Core Blade (CR16-4) with switching logic for 4 blades (unique to DCX8510-4)
◆ Based on Brocade’s seventh-generation ‘Condor3’ ASIC technology, supporting 2, 4, 8, 16 Gb auto sensing Fibre Channel ports and 10 Gb Fibre Channel ports. 10 Gb FC ports will require 10 Gb FC SFP+
◆ 32-port 16 Gb and 48-port 16 Gb port blades
  • FC16-32 - 32 x 16/10/8/4/2 Gb Port blade
  • FC16-48 - 48 x 16/10/8/4/2 Gb Port blade
◆ All the 8 Gb application and CP blades as shown below are supported. 8 Gb port blades are not supported in FOS 7.0 release but many of them will be supported in the ensuing release. For more details, please refer to the blade matrix
  • CP8 – 2 x Control Processor blade for DCX-4S

Note: This spec is focused on hardware features and specifications. All software implications and interoperability/compatibility is outlined in the Fabric OS 7.0 External Functional Spec.

◆ FS8-18 -16x8/4/2/1 Gb Encryption blade with 2 GE ports for HA clustering
◆ FX8-24- Extension blades
◆ Following 4 Gb Condor1 based blades are NOT supported in DCX8510 Family as Condor3 based platforms (i.e., DCX8510 Family) is only one generation backward compatible. For more details, please refer to the blade matrix
  • FA4-18 Fabric application blade
  • FR4-18i Routing and Fibre Channel over IP blade
  • FC10-6 10 Gb Fibre Channel Port blade
◆ Almost no oversubscription in real-world SAN and Data Center with 8 Gb/16 Gb/10 Gb speeds. Similar to that of DCX family, advanced systems architecture of DCX8510 family enables all ports to operate with a worse case oversubscription of 1.5:1 at 16 Gb/s
◆ Local switching is also available on all 16 Gb port blades. Blade-local switching and general real-world Fibre Channel traffic patterns assure virtually no oversubscription in the chassis. High bandwidth performance with low oversubscription ensures efficient, maintainable network designs with high resilience.
- Dual redundant control processors and core switching blades provide enhanced high availability and enable non-disruptive software upgrades.

- The multi-protocol design of DCX8510 supports other blades such as 10 Gb FC-IP Extension (FX8-24) blade.

- 64 Gb QSFP based optical ICLs allow connecting up to 5 DCX8510 chassis without wasting ports in port blades and helps build Scale out modular only SAN. It allows flexible topologies like core edge and full mesh topologies.

- Integrated 10Gb FC interface for DWDM and CWDM connectivity. Requires 10 Gb FC SFP+ optic

- In-flight encryption for 4 E-Ports or 64 Gb BW per 16 Gb port blade

- In-flight compression for 4 E-Ports or 128 Gb BW per 16 Gb port blade

- Inter-Switch Link (ISL) Trunking allows up to eight ports between a pair of switches to be combined to form a single, logical ISL with an aggregate speed of up to 128 Gb for optimal bandwidth utilization

- Dynamic Path Selection can evenly balance up to 8 equal cost paths; this includes trunks and ISLs at speeds from 2 Gb to 16 Gb. With this, two DCX-4Ss can have up to 1024 Gbit/sec (8 x 8 x 16 Gb/s) of H/W load balanced paths

- Universal ports self-configure as E, F, M, EX, D ports

- Brocade extended distance support leads the industry, enabling full performance for native Fibre Channel extension with the support of up to 5000km (or up to 10,000 km when credit linking is enabled in FOS) for native Fibre Channel at 2 Gb speed

- Hardware zoning (implemented via firmware-accessible table per output port) permits or denies delivery of frames to any particular destination port address

- Unicast and broadcast data traffic types are supported

- Small Form-Factor Pluggable (SFP) and SFP+ optical transceivers support any combination of Brocade Short Wavelength (SWL), Long Wavelength (LWL) and Extended Long Wavelength (ELWL) optical media on a single port blade
Brocade Fabric Operating system (FOS) delivers distributed intelligence throughout the network and enables a wide range of value-added applications provided in the Enterprise Software Bundle

- Both ED-DCX8510-8B base chassis and ED-DCX 8510-4B base chassis comes with Advanced Zoning (AZ), Web Tools (WT) and Enhanced Group Management (EGM) without any extra licensing– EGM provides the built in functionality needed for BNA.
- DCX8510-4: Enterprise Software Bundle (consisting of value-added applications: Adaptive Networking, Server Application Optimization, Extended Fabrics, Advanced Performance Monitoring, Trunking and Fabric Watch) can be part of base or optional similar to existing DCX-4S
- Virtual Fabric features (Logical switch and Logical fabric offered in FOS 6.2) are also offered part of base chassis without requiring purchase of licensing
- Customers will also have option to purchase above licenses as ala-carte as well. Integrated Routing, FICON CUP, Hi-Performance Extension for FC-IP, Encryption Upgrade, Brocade Accelerator for FICON are also available as separate value-added software offering.
- High availability redundant design, extensive diagnostics, and system monitoring capabilities integrated with Fabric OS management tools deliver unprecedented Reliability, Availability, and Serviceability (RAS)

Core switching blade

The ED-DCX8510-4B has a new core switching blade that is designed to support 4 slots, as shown in Figure 2 on page 38.
Figure 2  
ED-DCX8510-4B core switching blade

Supported features

- SSH v2
- HTTP/HTTPS
- SNMP v1/v3
- Telnet
- SNMP (FE MIB, FC Management MIB)
- Web Tools
- Fabric Watch
- SMI-S
- RADIUS
For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

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**Unsupported features**

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

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**System architecture**

**Fibre Channel ports**
- 192 ports (E, F, M, EX, D)
- Up to four 32 or 48-port 16 Gb or 64-port 8 Gb Fibre Channel blades

**Performance**
Performance features include:
- Autosensing of 2, 4, 8, 16 Gb and 10 Gb port speeds
- Optionally programmable to fixed port speed

**Port types**
- FL-Port (except FC8-48), F_Port, M_Port (Mirror Port), E_Port; self-discovery based on switch type (U_Port); optional port type control

**Control processor**
- Redundant (active/standby) control processor blades

**Scalability**
- Full fabric architecture: 239 switches maximum

**Hardware trunking**
- Up to 8, 16 Gb ports per ISL trunk; Up to 128 Gb per ISL trunk

**Inter-chassis links**
- 16 64 Gb QSFP (licensed feature)

**Dynamic path selection**
- Up to 64 equal cost paths (ISLs or trunks) up to 1024 Gb/s balanced path
Aggregate bandwidth
- 4.1 Tb/s

Slot bandwidth
- 512 GB/s

Inter-chassis links bandwidth
- 1 Tb/s

Frame buffers
- 2048 per 16-port group on the 16/32-port blades and up to 2048 per 24-port group on the 48-port blade, dynamically allocated

Data traffic type
- Fabric switches supporting unicast, multicast (255 groups), and broadcast

USB
- 1 USB port per Control Processor for firmwareDownload and for supportSave

Media types
- Hot-pluggable, industry-standard Small form-factor pluggable (SFP) and Quad Small Form Factor Pluggable (WSF) media types, LC connector
- Short-wave laser (SWL)
- Long-wave laser (LWL)
- Extended long wave (ELWL)
Distance depends on fiber optic cable and port speed.

Maximum size frame
- 2112-byte payload FC

Fabric latency
- Locally switched ports 800 ns (add additional 400ns for E_Port to E_Port traffic as Forward Error Correction is enabled by default)
- Blade to blade latency is 2.4 micro-seconds (add 400ns for E_Port to E_Port traffic Forward Error Correction is enabled by default)

Class of service
- Class 2, Class 3, Class F (interswitch frames)

Fabric services
Simple Name Server (SNS); Registered State Change Notification (RSCN); NTP v3; Reliable Commit Service (RCS); Dynamic Path
Selection (DPS); Brocade Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning); NPIV; N_Port Trunking; FDMI; Management Server; FSPF; Fabric Watch; Extended Fabrics; ISL Trunking; Advanced Performance Monitoring; Adaptive Networking (per data flow QoS, Ingress Rate Limiting, Traffic Isolation, Top Talkers; licensing varies); IPoFC, Integrated Routing (FR4-18i SAN Extension blade not required for routing only); Frame Redirection; Port Fencing; BB credit recovery

Management

Management access
- 10/100/1000 Ethernet port (RJ-45), in-band over Fibre Channel
- Serial ports (RJ-45) and one USB per Control Processor blade
- Call-home integration through Connectrix Manager
- EMC Connectrix Manager

Diagnostics
- POST and embedded online/offline diagnostics, including FCping, Pathinfo (FCtraceroute), etc.

Mechanical specifications
- Width = 17.22 inches (43.74 cm)
- Height = 8U
- Depth = 24.09 inches (61.19 cm)
- Weight = 150 pounds (68 kg); 192 port fully populated

Environment
- Temperature
  - Operating: 0°C to 40°C outside switch (32°F to 104°F)
  - Non-operating: -25°C to +70°C outside switch (-13°F to 158°F)
- Humidity
  - Operating: 5% to 85% RH, noncondensing at 40°C, with maximum gradient of 10% per hour
  - Non-operating and storage (non-condensing): 10% to 90% RH, noncondensing at 70°C,
- Altitude
  - Operating: 0 to 3 km (10,000 ft) above sea level
  - Non-operating: 0 to 12 km (40,000 ft) above sea level
- Shock
  - Operating: 20 G, 6 ms, half-sine wave
EMC Connectrix B Products Data

- Non-operating: 33 G, 11 ms duration, half-sine wave
- Vibration
  - Operating: 0.5 G p-p. 5-500 Hz at 1.0 octave/minute
  - Non-operating: 2.0 G p-p. 5-500 Hz at 1.0 octave/minute
- Heat dissipation
  - Operating: 192 port configuration (fully loaded w/ QSFPs), 1195W, 4078 BTU/hr
  - Non-operating: N/A

**Power**
- Two 2000 W AC power supply modules (100 to 240 V auto-sensing), 2N redundancy;

**High Availability**
- Control Processor
  - Redundant (active/standby) Control Processor Blades;
    Automatic failover
  - Non-disruptive software upgrades
  - Dual-flash memory on each Control Processor to store two software images
- Core Blade
  - Redundant (active/active) Core Switching blade with two ICL connectors
- Port Blades
  - Hot-swappable
- Backplane
  - Fully passive
- WWN card
  - Redundant
- Operating voltage
  - Nominal: 200 to 240 VAC, single phase
- Input frequency range
  - 47 – 63 Hz
- Chassis power
  - Four (4) AC-DC power supply modules, 2+2 redundant
- Cooling
  - Three blower assembly modules (three operational required)
Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.
The Connectrix ED-DCX-4S-B is a Backbone product line extension offering 192 x 8 Gb ports (half the port count offered by the DCX Backbone) in a horizontal chassis. ED-DCX-4S-B offers Data Center Fabric (DCF) platform features to the DCF Edge and smaller DCF backbone market.

The ED-DCX-4S-B runs fabric OS version 6.2.x and greater.

**Note:** For specific versions of supported firmware, as well as fabric topology constraints associated with the ED-DCX-4S-B, refer to the [EMC Support Matrix](#) and the Connectrix product release notes.

### Key features

Key features of the ED-DCX-4S-B include:

- Up to 384 8 Gb/s ports connected in a dual core with the use of Inter Chassis Links (ICLs) and up to 192 ports in a single domain (or single chassis).

- All the application, port blades and CP blades supported in ED-DCX-B are supported in ED-DCX-4S-B (with the exception of ED-DCX-B Core Blade (CR-8)) providing flexible system configurations and less types of new blades
  - FC8-16 - 16 x 8/4/2 Gb Port blade
  - FC8-32 - 32 x 8/4/2 Gb Port blade
  - FC8-48 - 48 x 8/4/2 Gb Port blade
  - CP8 – 2 x Control Processor blade for ED-DCX-4S-B
  - FS8-18 -16x8/4/2 Gb Encryption blade with 2 GE ports for HA clustering

- The following blades are *only* supported on the ED-DCX-4S-B Backbone (not in ED-DCX-B):
  - CR4S-8 – 2 x Core blade with switching logic for 4 port/application blades (CR-8 is not supported in ED-DCX-4S-B)

- The ED-DCX-4S-B architecture enables 192 ports to operate with a worse case oversubscription of 1.5:1 at 8 Gb /s. 384 ports operate at 8 Gb speed (any to any connectivity) with a worst case oversubscription.
oversubscription of 6:1 at 8 Gb (Passing $192 \times 8 \text{ Gb/s} = 1.5 \text{Tbit/sec}$ across ICLs of BW of 256 Gb/s). 8 Gb local switching is also available on all blades. Blade-local switching and general real-world Fibre Channel traffic patterns operate with virtually no oversubscription in the chassis.

- Dual redundant control processors and core switching blades provide high availability and enable non-disruptive software upgrades.
- The multi-protocol design of ED-DCX-4S-B supports other blades such as FCIP/routing, iSCSI, and application platform blades that are the cornerstone of highly intelligent fabrics.
- ED-DCX-4S-B is based on Brocade’s sixth-generation ‘Condor2’ ASIC technology, supporting 2, 4 and 8 Gb auto-sensing Fibre Channel ports.
- Inter-Switch Link (ISL) trunking allows up to eight ports between a pair of switches to be combined to form a single, logical ISL with an aggregate speed of up to 64 Gb.
- Dynamic path selection can evenly balance up to 8 equal cost paths; this includes trunks and ISLs at speeds from 2 Gb/s to 8 Gb/s.
- Universal ports self-configure as E, F, M, EX or FL ports.
- Full performance for native Fibre Channel extension with the support of up to 2492 km for native Fibre Channel.
- 16,000 hard zones supported.
- Unicast and broadcast data traffic types are supported.
- Small Form-Factor Pluggable (SFP) and SFP+ optical transceivers support any combination of Brocade Short Wavelength (SWL), Long Wavelength (LWL) and Extended Long Wavelength (ELWL) optical media on a single port blade.
Port side

Figure 3 shows the port side view of the ED-DCX-4S-B.

Figure 3  ED-DCX-4S-B port side view

1  PB-DCX-48P port blade (example, 4x)
2  Core switch blade (CR4S-8) (2x)
3  Control processor blade (CP8) (2x)
4  Exhaust vent
**Nonport side**

Figure 4 shows the nonport side view of the ED-DCX-4S-B

**Figure 4** ED-DCX-4S-B nonport side view

1. WWN card bezel (logo plate)  
2. Power supply (2x)  
3. Blower assembly (2x)

**Supported software**

- EMC Ionix ControlCenter  
- Fabric Manager  
  - Connectrix Manager Data Center Edition (CMDCE)  
- RADIUS
◆ Embedded web server to provide single-point management using the Web Tools GUI.
◆ Centralized configuration and management of fabric via Client/Server architecture and CLI.
◆ Support for 10/100 Mb Ethernet connections to CP for out-of-band management.
◆ In-band over Fibre Channel (requires fabric)
◆ SNMP (FE MIB, FC Management MIB)
◆ Telnet/SSH

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix M Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Performance
◆ 2.125 Gb/s line speed, full duplex
◆ 4.25 Gb/s line speed, full duplex
◆ 8.50 Gb/s line speed, full duplex
◆ Auto-sensing of 2, 4 and 8 Gb/s port speeds
◆ Optionally programmable to fixed port speeds

Link Distance

For supported link distances, refer to the “Cable/fiber types and supported distances” section in the Networked Storage Concepts and Protocols TechBook, available through the E-Lab Interoperability Navigator, Topology Resource Center tab, at http://elabnavigator.EMC.com. For distances exceeding the listed coverages, refer to “Distance extension consideration” chapter in the Extended Distance Techbook, available through the E-Lab
Interoperability Navigator at http://elabnavigator.EMC.com, or the EMC Support Matrix.

World Wide Name Card (WWN)
There are two World Wide Name (WWN) cards. There are no visible LEDs on those cards any more as blade status LEDs are available on the port side of the chassis. The remaining WWN LED is visible when the WWN cover plate is removed and will be available to indicate which WWN to remove when there is a fault.

The serial electronically erasable programmable read-only memory (SEEPROM) device contains multiple serial numbers for identification of the chassis, back plane, the WWN cards and the logical switch them self.

Control Processor
◆ The CP8 Control Processor in the ED-DCX-4S-B is similar to the Control Processor on the ED-DCX-B (CP4). Redundant (active/standby) control processor modules are present.
◆ The CP8 has 1 RJ-45 RS-232 console connector, 2 x Ethernet management ports and 1 USB port (for supportSave and firmwareDownload).
◆ The Control Processor hardware provides the ability to continue to operate (i.e., service Fabric OS requests) while loading the new image, and non-disruptively failover to the Standby CP to activate the new firmware.
◆ The Control Processor manages all four port blades and the two core blades within ED-DCX-4S-B and monitors up to two power supplies, two blowers, three inlet temperatures (in the blower), up to eight outlet temperature monitors (1 per blade) and other blade environmental features.

Core switching blade
◆ Two new core blades are added to split the control and data plane in the ED-DCX-4S-B.
◆ Each Condor blade has 4 Condor2 ASICs as its switching core.
◆ The Core section of the CP8 provides 8 Gb speed for all 80-core ports per core blade. 64 8 Gb ports are connected to the backplane per core blade and 16 8 Gb ports are connected to the two ICL connectors on the core blade for chassis interconnect.
◆ The ICL ports which utilize an ICL cable product by Brocade are only operational when the ICL license is enabled on the chassis.
Fibre Channel ports
- Up to four hot-swappable port blade assemblies, delivering up to 192 8 Gb Fibre Channel ports in a single chassis
- Two slots for Control Processor blade assemblies
- Two slots for core switching blade assemblies (DCX and DCX-4S core blades are not inter-changeable)
- Up to four Fibre Channels port cards, either 16, 32 or 48 auto-sensing 2, 4 and 8 Gb/s FC ports

Port types
- FL_Port (except FC8-48), F_Port, M_Port (Mirror port), and E_Port
- Self-discovery based on switch type (U_Port)
- Optional port type control available

Port numbering
The Connectrix ED-DCX-4S-B uses the following port numbering schemes:
- For the FC8-16 port blade, ports are numbered from 0 through 15 from bottom to top.
- For the FC8-32 port blade, ports are numbered from 0 through 15 from bottom to top on the left set of ports and 16 through 31 from bottom to top on the right set of ports.
- For the FC8-48, port blade, ports are numbered from 0 through 23 from bottom to top on the left set of ports and 24 through 47 from bottom to top on the right set of ports.
- Slots are numbered 1 through 8, from left to right when facing the port side of the director.

ISL Trunking
- Up to eight 8.5 Gb/s ports per ISL trunk
- Up to 64 Gb/s per ISL trunk
- Up to two 8-port trunk groups supported on 16 port card
- Up to four 8-port trunk groups supported on 32 port card
- Up to six 8-port trunk groups supported on 48 port card
- ISL trunking at 2, 4 Gb/s for compatibility with prior B Series Connectrix products.
Aggregate bandwidth
- 3 Tb/s per chassis: 192 ports x 8.5 Gb/s (line rate) x 2 (full duplex)
- Aggregate ICL bandwidth: 256 Gb/s (32 x 8 Gb/s)

Oversubscription
- Oversubscription for the ED-DCX-4S-B is based on the port blade type and not total system port count. For example, the PB-DCX-16P port blade is not oversubscribed when mixed with PB-DCX-32P port blades. The PB-DCX-32P is not oversubscribed at 8 Gb/s either. The PB-DCX-48P is only oversubscribed 1.5:1 at 8 Gb/s. If these ports can be switches locally without going through the backplane, the backplane may still have enough bandwidth to support the remaining ports of the PB-DCX-48P blade without congestion at 8 Gb/s.
- PB-DCX-16P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb
- PB-DCX-16P blade oversubscription with core switch blade failure, no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb
- PB-DCX-32P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb
- PB-DCX-32P blade oversubscription with core switch blade failure, no local switching employed:
  - No oversubscription at 4 Gb
  - 16:8 oversubscription at 8 Gb
- PB-DCX-48P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - 24:16 oversubscription at 8 Gb
- PB-DCX-48P blade oversubscription with core switch blade failure, no local switching employed:
  - 24:16 oversubscription at 4 Gb
- 24:8 oversubscription at 8 Gb

**Maximum frame size**
- 2112-byte payload

**Frame buffers**
- 2048 per 16-port group on 16/32-port blades, dynamically allocated
- Up to 2048 per 24-port group on 48-port blades, dynamically allocated

**Classes of service**
- Class 2, Class 3, and Class F (inter-switch frames) Fibre Channel protocol support.

**Fabric services**
- Simple Name Server
- Registered State Change Notification (RSCN)
- NTP
- RADIUS
- LDAP
- Fabric-wide and port-level binding
- Dynamic Path Selection (DPS)
- Alias Server (multicast)
- Advanced Zoning
- Web Tools
- Fabric Watch
- Extended Fabrics
- ISL Trunking
- Advanced Performance Monitoring
- Adaptive Networking with QoS

**High availability**
- Redundant, hot-swappable components designed to provide 99.999 percent uptime capabilities
  - Chassis (including passive backplane, blower and power supply backplane, AC harness, and blower harness).
  - WWN Card
• Two blower modules (each includes blower, control board, and housing); two must be operational
• Power supply filler panel
• Power modules
• Small Form-factor Pluggable (SFP) Short-Wavelength Laser (SWL) transceivers
• Small Form-factor Pluggable (SFP) Long-Wavelength Laser (LWL) transceivers
◆ Enhanced data integrity on all data paths
◆ Fabric Shortest Path First (FSPF) rerouting around failed links
◆ Automatic control processor failover
◆ Non-disruptive “hot” software code loads and activation

**Chassis power**
◆ Two 2000 W AC-DC power supply modules (100 to 240 V auto-sensing)
◆ 2 N redundancy

**Cooling**
◆ Two blowers, providing cooling, allowing continuous operation even if one blower fails
◆ Two required for operation

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**Management**

**Management access**
◆ One 10/100/1000 Mb Ethernet RJ-45 management port per Control Processor module
◆ Serial port (RJ-45)
◆ One USB per control processor module
◆ Call-home integration enabled through Connectrix Manager
◆ EMC Connectrix Manager

**Diagnostics**
◆ POST and embedded online/offline diagnostics, FCPing, Pathinfo (FCTraceroute), etc.

**Mechanical specifications**
◆ Rear panel-to-door airflow
◆ Width = 43.74 cm (17.2 in)
◆ Height = 8U
◆ Depth = 61.19 cm (24.09 in)
◆ Weight = 103.5 kg (228.2 lb) for 384-port configuration fully populated
◆ Chassis weight = 150 lb

Environment

◆ Temperature
  • Operating: 0º C to 40º C (32º F to 104º F)
  
  Note: Operating range is outside switch.
  
  • Non-operating: -25º C to 70º C (-13º F to 158º F)
  
  Note: Non-operating is when the switch is not powered on.

◆ Humidity
  • Operating: 5% to 85% RH non-condensing at 40º C (104º F)
  • Non-operating and storage (non-condensing).

◆ Altitude
  • 0 to 3 km

◆ Shock
  • Operating: 20g, 6 ms, half sine

◆ Vibration
  • Operating: 0.5G p-p, 5 to 500 to 5 Hz
  • Non-operating: 2G p-p, 5 to 500 Hz

◆ Heat dissipation
  • 753 W or 2570 BTU/hr (Four PB-DCX-48P blades, two CP8 blades, and two CR4S-8 blades)

Power

◆ Supported power range
  • Nominal: 100 to 240 VAC nominal, 5.0 A, single phase
  • Operating: 85 to 264 VAC auto-sensing
  • In-rush current
- 20 Amps maximum, peak
- Frequency
  - 47 to 63 Hz

**Protocols**
- FC
- FICON

**Standards Compliance**
This release conforms to the FC Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website:

http://www.brocade.com/sanstandards

**Further reading**
For more information, refer to the following documents located at EMC Online Support at http://support.emc.com:

- EMC Connectrix B Series Fabric OS Release Notes
- EMC Connectrix B Series Fabric OS Command Reference Guide
- EMC Connectrix B Series Fabric OS Administrator’s Guide
- **EMC Support Matrix** for the most current information on supported firmware revisions, switches, interoperability, distance solutions, caveats, and topologies.
Connectrix ED-DCX-B

This section introduces the components of the EMC Connectrix ED-DCX-B.

The Connectrix ED-DCX-B is a Data Center Backbone Director class switch which can contain up to 384 concurrently active 8 Gb/s full-duplex ports in a single domain. It is based on the Brocade DCX Condor2 ASIC based architecture. The ED-DCX-B Director is a 384-port non-blocking switch.

The suggested use of the ED-DCX-B is in the core of a Data Center Fabric that is used to interconnect storage devices, hosts, and servers in a Storage Area Network (SAN), to interconnect servers for high performance server-to-server communication, and to interconnect a high performance server environment to a Local Area Network infrastructure.

The ED-DCX-B chassis is a 14U enclosure with up to 768 ports in a single Connectrix cabinet. Two ED-DCX-B Directors can be interconnected in a dual core with the use of Inter Chassis Links (ICLs) to create a high port density and high scalability solution.

The ED-DCX-B utilizes a Linux 2.4.x modified kernel to load the Fabric OS version 6.x and greater.

Note: For specific versions of supported firmware, as well as fabric topology constraints associated with the ED-DCX-B, refer to the EMC Support Matrix and the Connectrix ED-DCX-B Product release notes.

Key features

Key features of the ED-DCX-B include:

- Up to 768 8 Gb/s ports connected in a dual core with the use of Inter Chassis Links (ICLs) and up to 384 ports in a single domain (or single chassis).
- Support for three new high-performance port blades and new high performance switching and control processor blades providing flexible system configurations
  - 16-port 8/4/2 Gb/s blade (FC8-16)
  - 32-port 8/4/2 Gb/s blade (FC4-32)
  - 48-port 8/4/2 Gb/s blade (FC4-48)
- CP8 – 2 Control Processor blade for DCX
- CR8 – 2 Core blade with switching logic

- Dual-redundant control processors and core switching blades provide high availability and enable non-disruptive software upgrades.

- The ED-DCX-B systems architectures enables 384 ports to operate with a worst case oversubscription of 1.5:1 at 8 Gb/s, 768 ports to operate with a worst case oversubscription of 6:1 at 8 Gb/s (across ICLs between two chassis, any-any connection among 768 user ports). 8 Gb/s local switching is also available on all blades. Blade-local switching and general real-world FC traffic patterns operate with virtually no oversubscription in the chassis.

- Redundant and hot swappable CPs, power supplies, and blower assembly

- Backward compatible with Bloom, Bloom2, Condor and Goldeneye based products.

- The multi-protocol design of DCX supports other blades such as FCIP/Routing, iSCSI and application platform blades for intelligent fabrics

- Supports 2-, 4- and 8-Gb/s auto-sensing Fibre Channel ports.

- ISL Trunking groups up to eight ports between a pair of switches to create a single, logical ISL with an aggregate speed of up to 64-Gb/s.

- Dynamic Path Selection can equally balance up to 8 equal cost paths, this includes trunks and ISLs at speeds from 2 Gb/s to 8 Gb/s.

- SFP and SFP+ optical transceivers support any combination of Short Wavelength (SWL), Long Wavelength (LWL) and Extended Long Wavelength (ELWL) optical media on a single port blade.

- Both 4 Gb/s and 8 Gb/s SFPs can be deployed on the 8 Gb/s capable port blades. The 4 Gb/s SFPs support 2- and 4-Gb/s auto sensing FC ports, while the 8 Gb/s SFPs support 2-,4- and 8-Gb/s auto sensing FC ports.

- Universal ports self-configure as E_Ports, F_Ports, M_Ports or FL_Ports.

- Unicast and broadcast traffic types are supported.

- 16000 Hard zones supported.
- Full performance for native FC extended distance support of up to 3000 km.

Port side

Figure 5 shows the port side view of the ED-DCX-B.

![ED-DCX-B port side view](image)

1. Exhaust Vent
2. Core switch blade (CRB)
3. Control processor blade (CP8)
4. PB-DCX-48P
5. Cable management comb

Figure 5 ED-DCX-B port side view
Nonport side

Figure 6 shows the nonport side view of the ED-DCX-B.

![ED-DCX-B nonport side view]

1. **WNN bezel (logo plate)**
2. **Power supply**
3. **Blower assembly**

**Supported software**

The following management software is supported:

- EMC ControlCenter
- EMC Connectrix Manager 9.x
- Connectrix Manager B Series
- Brocade EFCM Standard Enterprise 9.x
- RADIUS
- Embedded web server to provide single-point management using the Web Tools GUI.
- Centralized configuration and management of fabric via Client/Server architecture and CLI.
- Support for 10/100 Mb Ethernet connections to CP for out-of-band management.
- In-band over Fibre Channel (requires fabric)
- SNMP (FE MIB, FC Management MIB)
- Telnet/SSH

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix M Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Performance
- 2.125 Gb/s line speed, full duplex
- 4.25 Gb/s line speed, full duplex
- 8.50 Gb/s line speed, full duplex
- Auto-sensing of 2, 4 and 8 Gb/s port speeds
- Optionally programmable to fixed port speeds

Link distance
The ED-DCX-B operates natively at up to 10 km at 2, 4 and 8 Gb/s and supports LWL and ELWL SFPs and single-mode fiber. ED-DCX-B can go further with the enablement of the Extended Fabrics license, which is a part of the Enterprise Software Bundle. Only 4 Gb/s and 8 Gb/s SFPs are supported. XFPs are supported on the 10 GB/s blades. The supported link distances are listed in Table 3.
In order to ensure quality in ED-DCX-B’s high performance system architecture, it is currently recommended to deploy the qualified and provided optical transceivers that operate in blades based on Condor2. The Condor2 blades include the PB-DCX-16P, PB-DCX-32P, and PB-DCX-48P port blades.

**World Wide Name Card (WWN)**

There are two World Wide Name (WWN) cards that are used to hold the world wide unique serial ID for each DCX chassis. The LEDs are split between them. These LEDs are an alternative system status indicator and resembles the look of status LEDs on the port side of the DCX. The LEDs provide the summary of cable-side system power status on the switch.

**Control Processor**

- The CP8 Control Processor in the ED-DCX-B is similar to the Control Processor on the ED-48000B (CP4). Redundant (active/standby) control processor modules are present.
- Enhancements to the CP8 include:
  - Upgraded CPU to FreeScale 8548 running at 1.2 GHz

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**Table 3 Supported link distances**

<table>
<thead>
<tr>
<th>Transceiver Type</th>
<th>Form Factor</th>
<th>Speed</th>
<th>Multi-Mode Media Maximum Distance</th>
<th>Single-Mode Media Maximum Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>62.5µm/200MHz (OM1)</td>
<td>50µm/500MHz (OM2)</td>
</tr>
<tr>
<td>SW</td>
<td>SFP/SFP+</td>
<td>2 Gb/s</td>
<td>150m</td>
<td>300m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>500m</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>SFP/SFP+</td>
<td>4 Gb/s</td>
<td>70m</td>
<td>150m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>380m</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>SFP+</td>
<td>8 Gb/s</td>
<td>21m</td>
<td>50m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>150m</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>XFP</td>
<td>10 Gb/s</td>
<td>33m</td>
<td>82m</td>
</tr>
<tr>
<td>LW</td>
<td>SFP</td>
<td>2 Gb/s</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>30 km</td>
</tr>
<tr>
<td></td>
<td>SFP</td>
<td>4 Gb/s</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>30 km</td>
</tr>
<tr>
<td></td>
<td>SFP+</td>
<td>8 Gb/s</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>10 km</td>
</tr>
<tr>
<td></td>
<td>XFP</td>
<td>10 Gb/s</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>80 km</td>
</tr>
</tbody>
</table>
• Integrated Ethernet switch where 2 10/100/1000 Base-T Ethernet ports are exposed to the front of each CP8
• A serial port with an RJ-45 connector is exposed
• A new USB port has been added for supportSave and firmwareDownload
• Memory has been increased with 2 GB of DDR2 RAM
• New Compact Flash controller with 2 GB of storage
◆ The Control Processor manages all 8 port blades, 2 core blades within the ED-DCX-B, and monitors up to 4 power supplies, 3 blowers, 3 inlets temperatures (in the blower), 12 outlet temperature monitors (1 per blade), and other blade environmental features, such as voltages.

Core switching blade
◆ Two new core blades are added to split the Control and Data plane in the ED-DCX-B.
◆ Each Condor blade has 4 Condor2 ASICs as its switching core.
◆ The Core section of the Control Processor CP8 provides 8 Gb/s speed for all the 160-core ports (40 ports per Condor2 ASIC) per core blade:
  • 128-ports 8 Gb ports are connected to the backplane per core blade
  • 32-ports are connected to the two ICL (Inter-Chassis Link) connectors on the core blade for chassis interconnect
◆ The ICL ports which utilize an ICL cable product are only operational when the ICL license is enabled on the chassis.

Fibre Channel ports
◆ Up to eight hot-swappable port blade assemblies, which can be configured in a single chassis, delivering up to 384 Fibre Channel ports.
◆ Two slots for control processor (CP8) blade assemblies (slots 6 and 7):
  • A single active CP blade can control all 384 ports in the chassis
  • The standby CP blade assumes control of the switch if the active CP fails
◆ Two slots for core switching (CR8) blade assemblies (slots 5 and 8):
  • Up to eight Fibre Channels port cards, either 16, 32 or 48 auto-sensing 2, 4 and 8 Gb/s FC ports
- Up to 768 ports per 42U rack

**Port types**
- FL_Port (except PB-DCX-48P), F_Port, M_Port (Mirror port), and E_Port
- Self-discovery based on switch type (U_Port)
- Optional port type control available

**Port numbering**
The Connectrix ED-DCX-B uses the following port numbering schemes:
- For the PB-DCX-16P port blade, ports are numbered from 0 through 15 from bottom to top.
- For the PB-DCX-32P port blade, ports are numbered from 0 through 15 from bottom to top on the left set of ports and 16 through 31 from bottom to top on the right set of ports.
- For the PB-DCX-48P port blade, ports are numbered from 0 through 23 from bottom to top on the left set of ports and 24 through 47 from bottom to top on the right set of ports.

Slots are numbered 1 through 12, from left to right when facing the portside of the director.

**ISL Trunking**
- Up to eight 8.5 Gb/s ports per ISL trunk
- Up to 64 Gb/s per ISL trunk
- Up to two 8-port trunk groups supported on 16 port card
- Up to four 8-port trunk groups supported on 32 port card
- Up to six 8-port trunk groups supported on 48 port card
- ISL trunking at 2, 4 Gb/s for compatibility with prior B Series Connectrix products

**Aggregate bandwidth**
- 6.5 Tb/s per chassis: 384 ports x 8.5 Gb/s (line rate) x 2(full duplex)
- Aggregate ICL bandwidth: 1.1 Tb/s; 4 ICLs x 16 FC connections x 8.5 Gb/s (line rate) x 2 (full duplex); load balanced using the eight 8-port frame-based trunks and DPS.
Oversubscription

- Oversubscription for the ED-DCX-B is based on the port blade type and not total system port count. For example, the PB-DCX-16P port blade is not oversubscribed when mixed with PB-DCX-32P port blades. The PB-DCX-32P is not oversubscribed at 8 Gb/s either. The PB-DCX-48P is only oversubscribed 1.5:1 at 8 Gb/s. If these ports can be switches locally without going through the backplane, the backplane may still have enough bandwidth to support the remaining ports of the PB-DCX-48P blade without congestion at 8 Gb/s.

- PB-DCX-16P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb

- PB-DCX-16P blade oversubscription with core switch blade failure, no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb

- PB-DCX-32P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - No oversubscription at 8 Gb

- PB-DCX-32P blade oversubscription with core switch blade failure, no local switching employed:
  - No oversubscription at 4 Gb
  - 16:8 oversubscription at 8 Gb

- PB-DCX-48P blade oversubscription with no local switching employed:
  - No oversubscription at 4 Gb
  - 24:16 oversubscription at 8 Gb

- PB-DCX-48P blade oversubscription with core switch blade failure, no local switching employed:
  - 24:16 oversubscription at 4 Gb
  - 16:8 oversubscription at 8 Gb

Maximum frame size

- 2112-byte payload
Frame buffers
- 2048 per 16-port group on 16/32-port blades, dynamically allocated
- Up to 2048 per 24-port group on 48-port blades, dynamically allocated

Classes of service
- Class 2, Class 3, and Class F (inter-switch frames) Fibre Channel protocol support.

Fabric services
- Simple Name Server
- Registered State Change Notification (RSCN)
- NTP
- RADIUS
- LDAP
- Fabric-wide and port-level binding
- Dynamic Path Selection (DPS)
- Alias Server (multicast)
- Zoning
- Web Tools
- Fabric Watch
- Extended Fabrics
- ISL Trunking
- Performance Monitoring
- Adaptive Networking with QoS

High Availability
- Redundant, hot-swappable components designed to provide 99.999 percent up-time capabilities
  - Chassis (including passive backplane, blower, and power supply backplane, AC harness, and blower harness)
  - WWN Card
  - Three blower modules (each includes blower, control board, and housing); at least two must be operational
  - Power supply filler panel
  - Power modules
• Small Form-factor Pluggable (SFP) Short-Wavelength Laser (SWL) transceivers
• Small Form-factor Pluggable (SFP) Long-Wavelength Laser (LWL) transceivers
◆ Enhanced data integrity on all data paths
◆ Fabric Shortest Path First (FSPF) rerouting around failed links
◆ Automatic control processor failover
◆ Non-disruptive “hot” software code loads and activation

**Chassis power**
◆ Two 2000 W AC-DC power supply modules (100 to 240 V auto-sensing)
◆ 2N redundancy

**Cooling**
◆ Three blowers, providing cooling, allowing continuous operation even if one blower fails
◆ Two required for operation

---

**Management**

**Management access**
◆ One 10/100/1000 Mb Ethernet RJ-45 management port per Control Processor module
◆ Serial port (RJ-45)
◆ One USB per control processor module
◆ Call-home integration enabled through Connectrix Manager
◆ EMC Connectrix Manager

**Diagnostics**
◆ POST and embedded online/offline diagnostics

**Mechanical Specifications**
◆ Rear panel-to-door airflow
◆ Width = 43.74 cm (17.2 in)
◆ Height = 61.24 cm (24.11 in) for 14U
◆ Depth = 61.19 cm (24.09 in) without door and 73.20 cm (28.82 in) with door
Weight = 103.5 kg (228.2 lb) for 384-port configuration fully populated 39.55 kg (82.2 lb) for chassis

**Environment**

- **Temperature**
  - Operating: 0°C to 40°C (32°F to 104°F)
  - Non-operating: -25°C to 70°C (-13°F to 158°F)

- **Humidity**
  - Operating: 20% to 85% RH non-condensing at 40°C (104°F)
  - Non-operating and storage (non-condensing): 0% to 93% at 70°C (158°F)

- **Altitude**
  - Up to 3000 meters (9842 feet)

- **Shock**
  - Operating: 20 G, 6 ms, half sine
  - Non-operating: 33 G, 11 ms, half sine

- **Vibration**
  - Operating: 0.5 G p-p, 5 to 500 to 5 Hz
  - Non-operating: 2 G p-p, 5 to 500 to 5 Hz

- **Heat dissipation**
  - Min: 16-port configuration of 505 W or 1722 BTU/hr
  - Max: 384-port configuration of 1337 W or 4564 BTU/hr

**Power**

- **Supported power range**
  - Nominal: 100 to 240 VAC nominal, 5.0 A, single phase
  - Operating: 85 to 264 VAC auto-sensing

- **In-rush current**
  - 20 Amps maximum, peak

- **Frequency**
  - 47 to 63 Hz

**Protocols**

- FC

**Standards compliance**

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In
certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website:

http://www.brocade.com/sanstandards

Further reading

For more information, refer to the following documents located at EMC Online Support at http://support.emc.com:

- EMC Connectrix B Series Fabric OS Release Notes
- EMC Connectrix B Series Fabric OS Command Reference Guide
- EMC Connectrix B Series Fabric OS Administrator’s Guide
Connectrix AP-7600B

This section introduces the components of the EMC Connectrix AP-7600B.

The EMC Connectrix B Series AP-7600B is a 1U Switch that is capable of supporting storage virtualization and a fabric hosted data and storage management solution. The switch has 16 1/2/4 Gb/s Fibre Channel ports and 2 physical Gigabit Ethernet (GbE) ports. It includes the Fabric Operating System and is compatible with other switches. It can operate independently or in a fabric containing multiple switches. In addition to 16 Fibre Channel ports supporting FCIP, the switch can have up to 16 virtual ports (VE or VEX ports) available through the two physical GbE ports. These internal ports are managed by virtualization software.

Key features

The new application platform switch, the AP-7600B, is supported with firmware v5.3.0a and up.

The AP-7600B application platform is a fixed configuration, 1U high chassis that is capable of enabling fabric intelligence by hosting storage applications that provide storage virtualization, data mobility, and data protection functionality. The AP-7600B is designed to provide the same high availability and RAS features that exist in all Connectrix B Series platforms utilized in an enterprise class SAN.
Figure 7 shows the port side of the switch.

**Figure 7 Port side view**

- **1** Console management (serial) port
- **2** Ethernet management port
- **3** Fibre ports (0-15)
- **4** GbE ports (2)
- **5** System status LED
- **6** Power status LED
- **7** IP address tab location

**ATTENTION:**
Maximum screw length for rack mounting to be 5mm or 13/64 in.
The Fibre Channel ports are numbered from left to right, in eight-port groups, and are also numbered on the faceplate (see Figure 8).

![Figure 8 Port numbering in the switch](image)

The port side also displays the system status LED, power status LED, and port status LEDs.

**Power**

Two power supplies, 12 V, 300 W with dual speed fans. The power supplies are hot-swappable FRU, allowing 1+1 redundant configurations. The unit is universal power supply capable of functioning worldwide without voltage jumpers or switches. The fully enclosed, self-contained unit has internal fans to provide cooling and is autoranging in terms of accommodating input voltages. If one power supply fails, the switch can continue to operate but the failed power supply should be replaced as soon as possible.

**Multiprotocol ports**

There are 16 multiprotocol ports (numbered 0 through 15, left to right). Each of the 16 multiprotocol ports can be equipped with an SFP (optional). The SFPs are hot-swappable and use industry-standard local channel connectors. In Fibre Channel mode, each port provides ISL and fabric (E, EX, and F respectively) type.
connectivity that is automatically sensed and requires no administration to identify the port type.

In addition to the 16 Fibre Channel ports, 16 internal ports (VE and VEX), which are referred to as virtual or hidden ports are available. These internal ports are managed by virtualization software. In Gigabit Ethernet mode, SFP fiber optic transceivers that convert electrical signals to optical signals (and optical signals to electrical signals) are used. Capable of transmitting at both 1, 2, and 4 Gb/s speeds, each SFP fiber optic transceiver supports 850 nm SWL on multimode fiber optic cable and 1310 nm LWL on single-mode fiber optic cable. These miniature optical transceivers provide the high port density available in the switch and deliver twice the port density of standard removable GBIC transceivers.

**Management ports**
The switch provides 10/100 BaseT for switch management and two 10/100/1000 Ethernet ports for virtualization management. When a device is connected to the port, both ends negotiate to determine the optimal speed. The Ethernet port uses an RJ-45 connector. The TCP/IP address for each port can be configured from the serial port.

**Serial port**
An RS-232 serial port is provided on the switch. The serial port uses an RJ-45 connector. The serial port’s parameters are fixed at 9600 baud, 8 data bits, and no parity, with flow control set to None. This connector is for initial IP address configuration and for recovery of the switch to its factory default settings, should flash memory contents be lost. The serial port connection is not intended for normal administration/maintenance functions.

**Serial port specifications**
The serial port can be used to connect to a workstation to configure the switch IP address before connecting the switch to a fabric or IP network. The serial port’s parameters are fixed at 9600 baud, 8 data bits, and no parity, with flow control set to None. Table 13 lists the serial cable pinouts.
The Fibre Channel ports in the Switch are compatible with SWL, LWL, and ELWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards.

The ports are capable of operating at 1-, 2-, or 4-Gb/s and are able to auto-negotiate to the maximum link speed.

**GbE port specifications**

The GbE ports in the Switch are IEEE-compliant RJ-45.

The ports meet all required safety standards.

The GbE ports are capable of operating at 1-Gb/s.

---

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>UART1_TXD</td>
<td>Transmit data</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>6</td>
<td>UART1_RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>7</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>Not supported</td>
<td>NA</td>
</tr>
</tbody>
</table>
Nonport side

Figure 9 shows the nonport side of the switch, which contains the power supplies (including the AC power receptacle and AC power switch) and fans.

Figure 9  Nonport side of the switch

1  Power plug 6  Fan assembly 1
2  Power supply on/off switch 7  Power plug
3  Power supply 1 8  Power supply on/off switch
4  Fan assembly 3 9  Power supply 2
5  Fan assembly 2
**Supported software**

The AP-7600B is shipped with the following features pre-installed:

- SAS — Storage Application Services
- Zoning
- Web Tools
- Full Fabric
- Extended Fabric

The following *optional* software is available with the purchase of a specific license key:

- Fabric Watch
- ISL Trunking
- Performance Monitoring

For information on these features, see the *Connectrix B Series Fabric OS Administrator’s Guide*.

**Unsupported features**

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

**Components**

The switch includes the following components:

- 1U chassis designed to be mounted in a standard cabinet space, with forced-air cooling that flows from the nonport side of the Switch to the port side.
- 16 Fibre Channel ports, compatible with short wavelength (SWL), long wavelength (LWL), and extended long wavelength (ELWL) SFP transceivers.
- One IEEE-compliant RJ-45 serial cable, 10-ft. (approximately 3 m) long. An RJ-45 to DB9 adaptor is also provided with the Switch.
- Four IEEE-compliant RJ-45 connectors, one serial, one 10/100 Mb/s, and two GbE ports on the port side of the Switch for use with a serial console and 10/100 MB/s Ethernet.
Switch status and management LEDs: 1 switch power LED, 1 switch status LED, 6 Ethernet LEDs, 2 power supply LEDs, and 3 fan LEDs.

Port status LEDs: 16 Fibre Channel port status LEDs.

2 universal AC input and redundant power supplies with AC switches and built-in fans.

Three fan assemblies containing two fans each. The fans have two speeds, which are set automatically and cannot be modified. They default to high speed upon boot, then switch to low speed as Fabric OS comes online, returning to high speed only as required.

The MP-7500B has three types of memory devices:
- Boot flash — 4 Mb
- Compact flash — 1 Gb
- Main memory (DDR SDRAM) — 1 Gb

System architecture

Performance
- 1.063 Gb/s line speed, full duplex
- 2.125 Gb/s line speed, full duplex
- Autosensing of 1 Gb/s and 2 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed matching between 1 Gb/s, 2 Gb/s port, and 4 Gb/s ports

Ports
- 16 ports with 16 internal ports (VE or VEX ports) which are virtual or hidden ports for use with virtualization software

Port types
- F_Port
- E_Port
- EX_Port
- Self-discovery based on switch type (U_Port)
- Gigabit Ethernet

For virtualization:
- VE_Port
◆ VEX_Port

**Media types**
◆ Small form-factor Pluggable (SFP) laser

**Maximum size frame**
◆ 2112-byte payload FC
◆ 1518-byte payload Gigabit Ethernet

**Aggregate bandwidth**
◆ 128 Gb/s routed full duplex large frame bandwidth

**Fabric latency**
◆ Storage application dependent

**Class of service**
◆ Class 3

**Fabric services**
◆ Simple Name Server
◆ Registered State Change Notification (RSCN)
◆ Zoning
◆ Exchange-Based Trunking
◆ Web Tools

**Options**
◆ SFP media

---

**Management**

**Management software supported**
◆ Telnet
◆ SNMP
◆ Web Tools
◆ EMC Connectrix Manager

**Management access**
◆ 10/100 for switch management
◆ Two 10/100/1000 Ethernet ports (RJ-45) for storage application management
Diagnostics
◆ POST
◆ Embedded online/offline diagnostics

Mechanical specifications
◆ Width = 429 mm (16.89 in.)
◆ Height = 1U = 42.44 mm (1.67 in.)
◆ Depth = 635 mm (25.0 inches)
◆ Weight (with two power supplies and three fan assemblies installed) = 12.43 kg (27.4 lbs)

Environment
Table 5 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40° C (32° to 104° F)</td>
<td>-25° to 70° C (-13° to 158° F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% RH non-condensing, at 40° C (104° F), with maximum gradient of 10% per hour</td>
<td>10% to 90% RH non-condensing, at 70° C (158° F)</td>
</tr>
<tr>
<td>Altitude</td>
<td>0 to 3 km (10,000 ft) above sea level</td>
<td>0 to 12 km (40,000 ft) above sea level</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine wave</td>
<td>15 G, 12-18 milliseconds, trapezoid</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G, 5-500 Hz</td>
<td>2.0 G, 5-500 Hz</td>
</tr>
<tr>
<td>Air Flow</td>
<td>31 cu ft/min (52.7 cu m/hr)</td>
<td>NA</td>
</tr>
</tbody>
</table>

Power
The power supply provides three DC outputs (5V standby and 12V), providing a total output power of 300 maximum usable watts. Each power supply plugs directly into the enclosure from the port side of the unit, mating to internal blind connectors that connect both the DC outputs and the interface signals to the system backplane. An integral on/off switch, input filter, and power indicator are provided in each power supply, as well as a serial EEPROM device that provides
identifying information. Table 6 lists the power supply specifications for the MP-7500B switch.

### Table 6  Power supply specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output</td>
<td>300 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>300W Max, 215W typical</td>
</tr>
<tr>
<td>Input voltage</td>
<td>100-240 VAC, Universal</td>
</tr>
<tr>
<td>Input line frequency</td>
<td>47 - 63 Hz</td>
</tr>
<tr>
<td>Harmonic distortion</td>
<td>Active power factor correction</td>
</tr>
<tr>
<td>BTU rating at 80% efficiency</td>
<td>240W X 3.412 BTU/hr/Watts = 820 BTU/Hr</td>
</tr>
<tr>
<td>Inrush current</td>
<td>Maximum of 15 amps for period between 10-150 ms at 50 degrees C (122 degrees F), hot or cold start</td>
</tr>
<tr>
<td>Input line protection</td>
<td>Fused in both hot and neutral lines, using independent fuses</td>
</tr>
</tbody>
</table>

### Standards compliance

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at [http://www.brocade.com/sanstandards](http://www.brocade.com/sanstandards)

### Further reading

For more information, refer to the following documents located at EMC Online Support at [http://support.emc.com](http://support.emc.com):

- [EMC Connectrix B AP-7600B Hardware Reference Manual](http://support.emc.com)
- [EMC Connectrix B Fabric OS Command Reference Guide](http://support.emc.com)
- [EMC Connectrix B Fabric OS Administrator’s Guide](http://support.emc.com)
- [EMC Connectrix B Fabric OS MIB Reference Guide](http://support.emc.com)
- [EMC Connectrix B Fabric OS Error Message and Reference Guide](http://support.emc.com)
- [EMC Connectrix B Fabric OS Administrator’s Guide](http://support.emc.com)
- [EMC Connectrix B Web Tools Administrator’s Guide](http://support.emc.com)
This section provides a description of the hardware and features for the EMC Connectrix ED-48000B. The information provided comes from Brocade data sheets and testing experience in the EMC IOP qualification labs. More information for the ED-48000B can be found in the Connectrix B Series ED-48000B Hardware Reference Manual located at EMC Online Support at http://support.emc.com.

The Connectrix ED-48000B is a Director class switch which can contain up to 256 concurrently active 4 Gb/s full-duplex ports in a single domain. It is based on the Brocade Silkworm 48000 Condor ASIC-based architecture. The ED-48000B Director is a 256-port non-blocking switch. The suggested use of the ED-48000B is in the core of the SAN where high availability, high port count, and robustness are needed. The ED-48000B chassis is a 14U enclosure with up to 512 ports in a single Connectrix cabinet. Two ED-48000B Directors can be interconnected to create a high port-count solution.

The ED-48000B utilizes a Linux 2.4.x modified kernel to load the fabric OS version 5.x and greater.

**Note:** For specific versions of supported firmware, as well as fabric topology constraints associated with the ED-48000B, refer to the *EMC Support Matrix.*

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**Key features**

- Up to 256 ports in a single chassis.
- A single logical switch, that encompasses all port blades in the chassis for ease of maintenance.
- Support for two new high-performance port blades running at 1, 2, or 4-Gb/s
- 16-port blade (FC4-16)
- 32-port blade (FC4-32)
- Dual-redundant control processors provide high availability and enable non-disruptive software upgrades
- Redundant and hot swappable CPs, power supplies, and blower assembly
- Forward and backward compatibility with all Connectrix B Series directors
- Supports 1-, 2-, and 4-Gb/s auto-sensing Fibre Channel ports.
- Trunking groups up to eight ports to create high performance 32 Gb/s ISL trunks between switches
- Universal ports self-configure as E_Ports, F_Ports, or FL_Ports.

Port side

Figure 10 displays the portside of the ED-48000B director.
Legend:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Exhaust Vent</td>
<td>G</td>
<td>AC Power Connector (for Power Supplies 2 and 4)</td>
</tr>
<tr>
<td>B</td>
<td>FC4-16 Port Blade</td>
<td>H</td>
<td>AC Power Switch (for Power Supplies 2 and 4)</td>
</tr>
<tr>
<td>C</td>
<td>CP4 Blade (Control Processor Blade)</td>
<td>I</td>
<td>Cable Management Tray</td>
</tr>
<tr>
<td>D</td>
<td>Grounding Strap Connector</td>
<td>J</td>
<td>Power Supply #1</td>
</tr>
<tr>
<td>E</td>
<td>AC Power Switch (for Power Supplies 1 and 3)</td>
<td>K</td>
<td>FC4-32 Port Blade</td>
</tr>
<tr>
<td>F</td>
<td>AC Power Connector (for Power Supplies 1 and 3)</td>
<td>L</td>
<td>Power Supply Filler Panel</td>
</tr>
</tbody>
</table>
Nonport side

Figure 11 displays the nonport side view of the ED-48000B.

Figure 11  Nonport side of the ED-48000B director

Legend:
A  Port Blade and CP Blade LEDs  F  Blower Handle
B  WWN Bezel  G  Blower Assembly #3
C  Power Supply LEDs  H  Blower Assembly #2
D  Blower Power LED  I  Blower Assembly #1
E  Blower Fault LED
**Supported features**

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

---

**Unsupported features**

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

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**System architecture**

**Performance**

Performance features include:

- 1.063 Gb/s line speed, full duplex
- 2.125 Gb/s line speed, full duplex
- 4.25 Gb/s line speed, full duplex
- Auto-sensing of 1, 2, and 4 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed-matching between 1, 2, and 4 Gb/s ports

**Extended ISL mode buffer allocation**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Buffer allocation</th>
<th>Distance @ 1 Gb/s</th>
<th>Distance @ 2 Gb/s</th>
<th>Distance @ 4 Gb/s</th>
<th>Extended Fabric license required?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Gb/s</td>
<td>2 Gb/s</td>
<td>4 Gb/s</td>
<td>1 Gb/s</td>
<td>2 Gb/s</td>
</tr>
<tr>
<td>L0</td>
<td>5(26)a</td>
<td>5</td>
<td>5</td>
<td>10 km</td>
<td>5 km</td>
</tr>
<tr>
<td>LE</td>
<td>11</td>
<td>16</td>
<td>26</td>
<td>10 km</td>
<td>10 km</td>
</tr>
<tr>
<td>L0.5</td>
<td>18</td>
<td>31</td>
<td>56</td>
<td>25 km</td>
<td>25 km</td>
</tr>
<tr>
<td>L1</td>
<td>31</td>
<td>56</td>
<td>106</td>
<td>50 km</td>
<td>50 km</td>
</tr>
<tr>
<td>L2</td>
<td>56</td>
<td>106</td>
<td>206</td>
<td>100 km</td>
<td>100 km</td>
</tr>
<tr>
<td>LDb</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto (500 km max)</td>
<td>Auto (250 km max)</td>
</tr>
<tr>
<td>LSc</td>
<td>User defined</td>
<td>User defined</td>
<td>User defined</td>
<td>User defined (500 km max)</td>
<td>User defined (250 km max)</td>
</tr>
</tbody>
</table>
a. For each data channel (in this case, there are 4) there are 5 credits, plus 6 extra credits.
b. The dynamic long-distance mode (LD) automatically configures the number of buffer credits required, based on the actual link distance.
c. The static long-distance mode (LS) allocates the number of buffer credits based on the user-specified distance.

**World Wide Name Card (WWN)**

WWN Card maintains chassis-specific information such as WWNs, IP addresses, and summary status information of each port blade assembly and power supply through LEDs.

**Control processor**

Redundant (active/standby) control processor modules.

**Fibre Channel ports**

- Up to eight hot-swappable port blade assemblies, which can be configured in a single chassis, delivering up to 256 Fibre Channel ports
- Two slots for control processor (CP) blade assemblies (slots 5 and 6):
  - A single active CP blade can control all 256 ports in the chassis
  - The standby CP blade assumes control of the switch if the active CP fails
- Up to eight Fibre Channels port cards, either 16 or 32 ports
- Up to 512 ports per 42U rack

**Port types**

- Universal ports (U_Port), which self-configure as E_Ports, F_Ports, or FL_Ports; G_Port functionality is determined by the type of attached device
- FL_Port Port Module support for SFP optical transceivers, supporting any combination of SWL and LWL optical media.
- F_Port
- E_Port

**Port numbering**

The Connectrix ED-48000B uses the following port numbering schemes:

- For the FC4-16 port blade, ports are numbered from 0 through 15 from bottom to top
For the FC4-32 port blade, ports are numbered from 0 through 15 from bottom to top on the left set of ports and 16 through 31 from bottom to top on the right set of ports.

Slots are numbered 1 through 10, from left to right when facing the portside of the director.

**ISL Trunking**
- Up to eight 4.25 Gb/s ports per ISL trunk
- Up to 32 Gb/s per ISL trunk
- Up to two 8-port trunk groups supported on 16 port card
- Up to four 8-port trunk groups supported on 32 port card
- ISL trunking at 2 Gb/s for compatibility with prior B Series Connectrix products

**Aggregate bandwidth**
- 2.176 Tb/s

**Switch latency**
- For the FC4-16 blade:
  - <1.2 µsec any port to any port at 4 GB/s, cut-through routing, within the same blade
- For the FC4-32 blade:
  - <3.6 µsec any port to any port at 4 GB/s, cut-through routing

**Oversubscription**
- 128 port configuration
  - 1.088 Tb/s at 4 Gb/s port speed
- 256 port configuration
  - 1.088 Tb/s at 2 Gb/s port speed
  - 2.176 Tb/s at 4 Gb/s port speed
- FC4-16 blade:
  - No oversubscription at 2 Gb
  - No oversubscription at 4 Gb
- FC4-32 blade:
  - No oversubscription at 2 Gb
  - 16:8 oversubscribed at 4 Gb
Maximum frame size
◆ 2112-byte payload

Frame buffers
◆ 1024 per blade
◆ Dynamically allocated up to 255 per port

Classes of service
◆ Class 2, Class 3, and Class F (inter-switch frames) Fibre Channel protocol support

Fabric services
◆ Simple Name Server
◆ Registered State Change Notification (RSCN)
◆ Alias Server (multicast)
◆ Zoning
◆ Web Tools
◆ Fabric Watch
◆ Extended Fabrics
◆ ISL Trunking
◆ Performance Monitoring.

High Availability
◆ Redundant, hot-swappable components
  • Chassis (including backplane, blower and power supply backplane, AC harness, and blower harness)
  • 16 and 32 port Fibre Channel switch modules
  • WWN Card
  • Small Form-factor Pluggable (SFP) Short-Wavelength Laser (SWL) transceivers
  • Small Form-factor Pluggable (SFP) Long-Wavelength Laser (LWL) transceivers
◆ Redundant power supply and blower assembly subsystems
  • The ED-48000B requires a minimum of two operating blower assemblies at all times. To ensure continuous adequate cooling, maintain three operating blower assemblies at all times except for the brief period when replacing a blower assembly.
- The port blades automatically shut down if the internal temperature range is exceeded (up to 75 degrees Celsius).
- Enhanced data integrity on all data paths
- Fabric Shortest Path First (F SPF) rerouting around failed links
- Integration with Simple Network Management Protocol (SNMP) managers
- Automatic control processor failover
- Non-disruptive “hot” software code loads and activation
- Easy configuration, save, and restore
- Hot-swappable World Wide Name (WWN) card
- Four AC-DC power supply modules
- 4N redundancy

**Cooling**
- Three blowers, providing cooling, allowing continuous operation even if one blower fails
- Rear panel-to-door airflow

**Management**

**Management software supported**
- EMC ControlCenter
- EMC Connectrix Manager
- RADIUS
- Embedded web server to provide single-point management using the Web Tools GUI
- Centralized configuration and management of fabric using Client/Server architecture and CLI
- Support for 10/100 Mb Ethernet connections to CP for out-of-band management
- In-band over Fibre Channel (requires fabric)
- SNMP (FE MIB, FC Management MIB)
- Telnet/SSH
Management access

- One 10/100 Mb Ethernet RJ-45 management port per Control Processor module
- Two DB-9 serial ports per Control Processor module

Diagnostics

- Post and embedded online/offline diagnostics

Mechanical specifications

- Width = 43.74 cm (17.2 in)
- Height = 61.24 cm (24.22 in) for 14U
- Depth = 70.90 cm (27.90 in) without door
  74.20 cm (29.20 in) with door
- Weight = 95 kg (210 lb) for 128-port configuration
  (8 X FC4-16, without media)
  98 kg (216 lb) for 256-port configuration
  (8 X FC4-32, without media)

Environment

- Temperature
  - Operating: 0°C to 40°C (32°F to 104°F)
  - Non-operating: -25°C to 70°C (-13°F to 158°F)
- Humidity
  - Operating: 5% to 85% non-condensing at 40°C (104°F)
  - Non-operating and storage (non-condensing): 0% to 93%
- Altitude
  - Up to 3000 meters (9800 feet)
- Shock
  - Operating: 20G, 11 ms, half sine 1 G p-p, 5-500Hz, 1 octave min
  - Non-operating: 33 G, 11ms, half sine 2.4 G p-p, 5-500Hz, 1 octave min
- Vibration
  - Operating: 5G p-p, 0 to 3kHz at 1.0 octave min
  - Non-operating: 10G p-p, 0 to 5 kHz at 1.0 octave min
Heat dissipation

- 915 W or 3115 BTU (eight FC4-32 blades and two CP4 blades)
- 710 W or 2425 BTU (eight FC4-16 blades and two CP4 blades)

Power

- Supported power range
  - Nominal: 200 to 240 VAC nominal, 5.0 A, single phase
  - Operating: 180 to 264 VAC auto-sensing

  **Note:** 256-port configuration requires a maximum of 750 Volt-Amps.

- In-rush current
  - 40 Amps maximum, peak

- Frequency
  - 47 to 63 Hz

- Recommended power connector: IEC 320, EN60320 C19-Angled, 16A/250VAC

Protocols

- FC
- FICON

Standards compliance

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website:

http://www.brocade.com/sanstandards

Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.
Oversubscription

Oversubscription is a condition where the potential demand on a device exceeds the device’s capability to service that demand. In and of itself, oversubscription does not create a performance issue in the form of congestion, but rather creates the potential for congestion to take place.

This section describes oversubscription ratios related to utilizing 16-port and 32-port 8 Gb/s blades in an EMC Connectrix ED-48000B Director chassis. While the oversubscription ratio between two pieces of hardware is a constant, the impact oversubscription has on the environment can be mitigated by carefully configuring the environment to take advantage of features, such as localized switching. In addition, considering port speeds and sustained traffic on the given ports during the design phase is also helpful.

The following information is discussed further in this section:

- “Control Processor blades” on page 91
- “Utilizing 4 Gb/s blades in an ED-48000B” on page 92
- “Utilizing 8 Gb/s blades in a ED-48000B” on page 94
- “Local switching” on page 97

Control Processor blades

The Connectrix ED-48000B Director uses two 4 Gb/s Control Processor (CP) blades, also known as Core Blades, that include ASICs that switch traffic between port blades, and any combination of up to eight of the following port blade types:

- 16-port 4 Gb/s blade (FC4-16)
- 32-port 4 Gb/s blade (FC4-32)
- 48-port 4 Gb/s blade (FC4-48)
- 16-port 8 Gb/s blade (FC8-16)
- 32-port 8 Gb/s blade (FC8-32)

Prior to a discussion of oversubscription ratios, it is first important to understand the architecture of the ED-48000B Director. This Director consists of 10 slots, eight reserved for port blades and two reserved for 4 Gb/s Control Processor (CP) /Core Blades.

Each CP/Core Blade consists of two 32-port Condor ASICs, for a total of 4 Condor ASICs connected to the ASICs on the port blades.
Figure 12 illustrates the basic architecture of the ED-48000B when utilizing FC4-16 port blades.

Utilizing 4 Gb/s blades in an ED-48000B
When the ED-48000B is populated with FC4-16 port blades, the 1:1 subscription ratio between the front-end ports used for device attachment and the back-end ports connected to the CPs is 1:1. Each FC4-16 port blade has 16 front-end ports used for connecting to external devices such as hosts, storage, or other FC switches. The FC4-16 port blade also has 16 back-end 4 Gb/s ports which are connected to the Condor ASICs located within the CPs.
**Figure 13** illustrates the internal connectivity between FC4-16 port blades and the CPs. All internal and external physical links are running at 4 Gb/s.

![Diagram of FC4-16 port blade internal connectivity](image)

**FC4-16 port blade internal connectivity**

When the ED-48000B is populated with FC4-32 port blades, there is a 16:8 oversubscription ratio between the front-end ports used for device attachment and the back-end ports connected to the CPs. Each FC4-32 port blade consists of two Condor ASICs, each delivering 16 front-end ports used for connecting to external devices such as hosts, storage, or other FC switches. Each FC4-32 Condor ASIC also has eight back-end 4 Gb/s ports that are connected to the Condor ASICs located within the CPs.

The oversubscription ratio for traffic between each of the FC4-32 port blade Condor ASICs is **16:8** because there are 16 front-end ports used for device connections and 8 back-end ports used for connection to the CPs.
Figure 14 illustrates the internal connectivity between FC4-32 port blades and the CPs. All internal and external links are running at 4 Gb/s.

When the ED-48000B is populated with FC4-48 port blades, there is a 24:8 oversubscription ratio between the front-end ports used for device attachment and the back-end ports connected to the CPs. Each FC4-48 port blade consists of two Condor ASICs, each of which has 24 front-end ports used for connecting to external devices such as hosts, storage, or other FC switches. Each FC4-48 Condor ASIC also has eight back-end 4 Gb/s ports which are connected to the Condor ASICs located within the CPs.

The oversubscription ratio for traffic between each of the FC4-48 port blade Condor ASICs is 24:8, because there are 24 front-end ports used for device connections and 8 back-end ports used for connection to the CPs.

Utilizing 8 Gb/s blades in a ED-48000B

When the ED-48000B is populated with FC8-16 port blades, there is a 16:8 oversubscription ratio between the front-end ports used for device attachment and the back-end ports connected to the CPs. Each FC8-16 port blade has sixteen 8 Gb/s front-end ports used for connecting to external devices such as hosts, storage, or other FC switches. The FC8-16 port blade also has sixteen back-end ports.
running at 4 Gb/s which are connected to the Condor ASICs located within the CPs.

The oversubscription ratio for traffic between each of the FC8-16 port blade Condor2 ASICs is 16:8 because there are 16 front-end ports used for device connections running at 8 Gb/s (16 x 8 Gb/s) and 16 back-end ports used for connection to the CPs, but running at 4 Gb/s (16 x 4 Gb/s = 8 x 8 Gb/s).

Figure 15 illustrates the internal connectivity between FC8-16 port blades and the CPs, all internal links running at 4 Gb/s, and all external links running at 8 Gb/s.

When the ED-48000B is populated with FC8-32 port blades, as shown in Figure 16 on page 96, there is a 16:4 oversubscription ratio between the front-end ports used for device attachment and the back-end ports connected to the CPs. Each FC8-32 port blade consists of two Condor2 ASICs, each of which has sixteen front-end ports used for connecting to external devices such as hosts, storage, or other FC switches. Each FC8-32 Condor2 ASIC also has eight back-end ports running at 4 Gb/s connected to the Condor ASICs located within the CPs.

The oversubscription ratio for traffic between each of the FC8-16 port blade Condor2 ASICs is 16:4 because there are 16 front-end ports used for device connections running at 8 Gb/s (16 x 8 Gb/s) and 8 back-end ports used for connection to the CPs, but running at 4 Gb/s (8 x 4 Gb/s = 4 x 8 Gb/s).
Figure 16 illustrates the internal connectivity between FC8-32 port blades and the CPs, all internal links running at 4 Gb/s, and all external links running at 8 Gb/s.

Note: The ED-48000B uses back-end 16 Gb/s or 8 Gb/s pipes that are frame balanced in hardware and are always congestion-free up to the total pipe bandwidth. Therefore, two FC8-16 and/or FC8-32 blades can switch up to eight point-to-point 8 Gb/s flows across the CPs.

To summarize, Table 7 indicates the oversubscription ratios as they relate to installing both 4 and 8 Gb/s port blades into an ED-48000B director.

<table>
<thead>
<tr>
<th>Blade</th>
<th>FC8-16</th>
<th>FC8-32</th>
<th>FC4-16</th>
<th>FC4-32</th>
<th>FC4-48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oversubscription</td>
<td>16:8</td>
<td>16:4</td>
<td>1:1</td>
<td>16:8</td>
<td>24:8</td>
</tr>
</tbody>
</table>

Table 7 Oversubscription ratios for port blades in an ED-48000B
Local switching

The use of local switching should be considered when designing your fabric. Local switching occurs when two ports are switched within the boundaries of a single ASIC. With local switching, no traffic transverses the backplane of a Director; therefore, the CP’s switching capacities are unaffected. Local switching always occurs at the full speed negotiated by the switching ports, regardless of any backplane oversubscription ratio for the port card. Only FOS-based platforms, such as the EMC ED-DCX-B Backbone Director and the EMC ED-48000B Director, have the local switching feature, since only they utilize multi-stage switching architectures.

The FC8-16 is comprised of one Condor2 ASIC and all of its 16 front-end ports make up one local switching group. The FC8-32 with two Condor2 ASICs is architected with the top 16 and bottom 16 front-end ports making up two local switching groups.

Local switching always occurs at full speed within an ASIC, but not necessarily within a port blade. For example, port 0 and port 31 on an FC8-32 blade communicate over the backplane and therefore must use the CP4 back-end switching ASICs. On the same FC8-32 blade, port 0 can switch locally at full speed with ports 1 to 15, and port 16 can switch locally at full speed with ports 17 to 31. These port groups are local switching groups since they each share the same port blade ASIC. Likewise, an FC8-16 in an ED-48000B Director can support eight 8 Gb/s ports switching non-locally to the backplane, yielding a 1:1 subscription ratio if the other eight ports on the FC8-16 are switching locally.

These examples of local switching use port-to-port nomenclature as a matter of convenience. The real limitation would be due to port blade-to-CP switching bandwidth. Thus, if any combination of the 16 ports on an FC8-16 blade in an ED-48000B switches 64 Gb/s or greater locally, those ports could switch other flows over the CP ASICs at up to 64 Gb/s, for a total of sixteen 8 Gb/s ports at full speed. For an FC8-32, each Condor2 ASIC port group needs to switch up to 96 Gb/s locally so those ports can switch other flows over the CP ASICs at up to 32 Gb/s in order to drive all the FC8-32 ports at full 8 Gb/s speeds.

Combinations of local and non-local traffic flows can occur simultaneously; therefore any local switching will mean fewer ports will be utilizing the bandwidth of the backplane. If the locality of a configuration is known, there is an opportunity to tune connection patterns for absolute maximum performance.
Even with no planning for local switching, the bursty, random nature of SAN traffic will create some traffic between ports within local switching groups. By performing a modest amount of connection planning, both local switching and high availability can be maximized.

The recommended port placement is to at least optimize for high availability considerations, which will give a minimum level of local switching. First, alternate across port blades and then alternate across multiple port blade ASICs for the FC4-32, FC4-48, and FC8-32. This pattern should be followed separately for host, disk, tape, and ISL connections. For even greater amounts of local switching, follow the HA placement strategy and also use LUN management to ensure a host’s targets are located on the same ASIC as the host connection.

If your primary concern is maximizing your performance when utilizing 8 Gb/s port blades in a ED-48000B Director, purposely group storage, host, and ISL ports that will need to switch with each other within local switching groups. In this way, performance is always maximized since all traffic is locally switched and no traffic goes over the backplane.

Keep the following points in mind when considering the use of 8 Gb/s port blades in an ED-48000B Director:

- Both the FC8-16 and FC8-32 with all ports able to simultaneously switch at 8 Gb/s using 50%+ or 67%+ local switching respectively, are fully supported.
- Local switching enables full 8 Gb/s performance and does not use up limited backplane bandwidth.
- FC8-16 has a maximum oversubscription ratio of 16:8 for traffic over the backplane.
- FC8-32 has a maximum oversubscription ratio of 16:4 for traffic over the backplane.
This section introduces the components of the EMC Connectrix MP-8000B.

The MP-8000B is a 24-port 10 GbE line-rate, low latency lossless Converged Enhanced Ethernet (CEE) and an 8-port auto-sensing 1, 2, 4, or 8 Gb/s Fibre Channel switch that delivers the latest Brocade ASIC technology and architecture for Fibre Channel Storage Area Networks (SANs). The MP-8000B enables the Fibre Channel over Ethernet (FCoE) protocol and is a high performance 8 Gb/s Fibre Channel switch designed for the needs of enterprise environments that require a high-port footprint for port aggregation and desire the simplified management environment that comes with reducing the total number of domains to manage.

The MP-8000B supplies Reliability, Availability, and Serviceability (RAS) performance and scalability requirements of an enterprise switch along with the interoperability and ease-of-use advantages found only in the Connectrix B product family.

Note: For specific versions of supported firmware, as well as fabric topology constraints associated with the MP-8000B, refer to the EMC Support Matrix and the Connectrix MP-8000B Product release notes.

Key features

Key features of the MP-8000B include:

Platform components and capabilities

The MP-8000B offers the following features and capabilities:

- A system motherboard that features a Freescale MPC8548 Reduced Instruction Set Computer (RISC) CPU running at 1.3 GHz with integrated peripherals, and that provides high performance with low power consumption.
- A USB port that provides storage for firmware updates, output of the supportSave command and storage for configuration uploads and downloads.
- Two hot-swappable, redundant power supply FRUs.
- Three hot-swappable fan assembly FRUs in an N+1 configuration to provide hardware-redundant cooling.
[Rack-mount design using existing rail kits (fixed and mid-mount/Telco rail kits) on a 19-inch EIA rack.

- Extensive diagnostics and system-monitoring capabilities for enhanced high Reliability, Availability, and Serviceability (RAS).
- The EZSwitchSetup wizard that makes SAN configuration a three-step point-and-click task.

**FCoE and Layer 2 capabilities**

The MP-8000B has the following capabilities for Ethernet functions:

- 24 ports 10 GbE CEE.
- Low latency, lossless, deterministic interconnect required for FCoE.
- FCoE support along with Fabric Provided MAC Address (FPMA) discovery.
- FOS delivers these features and also enables support for Priority-based Flow Control (802.1Qbb).
- Data Center Bridging eXchange (DCBX) — Capabilities Exchange and Enhanced Transmission Selection (802.1Qaz) delivers the lossless and deterministic FCoE requirement.
- Enables hardware-assisted MAC learning and aging.
- Support for 32K MAC addresses and 4K Vlans.
- Support for Layer 2 protocols STP/MSTP/RSTP (802.1q) and Link Aggregation (802.1ad).
- 10G SFP+ (SR and LR) and Twinax copper cables.
- Support for unicast, multicast (255 groups) and broadcast data traffic types.

**Fibre Channel capabilities**

The MP-8000B offers the following features for Fibre Channel functions:

- 1, 2, 4, and 8 Gb/s auto-sensing Fibre Channel switch and router ports.
- Full 1:1 subscription on 8 Gb/s ports.
- Universal ports self-configure as E, F, M (Mirror Port), or FL ports.
- Inter-Switch Link (ISL) Trunking (licensable), which allows up to eight ports (at 1, 2, 4, or 8 Gb/s speeds) between a pair of switches combined to form a single, logical ISL with a speed of up to 64 Gb/s (128 Gb/s full duplex) for optimal bandwidth utilization and load balancing.

- Dynamic Path Selection (DPS), which optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient available path in the fabric.

- SFP optical transceivers that support any combination of Short Wavelength (SWL) and Long Wavelength (LWL) optical media among the switch ports.

- Support for unicast, multicast (255 groups), and broadcast data traffic types.


- Port-to-port latency minimized to 700 nanoseconds through the use of cut-through frame routing at 8 Gb/s.

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**Port side**

*Figure 5* shows the port side view of the MP-8000B.
Figure 6 shows the nonport side view of the MP-8000B, which contains the power supplies (including the AC power receptacle and AC power switch) and fans.

<table>
<thead>
<tr>
<th>Legend:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Switch ID pull-out tab</td>
<td>5</td>
</tr>
<tr>
<td>2 System status LED (top)</td>
<td>6 GbE ports 0-7</td>
</tr>
<tr>
<td>System power LED (bottom)</td>
<td>7 GbE ports 8-15</td>
</tr>
<tr>
<td>3 Serial console port</td>
<td>8 GbE ports 16-23</td>
</tr>
<tr>
<td>4 Management Ethernet port</td>
<td>9 FC ports 0-7</td>
</tr>
</tbody>
</table>

---

**System architecture**

**Performance**

- Fibre Channel: 1, 2, 4, and 8 Gbps line speed full duplex
- CEE: 10 Gb/s line speed
**Fibre Channel ports**
- Eight Fibre Channel universal (E, F, M, and FL) ports with 1, 2, 4, and 8 Gb/s
- CEE ports
- 24 ports with 10 Gigabit Ethernet

**FCoE features**
Complete T11 FCoE entity and FCoE bridging.

The FCoE translation entity built into the hardware engine provides:
- Detection of Fibre Channel encapsulation and redirection of FCoE fabric login frames
- Encapsulation of Fibre Channel frames in FCoE Ethernet packets (FC > FCoE)
- Extraction of Fibre Channel frames from FCoE Ethernet packets (FCoE > FC)
- Mapping of Fibre Channel destination Virtual Fabrics and destination FC_ID to Ethernet Virtual LAN and destination MAC addresses
- Fabric-Provided MAC Addresses (FPMAs) enable new Ethernet MAC addresses to be created using the FC_ID assigned by the fabric

**CEE features**
- Data Center Bridging eXchange (DCBX)
- Priority-based Flow Control (PFC) – IEEE 802.1Qbb
- Enhanced Transmission Selection (ETS) – IEEE 802.1Qaz

**Port types**
- Configurable port types: F_Port, FL_Port, E_Port, and M_Port

**ISL Trunking**
- Frame-based ISL Trunking (optional license) enables up to eight ports between a pair of switches to be combined into a logical ISL with speeds of up to 64 Gbps (128 Gbps full duplex) for optimal bandwidth utilization and load balancing; exchange-based load balancing across ISLs with DPS (included in Fabric OS)
- Link aggregation (10 Gigabit Ethernet)
- Link Aggregation Control Protocol (LACP), enhanced and 802.3ad standards-based
Maximum frame size
- 2112-byte Fibre Channel payload; 9048-byte Ethernet frame

Classes of service
- Class 2 and Class 3, Class F (inter-switch frames)

Fibre Channel Fabric services
- Simple Name Server
- Registered State Change Notification (RSCN)
- NTP
- RADIUS
- LDAP
- Dynamic Path Selection (DPS)
- Enhanced Group Management (EGM)
- Web Tools

Optional:
- Fabric Watch
- ISL Trunking
- Performance Monitoring

CEE services
- Spanning Tree Protocol (STP, MSTP, RSTP, VLAN Tagging (802.1q), MAC address learning and aging; native FCoE switching; IEEE 802.3ad Link Aggregation (LACP); access control lists based on VLAN, source, destination address, and port; eight priority levels for QoS and 4k VLANs; Priority-based Flow Control (PFC); Data Center Bridging (DCBX)-Capabilities Exchange; Enhanced Transmission Selection (ETS)

Cooling
- Because the cooling system relies on pressurized air, do not leave any of the fan assembly slots empty longer than two minutes while the switch is operating. If a fan assembly fails, leave it in the switch until it can be replaced
- Maintain all three fan assemblies in operational condition to provide redundancy
Management

Management software supported
- SSH v2, HTTP/HTTPS, SNMP v1/v3, Telnet
- SNMP (FE MIB, FC Management MIB, RMON, and IF-MIB for CEE)
- Web Tools
- EMC Connectrix Manager
- SMI-S
- RADIUS
- Connectrix Manager Data Center Edition (CMDCE) (10.1.4 and later) CEE / FCoE limited support
  • Show both Ethernet and FC port properties
  • Show FCoE properties
  • Show FCoE-capable CNAs
  • Statistics for Ethernet and virtual FCoE ports
  • Pure EOS Fabric support
  • Installation and Migration
- Zoning configuration
- SNMP
- SMI Agent
  • FCoE support; Discovery only

Management access
- One 10/100/ Gigabit Ethernet (RJ-45), in-band over Fibre Channel, one serial port (RJ-45), and one USB port

Diagnostics
- POST and embedded online/offline diagnostics, including FCping and Pathinfo (FCtraceroute)

Mechanical Specifications
- Width = 42.9 cm (16.9 in.)
- Height = 1U or 4.3 cm (1.7 in.)
- Depth = 63.4 cm (25 in.)
Weight: 12.97 kg (28.6 lb); (with two power supplies, three fan assemblies, and no SFPs installed)

Environment

Temperature
- Operating: 0°C to 40°C (32°F to 104°F)
- Non-operating: -25°C to 70°C (-13°F to 158°F)

Humidity
- Operating: 10% to 85% RH non-condensing at 40°C (104°F)
- Non-operating and storage (non-condensing): 10% to 90% at 70°C (158°F)

Altitude
- Operating: 0 to 3 km (9,842 feet) above sea level
- Non-operating: 0 to 12 km (39,370 feet) above sea level

Shock
- Operating: 20 G, 6 ms, half sine wave
- Non-operating: 33 G, 11 ms, half sine wave 3/eg Axis

Vibration
- Operating: 0.5 G sine, 0.4 gms random, 5-500 Hz
- Non-operating: 2.0 G sine, 1.1 gms random, 5-500 Hz

Heat dissipation
- Operating: 1044 BTU/hr (32 port configuration)
- Non-operating: N/A

Power
- Maximum: 350 watts
- Consumption: 306 watts
- Input voltage: 85 to 264 VAC nominal
- Input line frequency: 47 to 63 Hz
- Inrush current: 60 amps maximum
- Maximum current: 29 amps at 12V DC

Protocols
- Fibre Channel over Ethernet (FCoE)
Standards compliance
This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards at conformance, visit this Brocade website at http://www.brocade.com/sanstandards

Further reading
For more information, refer to the following Brocade documents located at EMC Online Support at http://support.emc.com:

- Brocade 8000 Hardware Reference Manual
- EMC Connectrix B Series Fabric OS v6.1.2_cee1 Release Notes
- Brocade Converged Enhanced Ethernet Command Reference Guide
- Brocade Converged Enhanced Ethernet Administrator’s Guide
Connectrix MP-7800B

The MP-7800B Extension Switch is intended as a platform for Fibre Channel over IP (FCIP). This enables transmission of Fibre Channel data over long distances via IP networks by wrapping Fibre Channel frames in IP packets. Each end of the FCIP communication path must be a compatible FCIP device, either the MP-7800B or the PB-DCX-FX8-24 blade in a DCX-family chassis.

A minimum level of Fabric Operating System (FOS) 6.3 is required to use the MP-7800B.

Refer to the Brocade Fabric OS Administrator’s Guide for information on configuring these features.

The base model of the switch is shipped with six Fibre Channel SFP ports and two physical Gigabit Ethernet (GbE) ports active. It includes FOS 6.3 and is compatible with the entire Connectrix B switch family. It can operate independently or in a fabric containing multiple Extension Switches.

Key features

A fully licensed MP-7800B provides the following functionality:

- FCIP capability
- Up to 8 FCIP tunnels.
- Each FCIP tunnel is represented and managed as a virtual Fibre Channel E_Port (VE_Port).
- Fibre Channel Routing Services functionality can be used over the FCIP link.
- Fabrics connected through FCIP merge if the ports are configured as VE_Ports, and do not merge if one end of the connection is configured as a VEx_Port. If VE_Ports are used in a Fibre Channel Routing Services backbone fabric configuration, then the backbone fabric merges but the Ex_Port attached to edge fabrics do not merge. For more information see the Fabric OS Administrator’s Guide.
- FCIP Trunking with load balancing and network-based failure recovery
- Adaptive Rate Limiting
- Configurable maximum and minimum committed bandwidth per FCIP tunnel
- Minimum rate is guaranteed rate
- FC frame compression before FCIP encapsulation
- Fibre Channel Routing
- IPSec
- IPv6
- Virtual Fabrics
- VLAN Tagging
- In-band management over GbE ports
- SO-TCP with reorder resistance
- FastWrite over FCIP (not over FC)
- Open Systems Tape Pipelining over FCIP
- XRC acceleration and FICON tape pipelining over FCIP
- FICON CUP
- FCIP QoS
- TCP performance graphing in Web Tools
- Non-disruptive configuration changes for:
  - SO-TCP
  - FastWrite
  - Open Systems tape pipelining
  - XRC emulation
  - FICON tape pipelining
  - Compression

The MP-7800B provides the following hardware features:

- Up to 16 Fibre Channel SFP ports supporting Fibre Channel Routing Services with link speeds up to 1, 2, 4, or 8 Gbps
- Up to six 1 GbE ports supporting the FCIP and Fibre Channel Routing Services features with transmit link speeds up to 1-Gbps on each port:
  - Two ports (ge0 and ge1) can be configured for use with either copper or optical cables.
  - Rack mountable 1U -chassis.
  - Two PPC440EPx Processors running @ 667 MHz.
  - One GoldenEye2 switch ASIC for 1/2/4/8 Gbps FC switching.
  - One Cavium CN 5740 running with eight MIPS cores @ 750 MHz for data path processing
  - One Blaster FPGA for FC compression, IPSec functionality, offloads like checksum generation/checks, etc.
  - One 10/100/1000 Base-T Ethernet port for management interface.
  - One RJ45 terminal port.
- One USB port that provides storage for firmware updates, output of the supportSave command and storage for configuration uploads and downloads.
- Two redundant, hot-swappable combined power supply/fan assembly FRUs.
- Five internal temperature sensors.

**Port side**

*Figure 19* shows the port side of the MP-7800B Extension Switch.

---

**Legend:**

1. System Power LED
2. System Status LED
3. Console Port (RJ45)
4. Ethernet Management Port
5. USB Port
6. Fibre Channel Ports (16)
7. GbE ports - copper RJ45(2)
8. GbE ports - optical SFP (6)
9. Serial number pull-out tab

The Fibre Channel ports are numbered from left to right on the faceplate (see *Figure 20*).
You can have two trunking groups on a fully licensed MP-7800B. Groups 1 would consist of FC ports 0-7 and group 2 would be ports 8-15.

**Nonport side**

Figure 21 shows the nonport side of the MP-7800B Extension Switch, which contain the combined power supplies and fans.

Legend:
1. Fibre Channel Ports 0 through 3
2. Fibre Channel Ports 4 through 15
3. GbE ports ge0-ge1 (copper only)
4. GbE ports ge0 through ge5 (SFP)

**Figure 21** Nonport side of the MP-7800B Extension Switch

Legend:
1. Fan and Power Supply Assembly 2
2. Fan and Power Supply Assembly 1
3. Fan assembly 2
4. FRU LED
5. Power supply 2
6. Fan assembly 2
7. Fan assembly 1
8. FRU LED
9. Power supply 1
10. Fan assembly 1
11. FRU handle
12. FRU handle
Specifications

**General specifications**

Table 8 lists the general specifications for the MP-7800B.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configurable port types</td>
<td>The GbE ports can be VE_Ports. The Fibre Channel ports can be E_Ports, EX_Ports, FL_Ports, or F_Ports.</td>
</tr>
<tr>
<td>System architecture</td>
<td>Nonblocking shared-memory Extension Switch</td>
</tr>
<tr>
<td>System processors</td>
<td>PowerPC 440EPx, 667 MHz CPU, GoldenEye2 switch ASIC, Cavium CN5470 750 MHz processor, Blaster FPGA</td>
</tr>
<tr>
<td>ANSI Fibre Channel protocol</td>
<td>FC-PH (Fibre Channel Physical and Signalling Interface standard)</td>
</tr>
<tr>
<td>Modes of operation</td>
<td>Fibre Channel Class 2 and Class 3</td>
</tr>
<tr>
<td>Fabric initialization</td>
<td>Complies with FC-SW-3 Rev. 6.6</td>
</tr>
<tr>
<td>FCIP (IP over Fibre Channel)</td>
<td>Complies with FC-IP 2.3 of FCA profile</td>
</tr>
</tbody>
</table>
| Aggregate Extension Switch I/O bandwidth | A total 268 Gbps:  
  - 256 Gbps if all 16 FC ports are running at 8 Gbps, full duplex  
  - 12 Gbps if all 6 GbE ports are running at 1 Gbps, full duplex |
| Port-to-port latency                 | Less than 2 microseconds with no contention (destination port is free)        |

**Memory specifications**

The MP-7800B has three types of memory devices:

- Main memory (DDR2 SORDIMM SDRAM) — 2 GB
- Boot flash — 4 MB
- Compact flash — 1 GB

**Fibre Channel port specifications**

The Fibre Channel ports in the MP-7800B are compatible with SWL, LWL, and ELWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards.
The ports are capable of operating at 1-, 2-, 4-, or 8-Gbps and are able to auto-negotiate to the maximum link speed.

**GbE port specifications**
The GbE ports in the MP-7800B are compatible with short range (SR) and long range (LR) SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards.

The GbE ports are capable of operating at 1-Gbps. The 8 virtual FCIP Fibre Channel links over each physical GbE connection share this bandwidth.

**Serial port specifications**
The serial port is located on the port side of the MP-7800B. The switch uses an RJ-45 connector for the serial port. An RJ-45 to DB9 adaptor is also provided with the MP-7800B.

*Note:* To protect the serial port from damage, keep the cover on the port when not in use.

The serial port can be used to connect to a workstation to configure the MP-7800B IP address before connecting the switch to a fabric or IP network. The serial port’s parameters are fixed at 9600 baud, 8 data bits, and no parity, with flow control set to None. Table 9 lists the serial cable pinouts.

### Table 9 Serial cable pinouts

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>UART1_TXD</td>
<td>Transmit data</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>6</td>
<td>UART1_RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>7</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>Not supported</td>
<td>NA</td>
</tr>
</tbody>
</table>
Supported features

The section includes supported software features.

For the most up-to-date information on supported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Performance

Fibre Channel performance:
  ◆ 1.063 Gb/s line speed, full duplex
  ◆ 2.125 Gb/s line speed, full duplex
  ◆ 4.25 Gb/s line speed, full duplex
  ◆ 8.25 Gb/s line speed, full duplex
  ◆ Auto-sensing of 1 Gb/s, 2 Gb/s, 4 Gb/s, and 8 Gb/s ports

FCIP performance:
  ◆ 1 Gb/s line speed

ISL Trunking
  ◆ Up to eight 8 Gb/s ports per ISL trunk
  ◆ Up to 64 Gb/s per ISL trunk
  ◆ There is no limit to how many trunk groups can be configured in the switch

Aggregate bandwidth

Fibre Channel:
  ◆ 128 Gb/s: 16 ports at 8 Gb/s (data rate)
FCIP:
- 6 Gb/s: 6 ports at 1 Gb/s (data rate)

Fabric latency
- 700 ns with no contention, cut-through routing at 8 Gb/s

Maximum MTU size
- 1500-byte Ethernet packets with FCIP

Classes of service
- Class 2 and Class 3, Class F (inter-switch frames)

Port types
- F_Port, FL_Port, E_Port, Ex_Port, M_Port (Mirror Port), and self-discovery based on switch type (U-Port)
- For FCIP, VE_Port (Virtual E+_Port)

Fibre Channel ports
- 16 ports, universal (E, F, M, Ex, and FL)

Data Traffic Types
Fabric switches supporting unicast, multicast (255 groups), and broadcast

USB
One USB port for system log file downloads or firmware upgrades

Media types
Fibre Channel:
- Connectrix hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), SFP+, and LC connector
- Short-Wavelength Laser (SWL)
- Long-Wavelength Laser (LWL)
- Distance depends on fiber-optic cable and port speed
- Supports SFP+ (2, 4, and 8 Gb/s) and SFP (1, 2, and 4 Gb/s) optical transceivers

1 GbE:
- Connectrix hot-pluggable, industry-standard Small Form-factor Pluggable (SFP)
- Short-Wavelength Laser (SWL)
◆ Long-Wavelength Laser (LWL)
◆ GbE Copper SFP
◆ Built-in RJ-45 copper (2 GbE ports)
◆ Distance depends on fiber-optic cable and port speed

**Fibre Channel Fabric services**
◆ Advanced Zoning
◆ Simple Name Server
◆ Fabric Device Management Interface (FDMI)
◆ Frame Redirection
◆ Registered State Change Notification (RSCN)
◆ Reliable Commit Service (RSCS)
◆ Dynamic Path Selection (DPS)
◆ Enhanced Group Management (EGM)

**Optional:**
◆ Fabric Watch
◆ ISL Trunking
◆ Advanced Performance Monitoring
◆ Integrated Routing

---

**Management**

**Management software supported**
◆ SSH v2, HTTP/HTTPS, SNMP v1/v3, Telnet
◆ SNMP (FE MIB, FC Management MIB)
◆ Web Tools
◆ EMC Connectrix Manager
◆ SMI-S
◆ RADIUS
◆ LLDAP

**Management access**
◆ One 10/100/ Gigabit Ethernet (RJ-45), in-band over Fibre Channel, one serial port (RJ-45), and one USB port
Diagnostics
- POST and embedded online/offline diagnostics, including FCping and Pathinfo (FCtraceroute)

Mechanical specifications
Table 10 lists the weight and dimensions of the MP-7800B.

Table 10  Physical specifications

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>4.45 cm (1.75 in.)</td>
</tr>
<tr>
<td>Depth</td>
<td>64.14 cm (25.25 in.)</td>
</tr>
<tr>
<td>Width</td>
<td>43.18 cm (17 in.)</td>
</tr>
<tr>
<td>Weight (with two FRUs, and no SFPs installed)</td>
<td>10.9 kg (24 lb)</td>
</tr>
</tbody>
</table>

Power
The power supplies are universal and capable of functioning worldwide without voltage jumpers or switches, meet IEC 61000-4-5 surge voltage requirements, and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has a built-in fan for cooling. Table 11 lists the specifications.

Table 11  Power supply specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output of one power supply</td>
<td>150 watts</td>
</tr>
<tr>
<td>System DC power consumption (excluding power supply and fan FRUs)</td>
<td>Idle: 95 W</td>
</tr>
<tr>
<td></td>
<td>Maximum: 116 W</td>
</tr>
<tr>
<td>Input system power (including power supply and fan FRUs)</td>
<td>Idle: 145 W</td>
</tr>
<tr>
<td></td>
<td>Maximum: 173 W</td>
</tr>
<tr>
<td>Input voltage</td>
<td>85-264 VAC</td>
</tr>
<tr>
<td>Input line frequency</td>
<td>47-63 Hz</td>
</tr>
<tr>
<td>BTU rating</td>
<td>590 BTU/hr</td>
</tr>
<tr>
<td>Inrush current</td>
<td>Maximum of 60A for period of 10-150mS</td>
</tr>
<tr>
<td>Input line protection</td>
<td>Both AC lines are fused</td>
</tr>
</tbody>
</table>
Environment
Table 12 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

Table 12  Environmental requirements

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
</table>
| Ambient Temperature | 0º to 40º C  
                        | 32º to 104º F                     | -25º to 70º C  
                        |                                     | -13º to 158º F                   |
| Humidity        | 10% to 85% RH non-condensing, at   | 10% to 90% RH non-condensing, at |
|                 | 40º C (104º F)                      | 70º C (158º F)                   |
| Altitude        | 0 to 3 km (9,842 feet) above sea level | 0 to 12 km (39,370 feet) above sea level |
| Shock           | 20 G, 6 ms, half-sine wave         | 15 G, 12-18 ms, trapezoid |
| Vibration       | 0.5 G sine, 5-500 Hz                | 2.0 G sine, 5-500 Hz             |
| Air flow        | Maximum - 101.94 cmh (60 cfm)      | NA                              |
|                 | Nominal - 74.76 cmh (44 cfm)       |                                 |

Diagnostics
The MP-7800B runs POST by default each time it is powered on; it typically requires from 1 to 3 minutes to boot and complete POST.

POST can be skipped after subsequent reboots by entering the fastBoot command. For more information about this command, see the Fabric OS Command Reference.

Standards compliance
This release conforms to the FC Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at http://www.brocade.com/sanstandards
The MP-7500B is a 1U switch with 16 Fibre Channel SFP ports and 2 physical Gigabit Ethernet (GbE) ports. It includes the Fabric Operating System and is compatible with the entire EMC Connectrix B product family. It can operate independently or in a fabric containing multiple switches.

The MP-7500B has three types of memory devices:
- Boot flash — 4 MB
- Compact flash — 1 G
- Main memory (SDRAM) — 512 MB

This switch is intended as a platform for Fibre Channel Routing Services and Fibre Channel over IP (FCIP). Refer to the Connectrix B Series Fabric OS Administrator’s Guide for information on configuring these features.

More information for the MP-7500B can be found in the Connectrix B Series MP-7500B Hardware Reference Manual available at EMC Online Support at http://support.emc.com.

Key features

The MP-7500B provides the following features:
- Rack mountable 1U chassis
- 2 redundant, hot-swappable power supplies
- 3 internal temperature sensors
- 3 redundant, hot-swappable fan FRUs. Each fan FRU has two fans (for a total of 6 fans). Only one fan speed is displayed per FRU using the `fanShow` command
- 16 Fibre Channel SFP ports supporting Fibre Channel Routing Services with link speeds up to 1-, 2-, or 4-Gb/s
- 2 GbE ports supporting the FCIP and Fibre Channel Routing Services features:
  - Each GbE port can support up to 8 FCIP tunnels
  - Each FCIP tunnel is represented and managed as an Fibre Channel E_Port
  - Fibre Channel Routing Services functionality can be used over the FCIP link
- Fabrics connected through FCIP merge if the ports are configured as VE_Ports, and do not merge if they are configured as VEX_Ports. If VE_Ports are used in an Fibre Channel Routing Services backbone fabric configuration, then the backbone fabric merges but the EX_Port attached to edge fabrics do not merge. For more information see the Connectrix B Series Fabric OS Reference Manual.

Once the switch is configured, the `switchShow` command displays 32 Fibre Channel ports (port numbers 0 through 31) and 2 GbE ports. The first 16 Fibre Channel ports are physical ports on the MP-7500B, Ports 16-23 are virtual ports associated with the GE0 physical GbE link and ports 24-31 are virtual ports associated with GE1 physical GbE link. The GbE ports are displayed as `ge0` and `ge1` and are not assigned port numbers or area numbers.
Port side

Figure 22 shows the port side of the MP-7500B.

Legend:

1 MP-7500B
2 Console Management Port
3 Ethernet Management Port
4 Fibre Channel Ports (16)
5 GbE ports (2)
6 System Status LED (top)
7 IP address pull out tab

Figure 22 Port side view of the MP-7500B
The Fibre Channel ports are numbered from left to right, in eight-port groups, and are also numbered on the faceplate (see Figure 23).

Figure 23   Port numbering in the MP-7500B

Legend:

1  MP-7500B  
2  Fibre Channel Ports 0 through 3  
3  Fibre Channel Ports 4 through 7  
4  Fibre Channel Ports 8 through 11  
5  Fibre Channel Ports 12 through 15  
6  GbE ports (2)

The port side of the MP-7500B also displays the system status LED, power status LED, and port status LEDs.
Nonport side

Figure 24 shows the nonport side of the MP-7500B, which contains the power supplies (including the AC power receptacle and AC power switch) and fans.

Legend:
1 MP-7500B
2 Nonport Side of Switch
3 Power Supply #2
4 Fan Assembly #3
5 Fan Assembly #2
6 Fan Assembly #1
7 Power Supply #1
Fibre Channel port specifications
The Fibre Channel ports in the MP-7500B are compatible with SWL, LWL, and ELWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards. For more information about these standards, see the “Regulatory Compliance” section in the Connectrix B Series MP-7500B Hardware Reference Manual.

The ports are capable of operating at 1-, 2-, or 4-Gb/s and are able to auto-negotiate to the maximum link speed.

GbE port specifications
The GbE ports in the MP-7500B are compatible with SWL, LWL, and ELWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards. For more information about these standards, see the “Regulatory Compliance” section in the Connectrix B Series MP-7500B Hardware Reference Manual.

The GbE ports operates at 1-Gb/s. The 8 virtual FCIP Fibre Channel links over each physical GbE connection share this bandwidth.

Serial port specifications
The serial port is located on the port side of the switch. The MP-7500B uses an RJ-45 connector for serial port. An RJ-45 to DB9 adaptor is also provided with the switch.

__Note:__ To protect the serial port from damage, keep the cover on the port when not in use.

The serial port can be used to connect to a workstation to configure the switch IP address before connecting the switch to a fabric or IP network. The serial port’s parameters are fixed at 9600 baud, 8 data bits, and no parity, with flow control set to None.
Table 13 lists the serial cable pinouts.

### Supported features

The section includes supported software features.

**IMPORTANT**

References in the Fabric OS 5.2.1 documentation set specific to features/functionality available on the PB-48K-18i blade, such as FCR/FCIP functionality and port configurations, also apply to the MP-7500B.

The MP-7500B supports the following features that are included with the firmware:

- Web Tools
- Fibre Channel Routing Services
- Zoning
- Full Fabric

The following optional software is available with the purchase of a specific license key:

- FC over IP SAN Extension (FCIP)
- Performance Monitoring

<table>
<thead>
<tr>
<th>PIN</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>UART1_TXD</td>
<td>Transmit data</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Logic ground</td>
</tr>
<tr>
<td>6</td>
<td>UART1_RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>7</td>
<td>Not supported</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>Not supported</td>
<td>NA</td>
</tr>
</tbody>
</table>
Fabric Watch
Extended Fabric
Trunking

For information on these features, see the Connectrix B Series Fabric OS Administrator’s Guide.

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Nonblocking shared-memory switch.

Performance

Performance features include:

- Fibre Channel:
  - 1.063 Gb/s line speed, full duplex
  - 2.125 Gb/s line speed, full duplex
  - 4.250 GB/s line speed, full duplex
  - Autosensing of 1 Gb/s, 2 Gb/s, and 4 Gb/s port speeds
  - Optionally programmable to fixed port speed
  - Speed matching between 1 Gb/s, 2 Gb/s, and 4 Gb/s ports

- Ethernet:
  - 10/100/1000 Mb support

Port types

- Self-discovery based on switch type (U_Port)
- GbE ports can be:
  - VE_Ports
- VEX_Ports
- Fibre Channel ports can be:
  - E_Ports
  - EX_Ports
  - FL_Ports
  - F_Ports

**Dual-mode ports**
- 16 ports, Fibre Channel (E, F) and Gigabit Ethernet

**Media types**
- Small form-factor pluggable (SFP) laser
- Shortwave up to 500 m (1,640 feet)
- Long wave up to 10 km (6.2 miles)
- Extended long wave up to 25 km (15.5 miles)

**Maximum size frame**
- 2112-byte payload FC
- 2250-byte payload Gigabit Ethernet
- 2048-byte payload for Fibre Channel routed networks

**Aggregate switch I/O bandwidth**
A total 132 Gb/s:
- 128 Gb/s if all 16 FC ports are running at 4 Gb/s, full duplex
- 4 Gb/s if both GbE ports are running at 1 Gb/s, full duplex

**Fabric latency**
- < 8 microseconds (FC-to-FC routed traffic)
- 30 microseconds (FCIP)

**Class of service**
- Class 2
- Class 3

**Fabric services**
- Simple Name Server
- Registered State Change Notification (RSCN)
- Fibre Channel Routing

Optional fabric services include:
Zoning
Exchange-Based Trunking
Web Tools-AP Edition
Optional service includes:
FCIP Tunneling

Switch interoperability
- Connectrix B DS-8B and DS-16B running Fabric OS v2.6.1 or higher.
- Connectrix B DS-8B2 and DS-16B2 running Fabric OS v3.1 or higher.
- Connectrix B DS-32B2 and ED-12000B running Fabric OS v4.1 or higher.
- Connectrix B DS-8B3, DS-16B3, and ED-24000B running Fabric OS v4.2 or higher.
- Connectrix B DS-220B and ED-48000B running Fabric OS v5.0.1 or higher.
- SilkWorm 2xxx running Fabric OS V2.6.1 or higher.
- SilkWorm 3200 and 3800 running Fabric OS v3.1 or higher.
- SilkWorm 3900 and 12000 running Fabric OS v4.1 or higher.
- SilkWorm 3250, 3850, and 24000 running Fabric OS v4.2 or higher.
- SilkWorm 200E and 48000 running Fabric OS v5.x or higher.

Note: Refer to the EMC Support Matrix for the most up-to-date information on supported firmwares and EOL listings.

Options
- Redundant power supply
- SFP media

Management

Management software supported
- Telnet
- SNMP (FE MIB, FC Management MIB)
- Web Tools (optional)
EMC Connectrix Manager

RADIUS

Management access
- 10/100 Ethernet port (RJ-45)
- Serial port (RJ-45)
- In-band via Management Server

Diagnostics
- The MP-7500B switch runs POST by default each time it is powered on; it typically requires from 1 to 3 min to boot and complete POST.
- POST can be skipped after subsequent reboots by entering the fastBoot command. For more information about this command, see the Connectrix B Series Fabric OS Administrator’s Guide.

Mechanical specifications
- Width = 429 mm (16.89 in.)
- Height = 1U = 42.44 mm (1.67 in.)
- Depth = 635mm (25.0 inches)
- Weight (with two power supplies and three fan assemblies installed) = 12.43 kg (27.4 lbs)

Environment
Table 14 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40°C (32° to 104°F)</td>
<td>-25° to 70°C (-13° to 158°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>20% to 85% RH non-condensing, at 40°C (104°F), with maximum gradient of 10% per hour</td>
<td>10% to 85% RH non-condensing, at 70°C (158°F)</td>
</tr>
<tr>
<td>Altitude</td>
<td>0 to 3 km (10,000 ft) above sea level</td>
<td>0 to 12 km (40,000 ft) above sea level</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine wave</td>
<td>15 G, 12-18 milliseconds, trapezoid</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G, 5-500 Hz</td>
<td>2.0 G, 5-500 Hz</td>
</tr>
<tr>
<td>Air Flow</td>
<td>31 cu ft/min (52.7 cu m/hr)</td>
<td>NA</td>
</tr>
</tbody>
</table>
Power
The power supplies are universal and capable of functioning worldwide without voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has a built-in fan for cooling, pushing air towards the port side of the switch. Table 15 lists the power supply specifications for the MP-7500B switch.

Table 15  Power supply specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output</td>
<td>300 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>240W Max, 215W typical</td>
</tr>
<tr>
<td>Input voltage</td>
<td>85-264 VAC, Universal</td>
</tr>
<tr>
<td>Input line frequency</td>
<td>47 - 63 Hz</td>
</tr>
<tr>
<td>Harmonic distortion</td>
<td>Active power factor correction</td>
</tr>
<tr>
<td>BTU rating at 80% efficiency</td>
<td>240W X 3.412 BTU/hr/Watts = 820 BTU/Hr</td>
</tr>
<tr>
<td>Inrush current</td>
<td>Maximum of 15 amps for period between 10-150 ms at 50 degrees C (122 degrees F), hot or cold start</td>
</tr>
<tr>
<td>Input line protection</td>
<td>Fused in both hot and neutral lines, using independent fuses</td>
</tr>
</tbody>
</table>

Standards compliance
This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website:

http://www.brocade.com/sanstandards

Further reading
Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.
The Connectrix DS-6510B switch is a 48-port auto-sensing 2, 4, 8, 10 or 16 Gb/s Fibre Channel switch delivering single-chip architecture for Fibre Channel Storage Area Networks (SANs). The DS-6510B switch is an enterprise-class switch designed to handle the large-scale SAN requirements of an enterprise. The DS-6510B switch can also be used to address the SAN requirements of a small to medium-sized workgroup. With high port density and a slim 1U height, the DS-6510B enables the creation of very dense fabrics in a relatively small space.

Key features

The DS-6510B includes the following features:

- Combines up to 48 ports of high-performance 16 Gb/s technology and Ports on Demand scaling from 24 to 36 or 48 ports
- Based on Brocade’s seventh-generation ‘Condor-3’ ASIC technology, supporting 2, 4, 8, and 16 Gb/s auto-sensing Fibre Channel and 10 Gb/s Fibre Channel switch and router ports.
- FICON, FICON Cascading, and FICON Control Unit Port ready
- Two hot-swappable, redundant integrated power supply and fan FRUs
- Option for front-to-back and back-to-front airflows via choice of integrated power supply unit
- Universal ports self-configure as E, F, M or D ports. EX_Ports are activated on a per port basis with the optional Integrated Routing license.
- Virtual Fabric support to improve isolation between different VFs
- Fibre Channel Routing (FCR) service provides improved scalability and fault isolation. (via the optional Integrated Routing license)
- An RJ45 Ethernet management port, in conjunction with EZSwitchSetup, supports switch IP address discovery and configuration, eliminating the need to attach a serial cable to configure the switch IP address and greatly increasing the ease of use
◆ A USB port provides increased serviceability and error logging functionality by facilitating easy firmware upgrades and downloads of system log files

◆ Single motherboard design with 667 MHz PowerPC 440EPx Reduced Instruction Set Computer (RISC) CPU with integrated peripherals provides high performance

◆ Inter-Switch Link (ISL) Trunking ( licensable) allows up to eight ports (at 2G, 4G, 8G, 10G or 16G speeds) between a pair of switches to be combined to form a single, logical ISL with a speed of up to 128 Gb/s (256 Gb/s full duplex) for optimal bandwidth utilization and load balancing

◆ Dynamic Path Selection (DPS) optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient available path in the fabric

◆ Rack mountable using new fixed rail kit on a 19” EIA rack

◆ Industry-leading extended distance support enables native Fibre Channel extension up to 7,500 km at 2 Gb/s

◆ Hardware zoning is accomplished at the port level of the switch and by World Wide Name (WWN). Hardware zoning permits or denies delivery of frames to any destination port address.

◆ Brocade Small Form-Factor Pluggable Plus (SFP+) optical transceivers support any combination of Short Wavelength (SWL), Long Wavelength (LWL) or Extended Long Wavelength (ELWL) optical media among the switch ports

◆ Brocade Fabric Operating System (FOS) delivers distributed intelligence throughout the network and enables a wide range of value-added applications including Brocade Advanced Web Tools and Brocade Zoning. Optional Fabric Services include: Adaptive Networking with QoS, Brocade Extended Fabrics, Brocade Enhanced Group Management, Brocade Fabric Watch, ISL Trunking, Integrated Routing, and End-to-End Performance Monitoring (APM)

◆ Port-to-port latency is minimized to 800 nanoseconds through the use of cut-through frame routing at 16 Gb/s

◆ Extensive diagnostics and system monitoring capabilities enhance high Reliability, Availability, and Serviceability (RAS)

◆ Brocade Diagnostic Port (D-Port) feature provides physical media diagnostic, troubleshooting and verification services
- In-flight Compression and Encryption provides efficient link utilization and security
- 10G Fibre Channel integration on the same port provides for DWDM metro connectivity on the same switch
- Real time power monitoring enables users to monitor real time power usage of the fabric at a node level
- Utilizes the Brocade EZSwitchSetup wizard, which makes SAN configuration a 3-step point-and-click task

---

**Port side**

Figure 25 shows the DS-6510B port numbering and LEDs.
Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Performance
Performance features include:
- Auto-sensing of 2, 4, 8, and 16 Gb/s port speeds
- 10 Gb/s and optionally programmable to fixed port speed

Port types
- F_Port
- E_Port
- EX_Port
- D_port
- M_Port (Mirror port)

Media types
- Hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), LC connector
- Short-Wavelength Laser (SWL)
- Long-Wavelength Laser (LWL)
- Extended Long-Wavelength Laser (ELWL)

Note: Distance depends on fibre-optic cable and port speed.

- Supports SFP+ (16/8/4 Gb/s), SFP+ (8/4/2 Gb/s), SFP+ 10 Gb/s optical transceivers
Maximum size frame

- 2,112 byte payload

Aggregate switch I/O bandwidth

- 768 Gb/s end to end (full duplex)

Fabric latency

<table>
<thead>
<tr>
<th>Feature</th>
<th>Latency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 Latency (without Forward Error Correction)</td>
<td>800ns</td>
<td>Applies to F-Port/N-Port to F-Port/N-Port traffic only as FEC is not enabled for those ports</td>
</tr>
<tr>
<td>L2 Latency (with Forward Error Correction)</td>
<td>1.2us</td>
<td>Applies to E-Port to E-Port traffic only as FEC is enabled for those ports</td>
</tr>
<tr>
<td>Encryption /Compression</td>
<td>&lt;6us</td>
<td>Applies to one end of the link. For end to end latency, need to include both ends</td>
</tr>
</tbody>
</table>

Class of service

- Class 2
- Class 3
- Class F (Interswitch frames)

Fabric services

Fabric services include:

- Simple Name Server (SNS)
- Registered State Change Notification (RSCN)
- NTP
- RADIUS
- Reliable Commit Service (RCS)
- Dynamic Path Selection (DPS)
- Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning)
- Web Tools
- Enhanced Group Management (EGM)

Optional Fabric Services include:

- Adaptive Networking with QoS
- FICON CUP
- Extended Fabrics
- Fabric Watch
- ISL Trunking
- End-to-End Performance Monitoring (APM)

**Switch interoperability**
Refer to the *EMC Support Matrix* for the most up-to-date information on supported firmwares and EOL listings.

---

**Management**

**Management software supported**
- SSH v2
- HTTP/HTTPS
- SNMP v1/v3
- Telnet
- SNMP
- Web Tools
- EMC Connectrix Manager
- SMI-S
- RADIUS
- LDAP
- TACACS+

**Management access**
- 10/100 Ethernet port (RJ-45), in-band over Fibre Channel
- Serial port (RJ-45) and one USB port

**Diagnostics**
- POST and embedded online/offline diagnostics, including FCping and Pathinfo (FC traceroute), etc., Diagnostic Port (D_Port) diagnostic features for physical link troubleshooting

**Mechanical specifications**
- Width = 438 mm (17.23 inches)
- Height = 43 mm (1.7 inches)
- Depth = 443 mm (17.45 inches)
- Weight = 20.2 lbs), with two power supplies, without transceivers

**Environment**

Table 16 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable in non-operating environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40° Celsius (32° to 104° Fahrenheit)</td>
<td>-25 to 70° Celsius</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% (non-condensing)</td>
<td>10% to 90% (non-condensing)</td>
</tr>
<tr>
<td>Operating altitude</td>
<td>Up to 3,000 meters (9,842 feet)</td>
<td>Up to 3,000 meters (9,842 feet)</td>
</tr>
<tr>
<td>Storage altitude</td>
<td>Up to 12km (39,370)</td>
<td>Up to 12km (39,370)</td>
</tr>
<tr>
<td>Shock</td>
<td>Up to 20 G, 6 ms, half-sine</td>
<td>Half sine, 33G 11ms, 3/eg Axis</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G sine, 0.4 grms random, 5-500 Hz</td>
<td>2.0 g sine, 1.1 grms random 5 to 500 Hz</td>
</tr>
<tr>
<td>Heat dissipation</td>
<td>48 ports at 338 BTU/hr</td>
<td>48 ports at 338 BTU/hr</td>
</tr>
</tbody>
</table>

**Power**

Table 17 lists the power supply specifications for the DS-6510B.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Input</td>
<td>85V to 264V –5A – 2.5A</td>
</tr>
<tr>
<td>Frequency</td>
<td>Frequency 47 to 63 Hz</td>
</tr>
<tr>
<td>System power consumption</td>
<td>110 Watts with all 48 ports populated with 16 Gb/s SWL optics</td>
</tr>
<tr>
<td></td>
<td>72 Watts for empty chassis with no optics</td>
</tr>
</tbody>
</table>
**Standards compliance**

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit the Brocade website at http://www.brocade.com/sanstandards

**Further reading**

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.

**Note:** For specific versions of supported firmware, as well as fabric topology constraints associated with the DS-6510B, refer to the E-Lab Navigator.
The Connectrix DS-6505B is a 24-port, entry-level switch that provides exceptional price/16 Gbps performance value, combining flexibility, simplicity, and enterprise-class functionality. Delivering market-leading Gen 5 Fibre Channel technology, the DS-6505B switch is the industry’s easiest SAN switch to install, manage, and support.

## Key features

The DS-6505B offers the following features and capabilities:

- Up to 24 auto-sensing ports of high-performance 16-Gbps technology in a single domain.
- Ports on Demand scaling from 12 to 24 ports.
- 2, 4, 8, and 16 Gbps auto-sensing Fibre Channel switch and router ports.
  - 2, 4, and 8 Gbps performance is enabled by 8 Gbps SFP+ transceivers.
  - 4, 8, and 16 Gbps performance is enabled by 16 Gbps SFP+ transceivers.
- Universal ports self-configure as E, F, or M ports. EX_Ports can be activated on a per-port basis with the optional Integrated Routing license. D-port functionality is also available for diagnostics.
- Airflow is set for port side exhaust.
- Inter-Switch Link (ISL) Trunking, which allows up to eight ports (at 2, 4, 8, or 16 Gbps speeds) between a pair of switches combined to form a single, logical ISL with a speed of up to 128 Gbps (256 Gbps full duplex) for optimal bandwidth utilization and load balancing. The base model permits one eight-port trunk plus one four-port trunk.
- Dynamic Path Selection (DPS), which optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient available path in the fabric.
- Brocade-branded SFP+ optical transceivers that support any combination of Short Wavelength (SWL), Long Wavelength (LWL), and Extended Long Wavelength (ELWL) optical media among the switch ports.
- Extended distance support enables native Fibre Channel extension up to 7,500 km at 2 Gbps.
- Support for unicast traffic type.
- Brocade Fabric OS, which delivers distributed intelligence throughout the network and enables a wide range of value-added applications including Advanced Web Tools, Enhanced Group Management, and Zoning.
- Licensable fabric services include:
  - Adaptive Networking with QoS
  - Extended Fabrics
  - Fabric Watch
  - ISL Trunking
  - Advanced Performance Monitoring (APM)
  - Server Application Optimization (SAO)
- Support for Access Gateway configuration where server ports connected to the fabric core will be virtualized.
- Hardware zoning is accomplished at the port level of the switch and by World Wide Name (WWN). Hardware zoning permits or denies delivery of frames to any destination port address.
- Extensive diagnostics and system-monitoring capabilities for enhanced high Reliability, Availability, and Serviceability (RAS).
- EZSwitchSetup wizard that makes SAN configuration a three-step point-and-click task.
- Real-time power monitoring enables users to monitor real-time power usage of the fabric at a switch level.
- Port-to-port latency minimized to 800 nanoseconds through the use of cut-through frame routing at 16 Gbps.
Port side

The port side of the DS-6505B includes the system status LED, the console port, the Ethernet port and accompanying LEDs, the USB port, and the Fibre Channel ports and corresponding port status LEDs. Figure 27 shows the port side of the DS-6505B.

![Port side of DS-6505B diagram](image)

**Figure 27** Port side of DS-6505B

*Note:* The two LEDs on the serial console port are non-functional.

Nonport side

The nonport side of the Brocade 6505 contains the power supply (including the AC power receptacle and AC power switch) and fan assemblies. The base model configuration with a single assembly is shown in Figure 28 on page 142.
For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

**Unsupported features**

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

**System architecture**

**Performance**

Fibre Channel: 2.125 Gbps line speed, full duplex; 4.25 Gbps line speed, full duplex; 8.5 Gbps line speed, full duplex; 14.025 Gbps line speed, full duplex; auto-sensing of 2, 4, 8, and 16 Gbps port speeds.

**Port types**

- D_Port (ClearLink Diagnostic Port), E_Port, F_Port, M_Port (Mirror Port); optional port type control
- Brocade Access Gateway mode: F_Port and NPIV-enabled N_Port
Media types
- 16 Gbps: Brocade 6505 requires Brocade hot-pluggable SFP+, LC connector; 16 Gbps SWL, LWL, ELWL
- 8 Gbps: Brocade 6505 requires Brocade hot-pluggable SFP+, LC connector; 8 Gbps SWL, LWL, ELWL

Fibre Channel distance subject to fiber-optic cable and port speed

Maximum size frame
- 2,112 byte payload

Aggregate switch I/O bandwidth
- 384 Gb/s end to end (full duplex)

Maximum fabric latency
Latency for locally switched ports is 700 ns; Forward Error Correction (FEC) adds 400 ns between E_Ports (enabled by default).

Class of service
- Class 2
- Class 3
- Class F (Interswitch frames)

Fabric services

Note: Some fabric services do not apply or are unavailable in Brocade Access Gateway mode.

Fabric services include:
Monitoring and Alerting Policy Suite (MAPS); Flow Vision; Brocade Advanced Performance Monitoring (including Top Talkers for E_Ports, F_Ports, and Fabric mode); Brocade Adaptive Networking (Ingress Rate Limiting, Traffic Isolation, QoS); Bottleneck Detection; Brocade Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning); Dynamic Fabric Provisioning (DFP); Dynamic Path Selection (DPS); Brocade Extended Fabrics; Enhanced BB credit recovery; Brocade Fabric Watch; FDMI; Frame Redirection; Frame-based Trunking; FSPF; IPoFC; Brocade ISL Trunking; Management Server; NPIV; NTP v3; Port Fencing; Registered State Change Notification (RSCN); Reliable Commit Service (RCS); Server Application Optimization (SAO); and Simple Name Server (SNS).
Switch interoperability
Refer to the EMC Support Matrix for the most up-to-date information on supported firmwares and EOL listings.

Management

Management software supported
◆ HTTP, SNMP v1/v3 (FE MIB, FC Management MIB), SSH
◆ Auditing, Syslog
◆ EMC Connectrix Manager
◆ Command Line Interface (CLI)
◆ SMI-S compliant
◆ Administrative Domains

Trial licenses for add-on capabilities.

Management access
◆ 10/100 Ethernet port (RJ-45), in-band over Fibre Channel
◆ Serial port (RJ-45) and one USB port

Diagnostics
ClearLink optics and cable diagnostics, including electrical/optical loopback, link traffic/latency/distance; flow mirroring; built-in flow generator; POST and embedded online/offline diagnostics, including environmental monitoring, FCping and Pathinfo (FC traceroute), frame viewer, non-disruptive daemon restart, port mirroring, optics health monitoring, power monitoring, RAStrace logging, and Rolling Reboot Detection (RRD).

Mechanical specifications
◆ Width = 437.64 mm (17.23 in.)
◆ Height = 43.18 mm (1.7 in.)
◆ Depth = 443.23 mm (17.45 in.)
◆ Weight = 7.82 kg (17.25 lb) with one power supply, without transceivers or 9.16 kg (20.19 lb) with two power supply FRUs, without transceivers.

Environment
◆ Operating environment:
  • Temperature: 0°C to 40°C/32°F to 104°F
- Humidity: 10% to 85% (non-condensing)
- Non-operating environment:
  - Temperature: −25°C to 70°C / −13°F to 158°F
  - Humidity: 10% to 90% (non-condensing)
- Operating altitude: Up to 3000 m (9843 ft)
- Storage altitude: Up to 12 km (39,370 ft)
- Shock:
  - Operating: Up to 20 G, 6 ms half-sine
  - Non-operating: Half-sine, 33 G 11 ms, 3/eg axis
- Vibration:
  - Operating: 0.5 g sine, 0.4 grms random, 5 Hz to 500 Hz
  - Non-operating: 2.0 g sine, 1.1 grms random, 5 Hz to 500 Hz
- Head dissipation: 24 ports at 338 BTU/hr

**Power**
- Power supply: power supply with integrated system cooling fans. Optional dual redundant hot-swappable power supply.
- AC input: 85 V to 264 V ~5 A to 2.5 A
- Input line frequency: 47 Hz to 63 Hz
- Power consumption:
  - 80 W with all 24 ports populated with 16 Gbps SWL optics
  - 60 W for empty chassis with no optics

**Standards compliance**

For the list of standards conformance, visit the following Brocade website at [http://www.brocade.com/sanstandards](http://www.brocade.com/sanstandards).

**Further reading**

For more information, refer to the *Brocade5605 Hardware Reference Manual* or the Brocade 6505 Switch Data Sheet, available at [brocade.com](http://brocade.com).
The Connectrix DS-5300B is an 80-port 1, 2, 4, or 8 Gb/s Fibre Channel switch that delivers sixth generation ASIC technology and architecture for Fibre Channel Storage Area Networks (SANs). The DS-5300B is a 8 Gb/s switch that is designed for the needs of enterprise environments that require a high-port footprint for port aggregation.

With its high auto-sensing port count and ports-on-demand flexibility, the DS-5300B is an ideal solution as a fan-out switch from a director core, or as the core switch in a fabric. The DS-5300B satisfies demanding Reliability, Availability, and Serviceability (RAS), performance and scalability requirements of an Enterprise switch while delivering interoperability and ease-of-use advantages.

More information for the DS-5300B can be found in the Connectrix B Series DS-5300B Hardware Reference Manual available on Powerlink.

Key features

The DS-5300B switch includes the following features:

- Up to 80 auto-sensing ports of high-performance 8 Gb/s technology in a single domain.
- Ports On Demand scaling from 48 to 64 or 80 ports.
- Full 1:1 subscription on all 80 ports at 8Gb/s.
- 1, 2, 4 and 8 Gb/s auto-sensing Fibre Channel switch and router ports.
- FICON and FICON Control Unit Port ready.
- Two hot-swappable, redundant power supply FRUs.
- Three hot-swappable fan FRUs in an N+1 configuration to provide hardware-redundant cooling.
- Universal ports that self-configure as E, F, M or FL ports. EX_Ports are activated on a per port basis with the optional Integrated Routing license.
- An RJ45 Ethernet management port, in conjunction with EZSwitchSetup, that supports switch IP address discovery and configuration.
◆ USB port that provides storage for firmware updates, output of the supportsave command and storage for configuration uploads and downloads.

◆ A system motherboard that features a Freescale MPC8548 Reduced Instruction Set Computer (RISC) CPU running @ 1.3GHz with integrated peripherals that provides high performance with low power consumption.

◆ Inter-Switch Link (ISL) Trunking (licensable) allows up to eight ports (at 1G, 2G, 4G, or 8G speeds) between a pair of switches combined to form a single, logical ISL with a speed of up to 64 Gb/s (128 Gb/s full duplex) for optimal bandwidth utilization and load balancing.

◆ Rack mount designed using existing rail kits (fixed, sliding, and mid-mount/Telco rail kits) on a 19” EIA 310 rack.

◆ Extended distance support enables native Fibre Channel extension greater than (590) km.

Figure 29 shows the port side of the DS-5300B.

Legend:

1. DS-5300B
2. Switch pull-out Tab
3. System Status LED (top)
4. System Status LED (bottom)
5. Ethernet Port
6. USB Port
7. FC Ports 0-7
8. FC Ports 8-15
9. FC Ports 16-23
10. FC Ports 24-31
11. FC Ports 32-38
12. FC Ports 40-47
13. FC Ports 48-55
14. FC Ports 56-63
15. FC Ports 64-71
16. FC Ports 72-79
**Non-port side**

The non-port side of the Connectrix DS-5300B includes the two redundant power supply-fan assemblies and the corresponding status LEDs.

Figure 30 shows the port side of the Connectrix DS-5300B.

---

**Figure 30**  Non-port side view of the Connectrix DS-5100B

**Legend:**

1. DS-5300B
2. Nonport Side of Switch
3. Power Supply #2
4. Fan Assembly #3
5. Fan Assembly #2
6. Fan Assembly #1
7. Power Supply #1

---

**Supported features**

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.
Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation on Powerlink.

System architecture

Performance
Performance features include:
- Full line-speed switching at
  - 2.125 Gb/s line speed, full duplex
  - 4.25 Gb/s line speed, full duplex
  - 8.50 Gb/s line speed, full duplex
- Auto-sensing of 2, 4, and 8 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed matching between 2, 4, and 8 Gb/s ports

Port types
- F_Port
- FL_Port
- E_Port
- N_Port
- 48-port base with 16-port increments

Media types
- 4 Gb/s requires
  - Connectrix hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), LC connector
- 4 Gb/s Short-Wavelength Laser (SWL)
- 4 Gb/s Long-Wavelength Laser (LWL)
- 4 Gb/s Extended Long-Wavelength Laser (ELWL)

Note: Distance depends on fibre-optic cable and port speed.

- 8 Gb/s requires
- Connectrix hot-pluggable, industry-standard SFP+, LC connector
- Short-Wavelength Laser (SWL)

**Note:** Distance depends on fibre-optic cable and port speed.

**Maximum size frame**
- 2,112 byte payload

**Aggregate switch I/O bandwidth**
- 1360 Gb/s; 80 ports x 8.5 Gb/s (line rate) x 2 (full duplex)

**Fabric latency**
- 700 nano-seconds latency switch ports with no contention, cut-through routing at 8 Gb/s between locally switched groups

**Class of service**
- Class 2
- Class 3
- Class F (Interswitch frames)

**Fabric services**
Fabric services include:
- Simple Name Server (SNS)
- Registered State Change Notification (RSCN)
- NTP v3
- Reliable Commit Service (RCS)
- Dynamic Path Selection (DPS)
- Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning)
- NPIV
- N_Port Trunking
- FDMI
- Management Server
- FSPF
- Advanced Performance Monitoring
- IPoFC, Frame Redirection
Port Fencing
BB credit recovery

Optional Fabric Services include:
- Adaptive Networking with QoS
- Extended Fabrics
- Enhanced Group Management
- Fabric Watch
- ISL Trunking
- Integrated Routing
- End-to-End Performance Monitoring (APM)

**Switch interoperability**
Refer to the *EMC Support Matrix* for the most up-to-date information on supported firmwares and EOL listings.

---

**Management**

**Management software supported**
- Telnet, HTTP, SNMP v1/v3 (FE MIB, FC Management MIB)
- Auditing, Syslog, Change Management tracking
- EZSwitchSetup wizard
- Web Tools
- EMC Connectrix Manager
- SMI-S compliant, SMI-S scripting toolkit, Administrative Domains
- Trial licenses for select add-on capabilities

**Management access**
- Call home integration
- 10/100 Ethernet port (RJ-45), in-band over Fibre Channel
- Serial port (RJ-45)
- USB
- Call-home integration enabled through Connectrix Manager and Fabric Manager
Diagnostics
- POST and embedded online/offline diagnostics, including RAStrace logging, environmental monitoring, non-disruptive daemon restart, FCping and Pathinfo (FC traceroute), port mirroring (SPAN port)

Mechanical specifications
- Width = 42.88 cm (16.88 inches)
- Height = 8.60 cm (3.4 inches)
- Depth = 61.05 cm (24.00 inches)
- Weight = 15.6 kg (34.4 lbs), with dual power supplies, without SFP/SFP+ media

Environment
Table 18 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40° Celsius (32° to 104° Fahrenheit)</td>
<td>-25° to 70° Celsius (-13° to 158° Fahrenheit)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% (non-condensing)</td>
<td>10% to 95% (non-condensing)</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 3,000 meters (9,842 feet)</td>
<td>Up to 12 kilometers (39,370 feet)</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine</td>
<td>Half sine, 33 G 11ms, 3/eg Axis</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G sine, 0.4 grms random, 5-500 Hz</td>
<td>2.0 G sine, 1.1 grms random 5-500 Hz</td>
</tr>
<tr>
<td>Air flow</td>
<td>Maximum 609 CFM (cu.ft/min); nominal 44 CFM</td>
<td>None required</td>
</tr>
</tbody>
</table>

Power
Table 19 lists the power supply specifications for the DS-5300B.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output of one power supply</td>
<td>300 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>84 Watts nominal, 91 Watts maximum</td>
</tr>
</tbody>
</table>
Table 19  Power supply specifications  (page 2 of 2)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>90 - 264 VAC</td>
</tr>
<tr>
<td>Input line frequency</td>
<td>47 - 63 Hz</td>
</tr>
<tr>
<td>BTU rating</td>
<td>1313 BTU/hr</td>
</tr>
<tr>
<td>Inrush current</td>
<td>15 Amps maximum for a period of 10-150mS</td>
</tr>
</tbody>
</table>

Standards compliance

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit the following Brocade website:

http://www.brocade.com/sanstandards

Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.

Note: For specific versions of supported firmware, as well as fabric topology constraints associated with the DS-5300B, refer to the E-Lab Navigator.
Connectrix DS-5100B

The Connectrix DS-5100B is an Enterprise class 1U, 40-port Fibre Channel 1, 2, 4 or 8 Gb/s Fibre Channel switch that offers the next generation Connectrix, single-chip architecture for Storage Area Networks (SANs). The Connectrix DS-5100B is designed to function in large-scale enterprise SANs and can also fit the requirements of small to medium-sized work groups.

Because the Connectrix DS-5100B has a slim 1U height and a high port count, you can use the Connectrix DS-5100B to create very dense fabrics in a relatively small space.


Key features

The DS-5100B switch includes the following features:

- Up to 40 ports of high-performance 8 Gb/s technology and POD scaling from 24 to 32 or 40 ports.
- Support for 1, 2, 4, and 8 Gb/s auto-sensing Fibre Channel switch and router ports.
- FICON, FICON Cascading and FICON Control Unit Port ready.
- Two hot-swappable, redundant integrated power supply and fan FRUs.
- Universal ports that self-configure as E, F, M, or FL ports. Ex_Ports are activated on a per port basis with the optional Integrated Routing license.
- Fibre Channel Routing (FCR) service that provides improved scalability and fault isolation (through the optional Integrated Routing license).
- An RJ45 Ethernet management port, that in conjunction with EZSwitchSetup, supports switch IP address discovery and configuration.
- USB port that provides storage for firmware updates, output of the supportsave command and storage for configuration uploads and downloads.
◆ Single motherboard design with 667 MHz PowerPC 440EPx Reduced Instruction Set Computer (RISC) CPU and integrated peripherals.

◆ Inter-Switch Link (ISL) Trunking (licensable) which allows up to eight ports (at 2 G, 4 G, or 8 G speeds) between a pair of switches combined to form a single, logical ISL with a speed of up to 128 Gb/s full duplex.

◆ Rack-mount designed using existing 5100 rail kits (fixed, sliding, and mid-mount/Telco rail kits) on a 19” EIA 310 rack.

◆ Extended distance support enables native Fibre Channel extension greater than 590 km.

◆ Unicast, multicast (255 groups), and broadcast data traffic type, are support.

◆ Port-to-port latency minimized to 700 nanoseconds through the use of cut-through frame routing at 8 Gb/s.

---

**Port side**

Figure 31 shows the port side of the DS-5100B.
The Fibre Channel ports on the Connectrix DS-5100B are numbered from left to right, in eight-port groups from 0 to 39 as illustrated in Figure 32.

The port side of the DS-5000B switch also displays the system status LED, power status LED, and port status LEDs.

Non-port side

The non-port side of the Connectrix DS-5100B includes the two redundant power supply-fan assemblies and the corresponding status LEDs. Figure 33 on page 158 shows the port side of the Connectrix DS-5100B.
Figure 33  Non-port side view of the Connectrix DS-5100B

Legend:
1  Fan (for power supply/fan FRU2)
2  Power supply/Fan status LED (for power supply/fan FRU 2)
3  Power supply connector (for power supply/fan FRU2)
4  Fan (for power supply/fan FRU2)
5  Fan (for power supply/fan FRU1)
6  Power supply/Fan status LED (for Power Supply/fan FRU 1)
7  Power supply connector (for power supply/fan FRU 1)
8  Fan (for power supply/fan FRU1)

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation available at EMC Online Support at http://support.emc.com.
System architecture

Performance
Performance features include:
- Full line-speed switching at:
  - 2.125 Gb/s line speed, full duplex
  - 4.25 Gb/s line speed, full duplex
  - 8.50 Gb/s line speed, full duplex
- Auto-sensing of 2, 4, and 8 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed matching between 2, 4, and 8 Gb/s ports

Port types
- F_Port
- FL_Port
- E_Port
- M_Port (Mirror Port)
- EX_Port (Fibre Channel Integrated Routing)
- U_Port (Self discovery based on switch type)
- Optional port type control

Media types
- 4 Gb/s requires
  - Connectrix hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), LC connector
  - 4 Gb/s Short-Wavelength Laser (SWL)
  - 4 Gb/s Long-Wavelength Laser (LWL)
  - 4 Gb/s Extended Long-Wavelength Laser (ELWL)

  Note: Distance depends on fibre-optic cable and port speed.

- 8 Gb/s requires
  - Connectrix hot-pluggable, industry-standard SFP+, LC connector
  - Short-Wavelength Laser (SWL)
Note: Distance depends on fibre-optic cable and port speed.

Maximum size frame
◆ 2,112 byte payload

Aggregate switch I/O bandwidth
◆ 680 Gb/s if all 40 ports are running x 8.5 Gb/s (line rate) x 2 (full duplex)

Fabric latency
◆ 700 nano-seconds port-to-port latency

Class of service
◆ Class 2
◆ Class 3
◆ Class F (Interswitch frames)

Fabric services
Fabric services include:
◆ Simple Name Server (SNS)
◆ Registered State Change Notification (RSCN)
◆ NTP v3
◆ Reliable Commit Service (RCS)
◆ Dynamic Path Selection (DPS)
◆ Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning)
◆ NPIV
◆ N_Port Trunking
◆ FDMI
◆ Management Server
◆ FSPF
◆ Advanced Performance Monitoring
◆ IPoFC, Frame Redirection
◆ Port Fencing
◆ BB credit recovery

Optional Fabric Services include:
Connectrix DS-5100B

- Adaptive Networking with QoS
- Extended Fabrics
- Enhanced Group Management
- Fabric Watch
- ISL Trunking
- Integrated Routing
- End-to-End Performance Monitoring (APM)

**Switch interoperability**
Refer to the *EMC Support Matrix* for the most up-to-date information on supported firmwares and EOL listings.

## Management

### Management software supported
- Telnet, HTTP, SNMP v1/v3 (FE MIB, FC Management MIB)
- Auditing, Syslog, Change Management tracking
- EZSwitchSetup wizard
- Web Tools
- EMC Connectrix Manager
- SMI-S compliant, SMI-S scripting toolkit, Administrative Domains
- Trial licenses for select add-on capabilities

### Management access
- Call home integration
- 10/100 Ethernet port (RJ-45), in-band over Fibre Channel
- Serial port (RJ-45)
- USB
- Call-home integration enabled through Connectrix Manager and Fabric Manager

### Diagnostics
- POST and embedded online/offline diagnostics, including RAStrace logging, environmental monitoring, non-disruptive daemon restart, FCping and Pathinfo (FC traceroute), port mirroring (SPAN port)
**Mechanical specifications**
- Width = 42.88 cm (16.88 inches)
- Height = 4.29 cm (24.11 inches)
- Depth = 61.05 cm (24.00 inches)
- Weight = 9.34 kg (20.60 lbs), with dual power supplies, without SFP/SFP+ media

**Environment**
Table 20 lists the acceptable environmental ranges for both operating and non-operating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40° Celsius (32° to 104° Fahrenheit)</td>
<td>-25° to 70° Celsius (-13° to 158° Fahrenheit)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% RH non-condensing</td>
<td>10% to 95%</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 3,000 meters (9,842 feet)</td>
<td>Up to 12 kilometers (39,370 feet)</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine</td>
<td>Half sine, 33 G 11ms, 3/eg Axis</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G sine, 0.4 grms random, 5-500 Hz</td>
<td>2.0 G sine, 1.1 grms random 5-500 Hz</td>
</tr>
<tr>
<td>Air flow</td>
<td>Maximum 29 CFM (cu. ft/min); nominal 22 CFM</td>
<td>None required</td>
</tr>
</tbody>
</table>

**Power**
Table 21 lists the power supply specifications for the DS-5100B.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output of one power supply</td>
<td>125 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>84 Watts nominal, 91 Watts maximum</td>
</tr>
<tr>
<td>Input voltage</td>
<td>85 - 264 VAC, Universal</td>
</tr>
</tbody>
</table>
This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at http://www.brocade.com/sanstandards

Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.

Note: For specific versions of supported firmware, as well as fabric topology constraints associated with the DS-5100B, refer to the E-Lab Navigator.
The DS-5000B switch is a 1U Fibre Channel switch with 32 fixed Fibre Channel SFP ports that supports link speeds up to 1, 2, or 4 Gb/s. It includes the Fabric Operating System and is compatible with the entire EMC Connectrix B product family. The DS-5000B can operate in a fabric containing multiple switches or independently.

The switch’s enclosure has forced-air cooling, with the fans pushing the air from the rear part intake through the enclosure, and exhausting across the SFP devices through venting holes in the front panel (port side). The SFP media and integrated power supply/fan assembly Field Replaceable Units (FRUs) are hot-swappable so they can be removed and replaced without interrupting the system power.

Power supply/fan assembly units are the only FRUs in the DS-5000B. There are two power supply/fan assembly units in the DS-5000B. They are hot-swappable and redundant, and capable of functioning universally without voltage jumpers or switches. The FRU units are identical and interchangeable. The front panel of the FRUs has a status LED to indicate status of the unit.

The DS-5000B has three types of memory devices:

- Boot flash: 4 MB
- Compact flash: 1 GB
- Main memory (SDRAM): 256 MB


**Key features**

The DS-5000B switch includes the following features:

- Cabinet-mountable 1U chassis designed to be mounted in a 19-inch cabinet space, with forced-air cooling that flows from the nonport side of the switch to the port side.
- 32 Fibre Channel ports, compatible with short wavelength (SWL), long wavelength (LWL), and extended long wavelength (ELWL) SFP transceivers.
- One RS-232 serial port on the port side of the switch.
Port side

Figure 34 shows the port side of the DS-5000B.

Figure 34  Port side view of the DS-5000B

Legend:
1  System console port
2  System Ethernet port
3  Power supply/fan assembly Field Replaceable Unit (2x)
4  Power cord retainer (2x)
5  Switch ID pull out tab

On the port side of the unit there are two port connections, each discussed briefly in this section:

- "Ethernet Port" on page 166
- "Serial Port" on page 166
**Ethernet Port**

The DS-5000B provides a fully IEEE-compliant 10/100BaseT Ethernet port for switch management console interface. When a device is connected to the port, both ends negotiate to determine the optimal speed. The DS-5000B adopts a 1x2 RJ45 connector to provide Ethernet and serial ports to the outside. The Ethernet connection uses one of two RJ-45 ports. There are two integrated visible LEDs for Ethernet port (see Figure 34 on page 165). One indicates transmit/receive activity and one indicates speed (10 Mb/s or 100 Mb/s). The TCP/IP address for the port can be configured from the serial port or directly from the Ethernet port itself.

**Serial Port**

An RS-232 DTE terminal port is provided on the DS-5000B switch. The serial console uses the other RJ45 port in the 1x2 RJ45 connector. The serial port parameters are fixed at 9600 baud, 8 data bits, no parity and no hardware flow control (except during boot up for the console port). This connector is for initial IP address configuration and for recovery of the switch to its factory default settings should Flash memory contents be lost. The serial port connection is not intended for performance of normal administration/maintenance functions.

The Fibre Optic cables, Ethernet cables and Serial port cables connect in to the port side of the switch. AC power input cables and the power supply/fan assembly FRUs are inserted and removed from the port side of the switch.

The DS-5000B can be mounted in a 1U 19-inch Electronic Industries Association (EIA) rack, with a height of 1U. Because of the shallow depth, no rail kits are required for a rack mount, however the switch can be installed using the optional rack mount kit. The DS-5000B can also be used in a tabletop configuration.

The Fibre Channel ports are numbered from left to right, in eight-port groups, and are also numbered on the faceplate (see Figure 35).
**Note:** ISL Trunking is an optionally licensed software that allows you to create trunking groups of ISLs between adjacent switches. For more information about ISL Trunking, refer to the *EMC Connectrix B Series Fabric OS Administrator’s Guide*.

The port side of the DS-5000B switch also displays the system status LED, power status LED, and port status LEDs.

### Supported features

The DS-5000B is shipped with the following features pre-installed:

- Web Tools
- Zoning
- Full Fabric

The DS-5000B supports the optional software, which you can activate by purchasing a corresponding license key:

For more information, refer to the *EMC Connectrix B Fabric OS Administrator’s Guide*.

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

### Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at [http://support.emc.com](http://support.emc.com).

### System architecture

**Performance**

Performance features include:

- 1.063 Gb/s line speed, full duplex
- 2.125 Gb/s line speed, full duplex
- 4.25 Gb/s line speed (full duplex)
Auto-sensing of 1 Gb/s, 2 Gb/s, and 4 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed matching between 1, 2, and 4 Gb/s ports

**Port types**
- F_Port
- FL_Port
- E_Port
- M_port (Mirror Port)
- Self-discovery based on switch type (U_Port)

**Media types**
- Hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), LC connector
- Short-Wavelength Laser (SWL) up to 500 meters (1640 feet)
- Long-Wavelength Laser (LWL) up to 10 km (6.2 mi)
- Extended Long-Wavelength Laser (ELWL) up to 40 km (24.8 mi), and 80 km (49.6 mi) at 2 Gb/s

*Note:* Distance depends on fiber-optic cable and port speed, CWDM SFPs (8 lambdas).

**Maximum size frame**
- 2112-byte payload FC

**Aggregate switch I/O bandwidth**
- 256 Gb/s if all 32 ports are running at 4 Gb/s, full duplex

**Fabric latency**
- 800 nano-seconds port-to-port latency

**Class of service**
- Class 2
- Class 3
- Class F (interswitch frames)

**Fabric services**
Fabric services include:
- Simple Name Server
- Registered State Change Notification (RSCN)
- Zoning
- Web Tools

Optional fabric services include:
- Fabric Watch
- Extended Fabrics
- ISL Trunking (available between devices running FOS)
- Performance Monitoring
- FICON CUP

**Note:** Performance Monitoring and FICON CUP are not available in EOS environments.

**Switch interoperability**
- Connectrix B DS-8B and DS-16B running Fabric OS v2.6.1 or higher.
- Connectrix B DS-8B2 and DS-16B2 running Fabric OS v3.1 or higher.
- Connectrix B DS-32B2 and ED-12000B running Fabric OS v4.1 or higher.
- Connectrix B DS-8B3, DS-16B3, and ED-24000B running Fabric OS v4.2 or higher.
- Connectrix B DS-220B and ED-48000B running Fabric OS v5.0.1 or higher.
- SilkWorm 2xxx running Fabric OS V2.6.1 or higher.
- SilkWorm 3200 and 3800 running Fabric OS v3.1 or higher.
- SilkWorm 3900 and 12000 running Fabric OS v4.1 or higher.
- SilkWorm 3250, 3850, and 24000 running Fabric OS v4.2 or higher.
- SilkWorm 200E and 48000 running Fabric OS v5.x or higher.

Refer to the *EMC Support Matrix* for the most up-to-date information on supported firmwares and EOL listings.
Management

Management software supported
◆ EMC Connectrix Manager
◆ Web Tools
◆ Telnet
◆ SNMP v3 (FE MIB, FC Management MIB)
◆ SSH
◆ HTTPS/SSL
◆ RADIUS
◆ Third-party applications utilizing the SMI Agent

Management access
◆ 10/100 Ethernet port (RJ-45)
◆ Serial port (RS-232)
◆ In-band via Management Server

Diagnostics
◆ The switch performs POST by default each time it is powered on or rebooted or the system is reset. Boot time with POST is a minimum of three minutes.
◆ POST can be skipped after subsequent reboots by entering the fastBoot command. For more information about this command, refer to the Connectrix B Fabric OS Command Reference Manual.

Mechanical specifications
◆ Width = 428.75 mm (16.88 inches)
◆ Height = 1U = 43.5 mm (1.71 inches)
◆ Depth = 264 mm (10.39 inches)
◆ Weight (with two power supplies/fan assemblies installed, no SFPs) = 10.8 lbs (4.9 kg)
Environment

Table 22 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

Table 22  Environmental requirements

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>0° to 40° Celsius (32° to 104° Fahrenheit)</td>
<td>-25° to 70° Celsius (-13° to 158° Fahrenheit)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% RH non-condensing, at 40° Celsius (104° Fahrenheit), with maximum gradient of 10% per hour</td>
<td>10% to 90% RH non-condensing, at 70° Celsius (158° Fahrenheit)</td>
</tr>
<tr>
<td>Altitude</td>
<td>3,000 meters (9,842 feet) above sea level</td>
<td>0 to 12 kilometers (39,370 feet) above sea level</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine wave</td>
<td>Half sine, 33 G 11ms, 3/eg Axis</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G sine, 0.4 grms random, 5-500 Hz</td>
<td>2.0 G sine, 1.1 grms random 5-500 Hz</td>
</tr>
<tr>
<td>Air flow</td>
<td>High speed, 9300 RPM, 20.8 cubic feet/minute</td>
<td>Low speed, 7200 RPM, 15.4 cubic feet/minute</td>
</tr>
<tr>
<td></td>
<td>Low speed, 7200 RPM, 15.4 cubic feet/minute</td>
<td>None required.</td>
</tr>
</tbody>
</table>

Power

The power supplies are universal and capable of functioning worldwide without voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has a built-in fan for cooling, pushing air towards the port side of the switch. Table 23 lists the power supply specifications for the DS-5000B.

Table 23  Power supply specifications (page 1 of 2)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output</td>
<td>70 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>70 Watts maximum, 60 Watts typical</td>
</tr>
<tr>
<td>Input voltage</td>
<td>90 - 264 VAC, Universal</td>
</tr>
</tbody>
</table>
### Standards compliance

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at [http://www.brocade.com/sanstandards](http://www.brocade.com/sanstandards).

### Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at [http://support.emc.com](http://support.emc.com).

---

**Table 23  Power supply specifications  (page 2 of 2)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input line frequency</td>
<td>47 - 63 Hz</td>
</tr>
<tr>
<td>BTU rating at 80% efficiency</td>
<td>$56 \text{ Watts} / 0.8 \times 3.412 \text{ BTU/hr/Watts} = 239 \text{ BTU/hr}$</td>
</tr>
<tr>
<td>Inrush current</td>
<td>Maximum of 15 amps for period between 10-150 ms at 50 degrees Celsius (122 degrees Fahrenheit), hot or cold start</td>
</tr>
</tbody>
</table>
Connectrix DS-4900B

This section provides a description of the hardware and features for the EMC Connectrix DS-4900B. The information provided comes from Brocade data sheets and testing experience in the EMC IOP qualification labs. More information for the DS-4900B can be found in the Connectrix B Series DS-4900B Hardware Reference Manual available at EMC Online Support at http://support.emc.com.

The Connectrix DS-4900B is a Departmental class switch which can contain up to 64 concurrently active 4 Gb/s full-duplex ports in a single domain. It is based on the Brocade Silkworm 4900 Condor ASIC based architecture. The DS-4900B is a 64-port non-blocking switch housed in a 2U enclosure. The DS-4900B is ideal for consolidating existing 1 and 2 Gb/s SANs into a single high-availability switch to improve performance, reduce the ISL count, and simplify management. The DS-4900B can also serve as an edge switch in a core-edge topology.

The DS-4900B utilizes a Linux 2.4.x modified kernel to load the fabric OS version 5.1.x and later.

**Note:** For specific versions of supported firmware, as well as fabric topology constraints associated with the DS-4900B, refer to the E-Lab Navigator.

---

**Key features**

- Base configuration of 32 ports with the ability to increase port count 16 at a time with a Ports On Demand (POD) license.
- Non-disruptive firmware upgrades.
- Redundant and hot swappable power supplies and fans.
- Forward and backward compatibility with all Connectrix B Series switches.
- Supports 1-, 2-, and 4-Gb/s auto-sensing Fibre Channel ports. Trunking groups up to eight ports to create high performance 32-Gb/s ISL trunks between switches.
- Universal ports self-configure as E_Ports, F_Ports, or FL_Ports.
Figure 36 shows the port side view of the DS-4900B.

**Legend:**

1. Connectrix DS-4900B
2. Switch ID Pull-out Tab
3. System Status LED (top) / System Status LED (bottom)
4. Console Port
5. Ethernet Port
6. FC Ports 0 – 7
7. FC Ports 8 – 15
8. FC Ports 16 – 23
9. FC Ports 24 – 31
10. FC Ports 32 – 39
11. FC Ports 40 – 471
12. FC Ports 48 – 55
13. FC Ports 56 – 63
Nonport side

Figure 37 shows the nonport side of the DS-4900B.

Figure 37  DS-4900B Non-port side view

Legend:
1  Connectrix DS-4900B
2  Nonport Side of Switch
3  Power Supply #2)
4  Fan Assembly #3
5  Fan Assembly #2
6  Fan Assembly #1
7  Power Supply #1

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.
Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.

System architecture

Performance
- 1.063 Gb/s line speed, full duplex
- 2.125 Gb/s line speed, full duplex
- 4.25 Gb/s line speed, full duplex
- Auto-sensing of 1, 2, and 4 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed-matching between 1, 2, and 4 Gb/s ports

Extended ISL mode buffer allocation

<table>
<thead>
<tr>
<th>Mode</th>
<th>Buffer allocation</th>
<th>Distance @ 1 Gb/s</th>
<th>Distance @ 2 Gb/s</th>
<th>Distance @ 4 Gb/s</th>
<th>Extended Fabric license required?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Gb/s</td>
<td>2 Gb/s</td>
<td>4 Gb/s</td>
<td>1 Gb/s</td>
<td>2 Gb/s</td>
</tr>
<tr>
<td>L0</td>
<td>5(26)³</td>
<td>5(26)</td>
<td>5(26)</td>
<td>10 km</td>
<td>5km</td>
</tr>
<tr>
<td>LE</td>
<td>11</td>
<td>16</td>
<td>26</td>
<td>10 km</td>
<td>10 km</td>
</tr>
<tr>
<td>L0.5</td>
<td>18</td>
<td>31</td>
<td>56</td>
<td>25 km</td>
<td>25 km</td>
</tr>
<tr>
<td>L1</td>
<td>31</td>
<td>56</td>
<td>106</td>
<td>50 km</td>
<td>50 km</td>
</tr>
<tr>
<td>L2</td>
<td>56</td>
<td>106</td>
<td>206</td>
<td>100 km</td>
<td>100 km</td>
</tr>
<tr>
<td>LD²</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto (500 km max)</td>
<td>Auto (250 km max)</td>
</tr>
<tr>
<td>LS³</td>
<td>User defined</td>
<td>User defined</td>
<td>User defined</td>
<td>User defined (500 km max)</td>
<td>User defined (250 km max)</td>
</tr>
</tbody>
</table>

---

a. For each data channel (in this case, there are 4) there are 5 credits, plus 6 extra credits.
b. The dynamic long-distance mode (LD) automatically configures the number of buffer credits required, based on the actual link distance.
c. The static long-distance mode (LS) allocates the number of buffer credits based on the user-specified distance.
**Fibre Channel ports**
- Up to 64 Fibre Channel ports which are housed in a 2U enclosure.

**Port types**
- Universal ports (U_Port), which self-configure as E_Ports, F_Ports, or FL_Ports; G_Port functionality is determined by the type of attached device.
- FL_Port Port Module support for SFP optical transceivers, supporting any combination of SWL and LWL optical media.
- F_Port
- E_Port

**Port numbering**
The Connectrix DS-4900B uses the following port numbering schemes:
- Ports are numbered from left to right, in eight-port groups.
- Port numbers are also located on the faceplate.

![DS-4900B port numbering](image)

**ISL Trunking**
- Up to eight 4.25 Gb/s ports per ISL trunk
- Up to 32 Gb/s per ISL trunk
- ISL trunking at 2 Gb/s for compatibility with prior B Series Connectrix products.

**Aggregate bandwidth**
- 512 Gb/s
Switch latency
- ~700 nanoseconds within a locally switch group and <2.4 µsec with no contention, cut-through routing at 4 Gb/s between locally switched groups.

Oversubscription
- 64 port non-oversubscribed switch at 4 Gb

Maximum frame size
- 2112-byte payload

Frame buffers
- 584 buffers per switch
- Dynamically allocated up to 255 per port

Classes of service
- Class 2, Class 3, and Class F (inter-switch frames) Fibre Channel protocol support.

Fabric services
- Simple Name Server
- Registered State Change Notification (RSCN)
- Alias Server (multicast)
- Zoning
- Web Tools
- Fabric Watch
- Extended Fabrics
- ISL Trunking
- Performance Monitoring.

High Availability
- Redundant, hot-swappable components
  - Three fan assemblies
  - Power supplies.
  - Small Form-factor Pluggable (SFP) Short-Wavelength Laser (SWL) transceivers.
  - Small Form-factor Pluggable (SFP) Long-Wavelength Laser (LWL) transceivers.
Redundant power supply and fan assembly
  • The DS-4900B requires a minimum of two operating blower assemblies at all times. To ensure continuous adequate cooling, maintain three operating blower assemblies at all times except for the brief period when replacing a blower assembly.

Enhanced data integrity on all data paths

Fabric Shortest Path First (FSPF) rerouting around failed links

Integration with Simple Network Management Protocol (SNMP) managers

Non-disruptive “hot” software code loads and activation

Easy configuration, save, and restore

Two hot swappable 300W power supply modules providing N + 1 redundancy

Cooling
  • Three fan assemblies containing two fans each. The fans have two speeds, which are set automatically and cannot be modified. They default to high speed upon boot, then switch to low speed as Fabric OS comes online, returning to high speed only as required.
  • Non-port side to port-side airflow

Management

Management software supported
  • EMC ControlCenter
  • EMC Connectrix Manager
  • Embedded web server to provide single-point management using the Web Tools GUI.
  • Centralized configuration and management of fabric using Client/Server architecture and CLI.
  • Support for 10/100 Mb Ethernet connections for out-of-band management.
  • SNMP (FE MIB, FC Management MIB)
  • Telnet/SSH

Management access
  • 10/100Mb Ethernet port (RJ-45)
◆ Serial port (RJ-45)

Diagnostics
◆ Post and embedded online/offline diagnostics

Mechanical specifications
◆ Rear panel-to-door airflow
◆ Width = 42.87 cm (16.88 in)
◆ Height = 8.60 cm (3.39 in) for 2U
◆ Depth = 61.0 cm (24.02 in)
◆ Weight = 13.7 kg (30.2 lb) with dual power supply, no SFP

Environment
◆ Temperature
  • Operating: 0º C to 40º C (32º F to 104º F)
  • Non-operating: -25º C to 70º C (-13º F to 158º F)
◆ Humidity
  • Operating: 20% to 85% non-condensing at 40º C (104º F)
  • Non-operating and storage (non-condensing): 0% to 93%
◆ Altitude
  • Up to 3000 meters (9800 feet)
◆ Shock
  • Operating: 20 G, 11 ms, half sine 1 G p-p, 5-500 Hz, 1 octave min
  • Non-operating: 33 G, 11ms, half sine 2.4 G p-p, 5-500 Hz, 1 octave min
◆ Vibration
  • Operating: 20 G, 6 ms half-sine
  • Non-operating: 15 G, 12 to 18 ms trapezoid

Power
◆ Maximum output
  • 300 Watts

Note: 256-port configuration requires a maximum of 750 Volt-Amps.

◆ In-rush current
Maximum of 15 Amps for period between 10 to 150 ms at 50°C (122°F), hot or cold start

- System power consumption
  - Nominal system draw 175 Watts
- Nominal input voltage
  - 90 to 264 VAC, 47 to 63 Hz
- Minimum input voltage
  - 90 VAC
- Maximum input voltage
  - 264 VAC
- Frequency
  - 47 to 63 Hz
- BTU rating (80% efficiency)
  - 220 Watts / 0.8 X 3.412 BTU/hr/Watts = 756 BTU/hr

Protocols
- FC
- FICON

Standards compliance
This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at http://www.brocade.com/sanstandards

Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.
Connectrix DS-300B

More information for the DS-300B can be found in the Connectrix B Series DS-300B Hardware Reference Manual available at EMC Online Support at http://support.emc.com.

Key features

The DS-300B switch includes the following features:

- 1U chassis
- The chassis can be installed as a standalone unit or mounted in a standard Electronic Industries Association, EIA-310, 19 in. (48.26 cm) cabinet.
- One built-in fixed power unit (not a FRU).
- Three built-in fans (there are no fan FRUs).
  The DS-300B is cooled by a 2-1 redundant fan configuration, which means that it can sustain a single fan failure and continue to function properly.
- On-demand scaling of 8 to 24 8 Gb/s ports.
- GoldenEye-2 ASIC technology supporting 1, 2, 4 and 8 Gb/s auto-sensing Fibre Channel ports
- RJ45 Ethernet management port that in conjunction with EZSwitchSetup, supports switch IP address discovery and configuration.
- Support of the EZSwitchSetup wizard for setup and basic configuration.
- USB port that provides storage for firmware updates, output of the supportsave command and storage for configuration uploads and downloads.
- A single motherboard design with a 667 MHz PowerPC 440EPx Reduced Instruction Set Computer (RISC) CPU with integrated peripherals.
- Inter-Switch-Link Trunking ( licensable) which enables up to eight ports (at 1 G, 2 G, 4 G, or 8 G speeds) between a pair of switches to be combined to form a single, logical ISL switch with a speed of up to 64 Gb/s (128 Gb/s full duplex) for optimal bandwidth utilization and load balancing.
Port side

Figure 39 shows the port side of the DS-300B.

Figure 39 Port side view of the DS-300B

Legend:
1. System status (top) and power (bottom) LEDs
2. System RS232 console port (RJ-45)
3. Ethernet port with two Ethernet status LEDs
4. USB port
5. Fibre Channel status LEDs
6. Fibre Channel Ports (24)
7. AC power receptacle

Non-port side

The non-port side of the DS-300B is used solely for air flow. There are two labels on the bottom of the chassis. On the right side is the standard agency label. On the left side is the standard OEM data label.

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the most current version of the appropriate Connectrix B Series release notes and product documentation at EMC Online Support at http://support.emc.com.
System architecture

Performance
Performance features include:

- Full line-speed switching at
  - 2.125 Gb/s line speed, full duplex
  - 4.25 Gb/s line speed, full duplex
  - 8.50 Gb/s line speed, full duplex
- Auto-sensing of 2, 4, and 8 Gb/s port speeds
- Optionally programmable to fixed port speed
- Speed matching between 2, 4, and 8 Gb/s ports

Port types
- F_Port
- FL_Port
- E_Port
- M_Port (Mirror Port)
- EX_Port (Fibre Channel Integrated Routing)
- U_Port (Self discovery based on switch type)
- Optional port type control

Media types
4 Gb/s requires:

- Connectrix hot-pluggable, industry-standard Small Form-factor Pluggable (SFP), LC connector
- 4 Gb/s Short-Wavelength Laser (SWL)
- 4 Gb/s Long-Wavelength Laser (LWL)
- 4 Gb/s Extended Long-Wavelength Laser (ELWL)

---

**Note:** Distance depends on fibre-optic cable and port speed.

8 Gb/s requires:

- Connectrix hot-pluggable, industry-standard SFP+, LC connector
- Short-Wavelength Laser (SWL)
Note: Distance depends on fibre-optic cable and port speed.

**Maximum size frame**
- 2,112 byte payload

**Aggregate switch I/O bandwidth**
- 408 Gb/s 24 ports x 8.5 Gb/s (line rate) x 2 (full duplex)

**Fabric latency**
- 700 ns with no contention, cut-through routing at 8 Gb/s

**Class of service**
- Class 2
- Class 3
- Class F (Interswitch frames)

**Fabric services**
Fabric services include:
- Simple Name Server (SNS)
- Registered State Change Notification (RSCN)
- NTP v3
- Reliable Commit Service (RCS)
- Dynamic Path Selection (DPS)
- Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning)
- NPIV
- N_Port Trunking
- FDMI
- Management Server
- FSPF
- Advanced Performance Monitoring
- IPoFC, Frame Redirection
- Port Fencing
- BB credit recovery

Optional Fabric Services include:
- Adaptive Networking with QoS
- Extended Fabrics
- Enhanced Group Management
- Fabric Watch
- ISL Trunking
- Integrated Routing
- End-to-End Performance Monitoring (APM)

**Switch interoperability**
Refer to the *EMC Support Matrix* for the most up-to-date information on supported firmwares and EOL listings.

---

**Management**

**Management software supported**
- Telnet, HTTP, SNMP v1/v3 (FE MIB, FC Management MIB)
- Auditing, Syslog, Change Management tracking
- EZSwitchSetup wizard
- Web Tools
- EMC Connectrix Manager
- SMI-S compliant, SMI-S scripting toolkit, Administrative Domains
- Trial licenses for select add-on capabilities

**Management access**
- Call home integration
- 10/100 Ethernet port (RJ-45), in-band over Fibre Channel
- Serial port (RJ-45)
- USB
- Call-home integration enabled through Connectrix Manager and Fabric Manager

**Diagnostics**
- POST and embedded online/offline diagnostics, including RAStrace logging, environmental monitoring, non-disruptive daemon restart, FCping and Pathinfo (FC traceroute), port mirroring (SPAN port)
**Mechanical specifications**
- Width = 42.88 cm (16.88 inches)
- Height = 4.29 cm (24.11 inches)
- Depth = 30.66 cm (12.07 inches)
- Weight = 4.2 kg (9.3 lbs), without SFP/SFP+ media

**Environment**
Table 24 lists the acceptable environmental ranges for both operating and nonoperating (such as during transportation or storage) conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable during operation</th>
<th>Acceptable during non-operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>$0^\circ$ to $40^\circ$ Celsius ($32^\circ$ to $104^\circ$ Fahrenheit)</td>
<td>$-25^\circ$ to $70^\circ$ Celsius ($-13^\circ$ to $158^\circ$ Fahrenheit)</td>
</tr>
<tr>
<td>Humidity</td>
<td>10% to 85% (non-condensing)</td>
<td>10% to 95% (non-condensing)</td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 3,000 meters (9,842 feet)</td>
<td>Up to 12 kilometers (39,370 feet)</td>
</tr>
<tr>
<td>Shock</td>
<td>20 G, 6 ms, half-sine</td>
<td>Half sine, 33 G 11ms, 3/eq Axis</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5 G sine, 0.4 grms random, 5-500 Hz</td>
<td>2.0 G sine, 1.1 grms random 5-500 Hz</td>
</tr>
<tr>
<td>Air flow</td>
<td>Maximum 29 CFM (cu. ft/min); nominal 22 CFM</td>
<td>None required</td>
</tr>
</tbody>
</table>

**Power**
Table 25 lists the power supply specifications for the DS-300B.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet</td>
<td>The outlet must be a correctly wired, primary with earth ground</td>
</tr>
<tr>
<td>Maximum output of one power supply</td>
<td>75 Watts</td>
</tr>
<tr>
<td>System power consumption</td>
<td>48 watts nominal, 57 watts maximum</td>
</tr>
<tr>
<td>Input voltage</td>
<td>85 - 264 VAC, Universal</td>
</tr>
<tr>
<td>Input line frequency</td>
<td>47 - 63 Hz</td>
</tr>
<tr>
<td>BTU rating</td>
<td>277 BTU/hr</td>
</tr>
<tr>
<td>Inrush current</td>
<td>21.5 Amps at 240 VAC Cold Start</td>
</tr>
</tbody>
</table>
Standards compliance

This release conforms to the Fibre Channel Standards in a manner consistent with accepted engineering practices and procedures. In certain cases, Brocade might add proprietary supplemental functions to those specified in the standards. For the list of standards conformance, visit this Brocade website at http://www.brocade.com/sanstandards

Further reading

Several related EMC Connectrix B manuals and release notes are available at EMC Online Support at http://support.emc.com.

**Note:** For specific versions of supported firmware, as well as fabric topology constraints associated with the DS-300B, refer to the E-Lab Navigator.
EMC Connectrix Manager is the Connectrix Manager B-Series switch management software.

Connectrix Manager Converged Network Edition (CMCNE) greatly simplifies daily operations while improving the performance and reliability of the overall SAN and IP networking environment. CMCNE unifies under a single platform, full lifecycle network management for SAN, LAN and converged networks. CMCNE provides a consistent user experience, across the entire Connectrix B-series portfolio of products. This network management tool offers flexible and proactive SAN/IP network performance analysis in addition to IP network configuration change deployment and monitoring for compliance. CMCNE supports Fibre Channel SANs, including 16 Gbps platforms and Layer 2/3 IP networks.

CMCNE can reduce operation expenditures and help organizations focus on strategic IT initiatives by providing a common network management tool for provisioning, monitoring, reporting and troubleshooting. CMCNE provides customizable health and performance dashboards, with an easy-to-use graphical user interface and comprehensive features that automate repetitive tasks. With CMCNE, storage and network administrators can proactively manage their SAN/IP network environments to support non-stop networking. CMCNE also provides network administrators the ability to quickly access network topology, health and performance data required to troubleshoot and remediate network issues.

CMCNE is available in several versions which can be broken down in three major categories: SAN only management, SAN and IP management, and IP-only management capabilities. There are license options to enable some, all, and/or upgrade functionality from one category to another.

The CMCNE SAN Management options are structured the same as the previous CMCNE 11.x versions.

- **CMCNE SAN Professional Edition** — Intended for the management of smaller fabrics with Connectrix B Series departmental switches.

- **CMCNE SAN Professional Plus Edition** — is a Professional Plus edition which is in between Professional and Enterprise for scalability support and also supports the ED-DCX-4S-B and ED-DCX8510-4B.
- **CMCNE SAN Enterprise Edition** — A full-featured Enterprise class management solution for the largest of data center SAN infrastructures.

The three flavors differ predominantly in the set of supported features, hardware platforms, and supported scalability limits.

In addition to managing mixed fabrics, Connectrix Manager Converged Network Edition for SAN Professional Plus and SAN Enterprise have other features not found in Connectrix Manager Converged Network Edition for SAN Professional, as detailed in the following tables.

<table>
<thead>
<tr>
<th>Hardware Platform</th>
<th>CMCNE for SAN Professional</th>
<th>CMCNE for SAN Professional Plus</th>
<th>CMCNE for SAN Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brocade 40xx, 54xx Embedded Blade Switches</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>DS-220B, DS-4100B, DS-5000B, ED-48000B</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>DS-300B, DS-5100B, DS-5300B,</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MP-7500B/PB-48K-18i FCIP Port Blade</td>
<td>✓ (a)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AP-7600B, PB-48K-AP4-18 Application Blade</td>
<td>✓ (b)</td>
<td>✓ (b)</td>
<td>✓ (b)</td>
</tr>
<tr>
<td>PB-48K-16IP iSCSI Blade (2)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ED-DCX-B &amp; ED-DCX8510-8B Directors</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>ED-DCX-4S-B &amp; ED-DCX8510-4B Directors</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ES-5832B Encryption Switch &amp; PB-DCX-16EB</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Encryption Blade</td>
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<td></td>
</tr>
<tr>
<td>MP-8000B Switch &amp; PB-DCX-24FCOE Blade</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>MP-7800B FCIP Switch &amp; PB-DCX-FX8-24 Blade</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>DS-6505B, DS-6510B, &amp; DS-6520B</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

(a) Limited support  
(b) Basic Layer 2 configuration
<table>
<thead>
<tr>
<th>Feature</th>
<th>CMCNE for SAN Professional</th>
<th>CMCNE for SAN Professional Plus</th>
<th>CMCNE for SAN Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td># of fabrics</td>
<td>1</td>
<td>36</td>
<td>36</td>
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<tr>
<td>Type of fabrics supported</td>
<td>FOS</td>
<td>FOS</td>
<td>FOS</td>
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<tr>
<td># of ports</td>
<td>1,000</td>
<td>2,560</td>
<td>9,000 (FOS)</td>
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<tr>
<td>Virtual Fabrics</td>
<td>✓ (Limited Support)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FICON</td>
<td></td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Encryption configuration</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Quality of Service (QoS)</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Traffic Isolation (TI) zones</td>
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<td>✓</td>
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<tr>
<td>FCR/LSAN Zoning</td>
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<td>x</td>
<td>✓</td>
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<tr>
<td>FCIP Tunnels Interface (FOS only)</td>
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<td>✓</td>
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</tr>
<tr>
<td>FCIP configuration</td>
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</tr>
<tr>
<td>Port fencing</td>
<td>✓ (FOS Only)</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>RBAC and security schemes</td>
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<td>x</td>
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<td>Real-Time Performance</td>
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<td>Historical Performance</td>
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</tr>
<tr>
<td>DBMS (ODBC and JDBC)</td>
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<td>Top Talkers</td>
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<tr>
<td>Performance thresholds</td>
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<td>x</td>
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</tr>
<tr>
<td>HBA/CNA management</td>
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<td>✓</td>
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</tr>
<tr>
<td>Server Virtualization support</td>
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<tr>
<td>Access Gateway</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FCoE/DCB</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HBA management</td>
<td></td>
<td>✓</td>
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<tr>
<td>Partner software integration</td>
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<tr>
<td>Call Home support</td>
<td></td>
<td>x</td>
<td>✓</td>
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<tr>
<td>Microsoft SCOM Management Pack</td>
<td></td>
<td>x</td>
<td>✓</td>
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<tr>
<td>Management Plugin for VMware vCenter</td>
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<tr>
<td>Integrated SMI Agent</td>
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<td>x</td>
<td>✓</td>
</tr>
</tbody>
</table>

(a) Support for Role-Based Access Control (RBAC) and security schemes (RADIUS, LDAP, Active Directory, NIS/NIS+, and more)

(b) Data persistence for up to two years of data, out-of-box Open Database Connectivity (ODBC), and Java Database Connectivity (JDBC) access
CMCNE SAN Professional Edition

CMCNE Professional showcases a subset of features and hardware platforms of CMCNE Enterprise. The Professional version, which is a no charge version, is intended for the management of smaller fabrics with Connectrix B Series departmental switches. It cannot manage Director class products, has no FICON or routing support, and does not have remote clients or Call home support. The Professional version is limited to managing FOS departmental switch products only consisting of 1 fabric, 10 switches, 640 switch ports, and 1,000 hosts or storage devices. CMCNE Professional presents several new benefits to both new customers and existing Web Tools (FOS Switch Element Manager) customers including (but not limited to):

◆ A topology view that provides a comprehensive fabric connectivity map.
◆ Out-of-box database persistence for key information including zoning changes, switch configuration backups, audit of changes made to the environment, etc.
◆ The ability to perform group configuration activities across multiple switches simultaneously (e.g., download firmware to multiple switches simultaneously to meet aggressive change windows, schedule backup of switch configurations into the CMCNE repository on an automated basis to enable rapid troubleshooting and switch provisioning, replicate switch configuration from one "golden" switch to multiple other switches to maintain configuration consistency across the enterprise, etc.).

CMCNE SAN Professional Plus Edition

CMCNE Professional Plus is designed for medium-sized businesses or departmental storage networks. Very similar in functionality to the Enterprise version but limited in features/scalability by a license key to:

Support up to 4 fabrics and 2560 switch ports

◆ Support the ED-DCX-4S-B, ED-DCX8510-4B, encryption products, extension products, and Brocade HBA/CNAs
◆ Can be updated to CMCNE SAN Enterprise (via a license key update).
Refer to the *EMC Connectrix Manager Converged Network Edition (CMCNE) Professional, Professional Plus, and Enterprise User Guide*, available on EMC Online Support at [http://support.emc.com](http://support.emc.com), for detailed information on CMCNE.

### CMCNE SAN Enterprise Edition

CMCNE Enterprise builds on top of the functionality available with CMCNE Professional, and provides a comprehensive fabric management framework for the end-to-end management of the data center fabric. CMCNE Enterprise can scale to manage up to 9,000 switch ports. Refer to the most current *EMC Connectrix Manager Converged Network Edition (CMCNE) Release Notes*, available on EMC Online Support at [http://support.emc.com](http://support.emc.com), for up-to-date information on new features.
This chapter contains information on the following Connectrix MDS Series Storage Service Module, directors, and switches.

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- Connectrix MDS 9134 ............................................................... 210
- Connectrix MDS 9222i ................................................................. 217
- Connectrix MDS 9124 ................................................................. 227
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- Connectrix MDS 9506 ................................................................. 248
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Note: EMC resells Cisco switches. For Cisco switch documentation, visit http://cisco.com. EMC Connectrix MDS release notes and data sheets can be found on EMC Online Support at https://support.emc.com.
The Connectrix MDS 9148 Multilayer Fabric Switch, as shown in Figure 40 on page 198, is a high-performance, flexible, cost-effective platform with the industry’s highest port density and lowest power consumption available in a compact one rack-unit (1RU) chassis form factor. It provides 48 line-rate 8-Gb/s ports for storage networking deployments in small, medium-sized, and large enterprise environments. The MDS 9148, based on a purpose-built “switch-on-a-chip” application-specific integrated circuit (ASIC), offers the flexibility to expand from 16 to 48 ports in 8-port increments. The MDS 9148 offers the densities required to scale from an entry-level departmental switch to top-of-the-rack switch to edge switch connectivity into enterprise core SANs. The MDS 9148 delivers a nonblocking architecture, with all 48 1/2/4/8-Gb/s ports operating at line rate concurrently.

The MDS 9148 supports Zero-Touch installation as well as the Cisco Device Manager Quick Configuration Wizard, which allow it to be deployed quickly and easily in networks of any size. Powered by MDS 9000 NXOS Software, it includes advanced storage networking features and functions and is compatible with MDS 9500 Series Multilayer Directors and MDS 9200 and other 9100 Series Multilayer Fabric Switches, providing transparent, end-to-end service delivery in core-edge deployments.

The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9148 include:

- Flexibility for high-performance SANs
  - Up to 48 autosensing Fibre Channel ports capable of speeds of 8, 4, 2, and 1 Gb/s in a compact 1RU form-factor chassis
  - 8 Gb/s of dedicated bandwidth for each port and aggregate platform bandwidth of 768 Gb/s
  - On-Demand Port Activation license available, which allows addition of eight 8-Gb/s ports
• Advanced storage networking capabilities built into the platform
• Hot-swappable autosensing Small Form-Factor Pluggable (SFP) and Enhanced SFP (SFP+) optics with interfaces for 8, 4, 2, and 1 Gb/s.
  – Individual ports can be configured with either short- or longwavelength SFP optics for connectivity up to 860 meters (m) and 31 kilometers (km), respectively.

♦ VSANs for segmentation and isolation
• Up to 32 VSANs are supported per switch.
• Each VSAN can be zoned as a typical SAN and maintains its own fabric services and management domains.
• Switch-on-a-chip application-specific integrated circuits (ASICs) are ready to support Inter-VSAN Routing (IVR)

♦ Advanced traffic management for high-performance, resilient SANs
• Virtual output queuing helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
• Each port group consisting of 4 ports has a pool of 128 buffer credits, with a default of 32 buffer credits per port. When extended distances are required, up to 125 buffer credits can be allocated to a single port within the port group. This extensibility is available without additional licensing.
• PortChannels allow users to aggregate up to 16 physical ISLs into a single logical bundle, providing optimized bandwidth use across all links. The bundle can consist of any port from the switch, helping ensure that the bundle remains active even in the event of a port group failure.
• Fabric Shortest Path First (FSPF)-based multipathing provides the intelligence to load-balance across up to 16 equal-cost paths and, in the event of a switch failure, dynamically reroute traffic.
• QoS can be used to manage bandwidth and control latency, to prioritize critical traffic.
• Comprehensive port and flow statistics facilitate sophisticated performance analysis and service-level agreement (SLA) accounting.

♦ Advanced diagnostics and troubleshooting tools
• Integrates the industry’s most advanced analysis and debugging tools.

◆ Comprehensive security
  • VSANs isolation
  • Role-based access control (RBAC)
  • Secure FTP (SFTP)
  • Intelligent packet inspection at the port level
  • Hardware zoning using access control lists (ACLs)
  • Extended broadcast zoning
  • Secure shell (SSH)
  • Control-plane security
  • Simple network management protocol (SNMP)
  • FC-SP switch-to-switch plus host-to-switch access authentication

◆ High-availability platform for mission-critical environments
  • Nondisruptive software upgrades.
  • Hot-swappable, redundant fans and power supplies.
  • Ability to automatically restart failed processes.

◆ Simplified management
  • Consistent, logical CLI.
  • Zero-Touch installation
  • Quick Configuration Wizard
  • Cisco Fabric Manager and DCNM can be licensed for management of a combination of SAN and LAN environments
  • An extensive set of APIs for integration with third-party and user-developed management tools.

Figure 40  MDS 9148 Multilayer Fabric Switch
Supported features

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the *E-Lab Interoperability Navigator*.

Unsupported features

For the most up-to-date information on unsupported features, consult the appropriate *EMC Connectrix MDS SAN-OS Release Notes* release notes on EMC Online Support at [https://support.emc.com](https://support.emc.com).

System architecture

Performance and port configurations

- Port speed: 8-, 4-, 2-, and 1-Gb/s autosensing with 8 Gb/s of dedicated bandwidth per port
- Buffer credits: Up to 128 for a group of 4 ports, with a default of 32 buffer credits per port and a maximum of 125 buffer credits for a single port in the group
- Ports per chassis: Up to 48 8-Gb/s ports
  - Base configuration with 16 ports
  - Additional configurations for 32 and 48 ports available
  - Upgrade ports in 8-port increments from any configuration with the port activation license
- PortChannels: Up to 16 ports in a PortChannel with automatic load balancing

Security

- VSANs fabric isolation
- Intelligent packet inspection @ port level
- Hardware zoning by access control lists (ACLs)
- Logical-unit-number (LUN) zoning and read-only zones
- Extended broadcast zoning
- FC-SP switch-to-switch authentication
- FC-SP host-to-switch authentication
◆ RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions
◆ Management access
◆ Secure FTP (SFTP)
◆ Secure Shell Version 2 (SSHv2)
◆ Control-plane security

**Virtual Computing Environment (VCE) coalition**
◆ MDS 9148 is supported as a VCE coalition option for Vblock1 and Vblock2

**Fabric services**
◆ Name server
◆ Registered state change notification (RSCN)
◆ Login services
◆ Public loop
◆ Broadcast
◆ In-order delivery
◆ Name-server zoning

**Advanced services**
◆ NPIV
◆ VSANs
◆ PortChannels
◆ NPV mode
◆ FlexAttach
◆ F-port trunking and channeling
◆ IVR (currently no commitment for inclusion in a future MDS 9000 NX-OS Software release)

**Diagnostics and troubleshooting tools**
◆ POST diagnostics
◆ Online diagnostics
◆ Internal loopbacks
- SPAN (remote SPAN not supported)
- Fibre Channel traceroute
- Fibre Channel ping
- Fibre Channel debug
- Cisco Fabric Analyzer
- Syslog
- Port-level statistics

Management

Access methods
- Out-of-band 10/100/1000 Ethernet port
- EIA/TIA-232 serial console port
- In-band Fibre Channel over IP (FCIP)

Access protocols
- CLI
- SNMP
- SMI-S

Security
- RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions
- VSAN-based roles
- SSHv2
- SNMPv3

Management applications
- Zero-Touch Installation deployment and provisioning with DHCP (delayed availability; scheduled for Cisco MDS 9000 NX-OS Software Maintenance Release 5.2(2) or later)
- Cisco MDS 9000 Family CLI
- Quick Configuration Wizard
- Cisco Device Manager
- Cisco Fabric Manager and DCNM for SAN Essentials Edition
- Cisco DCNM for SAN Advanced Edition (optional software package)

**Availability**
- Nondisruptive In-Service Software Upgrade (ISSU)
- Process monitoring and stateful process restart
- Per-VSAN fabric services
- Redundant, hot-swappable power supply and redundant, hot-swappable power supply and fan trays
- Hot-swappable SFP and SFP+ optics
- PortChannels aggregating up to 16 ports with redundant load balancing
- F-port channeling and trunking
- Online diagnostics

**Serviceability**
- Configuration file management
- Call Home
- Port beaconing
- System LEDs
- SNMP traps for alerts

**Environmental**
- Ambient operating temperature is 32 to 104 degrees F (0 to 40 degrees C)
- Ambient nonoperating temperature is -40 to 158 degrees F (-40 to 70 degrees C)
- Physical dimensions (H x W x D) of 1RU: 1.72 x 17.16 x 18.89 in. (4.47 x 43.59 x 47.98 cm)
- Weight: Switch with dual power supplies: 22.2 lb (10 kg)
- Humidity (RH), ambient (noncondensing) operating: 10 to 90%
- Humidity (RH), ambient (noncondensing) nonoperating and storage: 5 to 95%
- Operating altitude: -197 to 6500 ft (-60 to 2000m)

**Power and cooling**
- Power supplies (300W) (maximum of 2 per switch):
- AC input: 100 to 240 VAC nominal (+/-10% for full range)
- Frequency: 50 to 60 Hz nominal (+/-3 Hz for full range)
- Maximum power consumption
  - With 4-Gb/s optics (48 ports fully populated): 99W with 0.89A at 110 VAC and 0.45A at 220 VAC
  - With 8-Gb/s optics (48 ports fully populated): 101W with 0.90A at 110 VAC and 0.46A at 220 VAC
- Airflow
  - Rear to front (towards ports)

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connectrix MDS 9148S

The Connectrix MDS 9148S 16G Multilayer Fabric Switch (Figure 41 on page 205) is the next generation of the highly reliable, flexible, and low-cost Cisco MDS 9100 Series switches. It combines high performance with exceptional flexibility and cost effectiveness. This powerful, compact one rack-unit (1RU) switch scales from 12 to 48 line-rate 16 Gbps Fibre Channel ports.

The Connectrix MDS 9148S is excellent for:

◆ A standalone SAN in small departmental storage environments
◆ A top-of-the-rack switch in medium-sized redundant fabrics
◆ An edge switch in enterprise data center core-edge topologies

The Connectrix MDS 9148S is powered by Cisco NX-OS and Cisco Prime Data Center Network Manager (DCNM) software. It delivers advanced storage networking features and functions with ease of management and compatibility with the entire Connectrix MDS 9000 Family portfolio for reliable end-to-end connectivity.

The Connectrix MDS 9148S offers the following benefits:

◆ High Performance and Flexibility at Low Cost
◆ High-Availability Platform for Mission-Critical Deployments
◆ Simplified Storage Management with Sophisticated Diagnostics
◆ Intelligent Network Services and Advanced Traffic Management
◆ Comprehensive Network Security Framework

For more details on features and benefits, refer to the Cisco MDS 9148S Multilayer Director Data Sheet located at www.cisco.com.

Key features

Key features include:

◆ Common software across all platforms
  ◆ Reduce total cost of ownership (TCO) by using Cisco NX-OS and Cisco Prime DCNM for consistent provisioning, management, and diagnostic capabilities across the fabric.
◆ PowerOn Auto Provisioning
  ◆ Automate deployment and upgrade of software images.
Smart zoning
- Reduce consumption of hardware resources and administrative time needed to create and manage zones.

Intelligent diagnostics/Hardware based slow port detection
- Enhance reliability, speed problem resolution, and reduce service costs by using Fibre Channel ping and traceroute to identify exact path and timing of flows, as well as Cisco Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN) and Cisco Fabric Analyzer to capture and analyze network traffic.

Virtual output queuing
- Help ensure line-rate performance on each port by eliminating head-of-line blocking.

High-performance ISLs
- Optimize bandwidth utilization by aggregating up to 16 physical ISLs into a single logical PortChannel bundle with multipath load balancing.

In-Service Software
- Reduce downtime for planned maintenance and software upgrades.

Figure 41 shows the MDS 9148S 16G Multilayer Fabric Switch.

Supported features
For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.
Unsupported features

For the most up-to-date information on unsupported features, consult the appropriate EMC Connectrix MDS SAN-OS Release Notes release notes on EMC Online Support at https://support.emc.com.

System architecture

Performance
- Port speed: 2/4/8/16-Gbps autosensing with 16 Gbps of dedicated bandwidth per port
- Buffer credits: Up to 256 for a group of 4 ports, with a default of 64 buffer credits per port and a maximum of 253 buffer credits for a single port in the group
- PortChannel: Up to 16 physical links

Fabric services
- Name server
- State Change Notification (RSCN)
- Login services
- Fabric Configuration Server (FCS)
- Public loop
- Broadcast
- In-order delivery

Advanced functions
- VSAN
- IVR
- PortChannel with multipath load balancing
- Flow-based and zone-based QoS

Management

For complete product specifications, including protocols, fabric services, diagnostic and troubleshooting tools, network security, and performance, refer to the Cisco MDS 9148S Multiservice Fabric Switch Data Sheet located at www.cisco.com.
Access methods
- Out-of-band 10/100/1000 Ethernet port
- RS-232 serial console port
- USB

Access protocols
- CLI using the console and Ethernet ports
- SNMPv3 using the Ethernet port and in-band IP over Fibre Channel access
- Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S)

Distributed device alias service

Network security
- Per-VSAN RBAC using RADIUS and TACACS+-based authentication, authorization, and accounting (AAA) functions
- SFTP
- SSHv2 implementing AES
- SNMPv3 implementing AES

Management applications
- MDS 9000 Family CLI
- Cisco Prime DCNM

Availability
- ISSU
- Hot-swappable, dual redundant power supplies
- Hot-swappable fan tray with integrated temperature and power management
- Hot-swappable SFP+ optics
- Passive backplane
- Stateful process restart
- Any port configuration for PortChannels
- Fabric-based multipathing
- Per-VSAN fabric services
- Port tracking
◆ VRRP for management connections
◆ Online diagnostics

**Environmental**
◆ Physical dimensions (H x W x D):
  - Dimensions (H x W x D): 1.72 x 17.16 x 16.34 in. (4.37 x 43.59 x 41.50 cm), 1RU
  - Rack-mountable in standard 19-inch Electronic Industries Alliance [EIA] rack
  - Weight of fully configured chassis: 19.84 lb (9 kg)

**Power and cooling**
◆ Power supply: 300W AC (2 per switch)
◆ Power cord: Notched C15 socket connector connecting to C16 plug on power supply
◆ AC input characteristics
  - 100 to 240V AC (10% range)
  - 50 to 60 Hz (nominal)
◆ Airflow: back to front (toward ports)
◆ 200 linear feet per minute (LFM) through system fan assembly
  - It is recommended to maintain a minimum air space of 2.5 in. (6.4 cm) between walls and chassis air vents and a minimum horizontal separation of 6 in. (15.2 cm) between two chassis to prevent overheating
◆ Temperature range
  - Temperature, ambient operating: 32 to 104°F (0 to 40°C)
  - Temperature, ambient non-operating and storage: -40 to 158°F (-40 to 70°C)
  - Relative humidity, ambient (noncondensing) operating: 10 to 90%
  - Relative humidity, ambient (noncondensing) non-operating and storage: 10 to 95%
  - Altitude, operating: -197 to 6500 ft (-60 to 2000m)
Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
The Connectrix MDS 9134 Multilayer Fabric Switch, as shown in Figure 42 on page 213, is designed for midrange to large enterprise customers, providing line-rate 4-Gb/s and 10-Gb/s ports based on a purpose-built "switch-on-a-chip" application-specific integrated circuit (ASIC) with high performance, high density, and enterprise-class availability. The switch offers flexibility, high-availability, security, and ease of use at an affordable price in a compact one-rack-unit (1RU) form factor. With the flexibility to expand from 24 to 32 ports in 8-port increments and optionally activate 2 10-Gb/s ports, the MDS 9134 offers the densities required for top-of-the-rack switch and edge connectivity in enterprise SANs. The MDS 9134 offers non-blocking architecture, with all 32 4-Gb/s ports and the 2 10-Gb/s ports operating at line rate concurrently.

The 10-Gb/s ports support a range of optics for connection to the MDS 9000 family core using 10-Gbps Inter-Switch Link (ISL) connectivity. The MDS 9134 can also be stacked using copper CX4 X2 transceivers to cost effectively offer up to 64-port densities. The MDS 9134 supports quick configuration and task wizards that allow it to be deployed quickly and easily in networks of any size. Powered by MDS 9000 NX-OS/SAN-OS Software, it includes advanced storage networking features and functions and is compatible with MDS 9500 Series Multilayer Directors and MDS 9200 Series Multilayer Fabric Switches, providing transparent, end-to-end service delivery in core-edge deployments.

The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9134 include:

- Flexibility and scalability
  - Up to 32 autosensing Fibre Channel ports capable of speeds of 4, 2, plus 2 10-Gb/s ports in a compact 1RU form-factor chassis
  - Advanced storage networking capabilities built into the platform
• Hot-swappable, Small Form-Factor Pluggable (SFP), LC interfaces
  – All SFP interfaces are 4, 2, and 1 Gb/s, with autosensing capabilities.
  – Individual ports can be configured with either short- or long-wavelength SFP optics for connectivity up to 860 meters (m) and 10 kilometers (km), respectively.
  – 10-Gb/s ports support X2 form-factor optics, copper or optical.

◆ VSANs for segmentation and isolation
  • Up to 16 VSANs are supported per switch.
  • Each VSAN can be zoned as a typical SAN and maintains its own fabric services and management domains.

◆ FICON support
  • Supports IBM zSeries FICON and Linux environments

◆ Advanced traffic management for high-performance, resilient SANs
  • Virtual output queuing helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
  • Each port group consisting of 4 ports has a pool of 64 buffer credits, with a default of 16 buffer credits per port. When extended distances are required, up to 61 buffer credits can be allocated to a single port within the port group. This extensibility is available without additional licensing. Each of the 10-Gb/s ports has 64 buffer credits.
  • PortChannels allow users to aggregate up to 16 physical ISLs into a single logical bundle, providing optimized bandwidth use across all links. The bundle can consist of any port from the switch, helping ensure that the bundle remains active even in the event of a port group failure.
  • Fabric Shortest Path First (FSPF)-based multipathing provides the intelligence to load-balance across up to 16 equal-cost paths and, in the event of a switch failure, dynamically reroute traffic.
  • QoS can be used to manage bandwidth and control latency, to prioritize critical traffic.
• Comprehensive port and flow statistics facilitate sophisticated performance analysis and service-level agreement (SLA) accounting.

◆ Advanced diagnostics and troubleshooting tools
  • Integrates the industry’s most advanced analysis and debugging tools.

◆ Comprehensive security
  • VSANs are used to achieve higher security and greater stability by providing complete isolation among devices that are connected to the same physical SAN.
  • Intelligent packet inspection at the port level, including the application of access control lists (ACLs) for hardware enforcement of zones, VSANs, and advanced port security features.
  • Extended zoning capabilities help ensure that broadcasts are restricted to the selected zones (the broadcast zones).
  • FC-SP provides switch-to-switch and host-to-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication supporting RADIUS or TACACS+ to help ensure that only authorized devices access protected storage networks.

◆ High-availability platform for mission-critical environments
  • Nondisruptive software upgrades.
  • Hot-swappable, redundant fans and power supplies.
  • Ability to automatically restart failed processes.

◆ Simplified management
  • Consistent, logical CLI.
  • Quick Configuration Wizard.
  • Cisco Fabric Manager is included for integrated, comprehensive management of larger SAN environments.
  • An extensive set of APIs for integration with third-party and user-developed management tools.
Supported features

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the *EMC Connectrix MDS 9124 SAN-OS Release Notes* release notes on EMC Online Support at [https://support.emc.com](https://support.emc.com).

System architecture

**Performance and port configurations**

- Port speed: 4-, 2-, and 1-Gb/s autosensing with 4 Gb/s of dedicated bandwidth per port and 10-Gb/s of dedicated bandwidth for 10-Gb/s ports
- Buffer credits: Up to 64 for a group of 4 ports, with a default of 16 buffer credits per port for the 4-Gb/s ports and 64 buffer credits per 10-Gb/s port
- Ports per chassis: Up to 32 4-Gb/s ports and 2 10-Gb/s ports
  - Base configuration with 24 ports
  - Additional ports in 8-port increment with the port activation license for 4-Gb/s ports
  - Two 10-Gb/s ports with the 10-Gb/s port license
- PortChannels: Up to 16 ports in a PortChannel

**Security**

- VSANs
- Zoning
  - Hardware-enforced zoning
  - Logical-unit-number (LUN) zoning and read-only zones
- FC-SP for host-to-switch and switch-to-switch authentication
- Port security
- Management access
  - SSHv2
  - SNMPv3
  - IP ACLs

**Fabric services**
- Name server
- Registered state change notification (RSCN)
- Login services
- Public loop
- Broadcast
- In-order delivery
- Name-server zoning

**Advanced services**
- N-port ID virtualization
- VSANs
- PortChannels
- FICON protocol integration

**Diagnostics and troubleshooting tools**
- POST diagnostics
- Online diagnostics
- Internal loopbacks
- SPAN
- Fibre Channel Traceroute
- Fibre Channel Ping
- Fibre Channel Debug
- Cisco Fabric Analyzer
Management

**Access methods**
- Out-of-band 10/100 Ethernet port
- EIA/TIA-232 serial console port
- In-band Fibre Channel over IP (FCIP)

**Access protocols**
- CLI
- SNMP
- SMI-S

**Security**
- RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions
- VSAN-based roles
- SSHv2
- SNMPv3

**Management applications**
- MDS 9000 Family CLI
- Quick Configuration Wizard
- Cisco Fabric Manager, DCNM, and Device Manager
- Cisco Fabric Manager Server and DCNM Server (optional; requires licenses)

**Availability**
- Nondisruptive software upgrades
- Stateful process restart
- Per-VSAN fabric services
- Redundant, hot-swappable power supply and redundant, hot-swappable power supply and fan trays
- Hot-swappable SFP optics
- PortChannels aggregating up to 16 ports
Online diagnostics

Serviceability
- Configuration file management
- Call Home
- Port beaconing
- System LEDs
- SNMP traps for alerts

Environmental
- Ambient operating temperature is 32 to 104 degrees F (0 to 40 degrees C)
- Ambient nonoperating temperature is -40 to 158 degrees F (-40 to 70 degrees C)
- Physical dimensions (H x W x D) of 1RU: 1.75 x 17.5 x 16 in. (4.5 x 44.5 x 40.6 cm)
- Weight: Switch with dual power supplies: 20 lb (44 kg)

Power and cooling
Power supplies (300W) (maximum of 2 per switch):
- AC input: 100 to 240 VAC nominal (+/-10% for full range)
- Frequency: 50 to 60 Hz nominal (+/-3 Hz for full range)
- Power consumption: 99 W maximum with 0.99A at 100 VAC and 0.45A at 220 VAC
- Airflow
  - Front to rear

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
The Connectrix MDS 9222i Multiservice Modular Switch, as shown in Figure 43 on page 221, is an optimized platform for deploying high performance SAN extension solutions, distributed intelligent fabric services, and cost-effective multiprotocol connectivity for both open systems and mainframe environments. With a compact form factor, modularity, and advanced capabilities normally available only on director-class switches, the MDS 9222i is an ideal solution for departmental and remote branch-office SANs.

Sharing a consistent architecture with the MDS 9500 Series Multilayer Directors, the MDS 9222i offers 18 4-Gbps Fibre Channel ports and 4 1-Gigabit Ethernet IP storage services ports as standard in a fixed slot plus a modular expansion slot to host optional MDS 9000 Family switching and services modules. The SAN Extension over IP application package license is enabled as standard on the 4 fixed Gigabit Ethernet IP storage services ports, enabling features such as Fibre Channel over IP (FCIP) and compression on the switch without the need for additional licenses.

As the storage network continues to expand, the MDS 9000 Family switching or service module installed in the expansion slot can be removed from the MDS 9222i modular switch and migrated to MDS 9500 Series Multilayer Directors.

The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

The MDS 9222i provides unique multilayer and multiprotocol functions in a compact three-rack-unit (3RU) form factor. Key features of the MDS 9222i include:

- SAN consolidation with integrated multiprotocol support: The MDS 9222i provides as standard 18 fixed 4-Gb/s Fibre Channel ports for high-performance SAN connectivity and 4 fixed Gigabit Ethernet ports for Fibre Channel over IP (FCIP) and Small Computer System Interface over IP (iSCSI) storage services.
High-density Fibre Channel switch with 8-Gbps connectivity: The MDS 9222i supports the MDS 9000 4/44-Port 8-Gb/s Host-Optimized Fibre Channel Switching Module in the expansion slot, with four of the Fibre Channel ports capable of running at 8 Gb/s. Thus, the MDS 9222i cost-effectively scales up to 66 ports for both open systems and IBM Fiber Connection (FICON) mainframe environments. The MDS 9222i also supports an MDS 9000 4-Port 10-Gb/s Fibre Channel Switching Module in the expansion slot.

Intelligent application services engines: The MDS 9222i includes as standard a single application services engine in the fixed slot that enables the included SAN Extension over IP software solution package to run on the four fixed 1 Gigabit Ethernet storage services ports. The MDS 9222i can add a second services engine when a MDS 9000 18/4-Port Multiservice Module (MSM) is installed in the expansion slot. This additional engine can run a second advanced software application solution package such as MDS 9000 I/O Accelerator (IOA) to further improve the SAN Extension over IP performance and throughput running on the standard services engine. If even more intelligent services applications need to be deployed, the MDS 9000 16-Port Storage Services Node (SSN) can be installed in the expansion slot to provide four additional services engines for simultaneously running application software solution packages such as Cisco Storage Media Encryption (SME). Thus, the MDS 9222i switch platform scales from a single application service solution in the standard offering to a maximum of five heterogeneous or homogeneous application services, depending on the choice of optional service module that is installed in the expansion slot.

Hardware-based virtual fabric isolation with virtual SANs (VSANs) and Fibre Channel routing with Inter-VSAN Routing (IVR): VSANs and IVR enable deployment of large-scale multisite and heterogeneous SAN topologies. Integration into port-level hardware allows any port in a system or in a fabric to be partitioned into any VSAN. Included in the optional MDS 9000 Enterprise advanced software package, IVR provides line-rate routing between any of the ports in a system or in a fabric without the need for external routing appliances.

Remote SAN extension with high-performance FCIP:
• Simplifies data protection and business continuance strategies by enabling backup, remote replication, and other disaster-recovery services over WAN distances using open-standards FCIP tunneling.

• Optimizes utilization of WAN resources for backup and replication by enabling hardware-based compression, hardware-based encryption, FCIP write acceleration, and FCIP tape read and write acceleration; up to 16 virtual Inter-Switch Link (ISL) connections are provided on the 4 Gigabit Ethernet port through tunneling.

• Preserves MDS 9000 Family enhanced capabilities, including VSANs, IVR, advanced traffic management, and network security across remote connections.

◆ Cost-effective iSCSI connectivity to Ethernet-attached servers:
  • Extends the benefits of Fibre Channel SAN-based storage to Ethernet-attached servers at a lower cost than is possible using Fibre Channel interconnect alone.
  • Increases storage utilization and availability through consolidation of IP and Fibre Channel block storage.
  • Through transparent operation, preserves the capability of existing storage management applications.

◆ Advanced FICON services: The MDS 9222i supports FICON environments, including cascaded FICON fabrics, VSAN-enabled intermix of mainframe and open systems environments, and N-port ID virtualization (NPIV) for mainframe Linux partitions. IBM Control Unit Port (CUP) support enables in-band management of MDS 9200 Series switches from the mainframe management console. FICON tape acceleration reduces latency effects for FICON channel extension over FCIP for FICON tape read and write operations to mainframe physical or virtual tape. This feature is sometimes referred to as tape pipelining.

◆ Cisco Storage Media Encryption (SME) as distributed fabric service: Cisco SME encrypts data at rest on heterogeneous tape drives and virtual tape libraries (VTLs) in a SAN environment using secure IEEE standard Advanced Encryption Standard (AES) 256-bit algorithms. MDS 9222i helps ensure ease of deployment, scalability, and high availability by using innovative technology to transparently offer Cisco SME capabilities to any device connected to the fabric without the need for reconfiguration or rewiring. Cisco SME provisioning and key
management are both integrated into the Cisco Data Center Network Manager (DCNM) for SAN Essentials Edition (formerly Cisco Fabric Manager); no additional software is required.

- **Cisco Data Mobility Manager (DMM) as a distributed fabric service:** Cisco DMM is a fabric-based data migration solution that transfers block data nondisruptively across heterogeneous storage volumes and across distances, whether the host is online or offline.

- **Platform for intelligent fabric applications:** The MDS 9222i provides an open platform that delivers the intelligence and advanced features required to make multilayer intelligent SANs, including hardware-enabled innovations to host or accelerate applications for data migration, storage backup, data replication, and storage media encryption. Hosting or accelerating these applications in the network can improve scalability, availability, security, and manageability of the storage environment.

- **In Service Software Upgrade (ISSU) for Fibre Channel interfaces:** MDS 9222i promotes high serviceability by allowing MDS 9000 NX-OS Software to be upgraded while the Fibre Channel ports are carrying traffic.

- **Intelligent network services:** MDS 9222i uses VSAN technology for hardware-enforced, isolated environments within a single physical fabric, access control lists (ACLs) for hardware-based intelligent frame processing, and advanced traffic management features such as fabric-wide quality of service (QoS) to facilitate migration from SAN islands to enterprise-wide storage networks.

- **High-performance ISLs:** MDS 9222i supports up to 16 Fibre Channel inter-switch links (ISLs) in a single PortChannel. Links can span any port on any module in a chassis for added scalability and resilience. Up to 4095 buffer-to-buffer credits can be assigned to a single Fibre Channel port to extend storage networks over very long distances.

- **Comprehensive network security framework:** The MDS 9222i supports RADIUS and TACACS+, Fibre Channel Security Protocol (FC-SP), Secure File Transfer Protocol (SFTP), Secure Shell (SSH) Protocol, Simple Network Management Protocol Version 3 (SNMPv3) implementing AES, VSANs, hardware-enforced zoning, ACLs, and per-VSAN role-based access control (RBAC). Additionally, the Gigabit Ethernet ports offer IP Security (IPsec) authentication, data integrity, and hardware-assisted data encryption for FCIP and iSCSI.
- **IP Version 6 (IPv6) capable:** The MDS 9222i supports IPv6 as mandated by the U.S. Department of Defense (DoD), Japan, and China. IPv6 support is provided for FCIP, iSCSI, and management traffic routed in-band and out-of-band.

- **Sophisticated diagnostics:** The MDS 9222i provides intelligent diagnostics, protocol decoding, and network analysis tools as well as integrated call-home capability for added reliability, faster problem resolution, and reduced service costs.

![MDS 9222i Multiservice Modular Switch](image)

**Supported features**

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

**Unsupported features**

For the most up-to-date information on unsupported features, consult the *EMC Connectrix MDS 9124 SAN-OS Release Notes* release notes on EMC Online Support at [https://support.emc.com](https://support.emc.com).

**System architecture**

**Performance and port configurations**

- **Port speed:** 1/2/4-Gb/s autosensing, optionally configurable
- **Buffer credits:** 16 per port (shared-mode ports), up to 250 per port (dedicated-mode ports), and up to 4095 on an individual port (dedicated-mode ports with optional MDS 9000 Enterprise package license activated)
- **Ports per chassis:** 18 to 66 Fibre Channel ports and up to 20 Gigabit Ethernet ports
- Ports per rack: Up to 980
- PortChannels: Up to 16 physical links
- FCIP tunnels: Up to 3 per port

**Security**
- VSANs
- ACLs
- Per-VSAN RBAC
- Fibre Channel zoning
- N-port worldwide name (WWN)
- N-port FC-ID
- Fx-port WWN
- Fx-port WWN and interface index
- Fx-port domain ID and interface index
- Fx-port domain ID and port number
- iSCSI zoning
- iSCSI name
- IP address
- FC-SP
- DH-CHAP switch-to-switch authentication
- DH-CHAP host-to-switch authentication
- Port security and fabric binding
- IPsec for FCIP and iSCSI
- IKEv1 and IKEv2
- Management access
- SSHv2 implementing AES
- SNMPv3 implementing AES
- SFTP

**Fabric services**
- Name server
- Internet Storage Name Server (iSNS)
- Registered state change notification (RSCN)
- Login services
- Fabric Configuration Server (FCS)
- Public loop
- Broadcast
- In-order delivery

**Advanced services**
- VSANs
- IVR
- PortChannel with multipath load balancing
- Flow-based and zone-based QoS
- FCIP tape read and write acceleration
- FICON over FCIP tape read and write acceleration (pipelining)
- Cisco SME for tape and virtual tape

**Diagnostics and troubleshooting tools**
- POST diagnostics
- Online diagnostics
- Internal loopbacks
- SPAN (remote SPAN not supported)
- Fibre Channel traceroute
- Fibre Channel ping
- Fibre Channel debug
- Cisco Fabric Analyzer
- Syslog
- Online system health
- Port-level statistics
- Real-Time Protocol (RTP) debug

**FICON**
- FC-SB-3 compliant
- Cascaded FICON fabrics
- Intermix of FICON and Fibre Channel Protocol traffic
- CUP management interface
Management

Access methods
- Out-of-band 10/100 Ethernet port
- RS-232 serial console port
- In-band IP over Fibre Channel
- DB-9 COM port
- In-band FICON CUP over Fibre Channel

Access protocols
- CLI using the console and Ethernet ports
- SNMPv3 using the Ethernet port and in-band IP over Fibre Channel access
- Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S)
- FICON CUP
- Distributed Device Alias service

Security
- Per-VSAN - RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions
- SFTP
- SSHv2 implementing AES
- SNMPv3 implementing AES

Management applications
- MDS 9000 Family CLI
- Cisco Fabric Manager
- Cisco DCNM for SAN Essentials Edition
- Cisco DCNM for SAN Advanced Edition (optional software package)
- Cisco Device Manager
- Cisco Works Resource Manager Essentials (RME) and Device Fault Manager (DFM)

Serviceability
- Configuration file management
ISSU for Fibre Channel interfaces
- Call Home
- Power-management LEDs
- Port beaconing
- System LEDs
- SNMP traps for alerts
- Network boot

**Environmental**
- Ambient operating temperature is 32 to 104 degrees F (0 to 40 degrees C)
- Ambient nonoperating temperature is -40 to 158 degrees F (-40 to 75 degrees C)
- Humidity (RH), ambient (noncondensing) operating: 10 to 90%
- Humidity (RH), ambient (noncondensing) nonoperating and storage: 10 to 95%
- Operating altitude: -197 to 6500 ft (-60 to 2000m)
- Physical dimensions (H x W x D): 5.25 x 17.32 x 22.66 in. (13.34 x 43.99 x 57.56 cm), 3RUs; all units rack mountable in standard 19-inch Electronic Industries Alliance [EIA] rack
- Weight of fully configured chassis with optional switching module: 62 lb (28.2 kg)

**Power and cooling**
- Power supply: 845W AC
- Power Cord: notched C15 female connector mating to C16 male socket on power supply
- AC input characteristics
  - 100 to 240V AC (10% range)
  - 50 to 60 Hz (nominal)
- Airflow (side to side)
  - 200 linear feet per minute (LFM) through system fan assembly
- EMC recommends maintaining a minimum air space of 2.5 in. (6.4 cm) between walls and chassis air vents and a minimum horizontal separation of 6 in. (15.2 cm) between two chassis to prevent overheating
Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
The Connectrix MDS 9124 Multilayer Fabric Switch, as shown in Figure 44 on page 229, has 24 Fibre Channel ports capable of speeds of 4, 2, and 1 Gb/s, providing flexibility, high availability, security, and ease of use at an affordable price in a compact 1-rack-unit (1RU) form factor.

With its flexibility to expand from 8 to 24 ports in 8-port increments, the MDS 9124 offers the densities required for both departmental SAN switches and edge switches in enterprise SANs. The MDS 9124 supports quick configuration and task wizards that allow it to be deployed quickly and easily in networks of any size.

Powered by MDS 9000 NX-OS software, it includes advanced storage networking features and functions and is compatible with MDS 9500 Series Multilayer Directors and MDS 9200 Series Multiservice Fabric Switches, providing transparent, end-to-end service delivery in core-edge deployments. The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9124 include:

- **Flexibility and scalability**
  - Up to 24 autosensing Fibre Channel ports capable of speeds of 4, 2, and 1 Gb/s in a compact 1RU form-factor chassis
  - Advanced storage networking capabilities built into the platform
  - Hot-swappable, Small Form-Factor Pluggable (SFP), LC interfaces
    - All SFP interfaces are 4, 2, and 1 Gb/s, with autosensing capabilities.
    - Individual ports can be configured with either short- or longwavelength SFP optics for connectivity up to 500 meters (m) and 10 kilometers (km), respectively.
- **VSANs for segmentation and isolation**
  - Up to 16 VSANs are supported per switch.
• Each VSAN can be zoned as a typical SAN and maintains its own fabric services and management domains.
• Advanced traffic management for high-performance, resilient SANs
  • Virtual output queuing helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
  • Each port group consisting of 4 ports has a pool of 64 buffer credits, with a default of 16 buffer credits per port. When extended distances are required, up to 61 buffer credits can be allocated to a single port within the port group. This extensibility is available without additional licensing.
  • PortChannels allow users to aggregate up to 16 physical ISLs into a single logical bundle, providing optimized bandwidth use across all links. The bundle can consist of any port from the switch, helping ensure that the bundle remains active even in the event of a port group failure.
  • Fabric Shortest Path First (FSPF)-based multipathing provides the intelligence to load-balance across up to 16 equal-cost paths and, in the event of a switch failure, dynamically reroute traffic.
  • QoS can be used to manage bandwidth and control latency, to prioritize critical traffic.
  • Comprehensive port and flow statistics facilitate sophisticated performance analysis and service-level agreement (SLA) accounting.
• Advanced diagnostics and troubleshooting tools
  • Integrates the industry’s most advanced analysis and debugging tools.
• Comprehensive security
  • VSANs are used to achieve higher security and greater stability by providing complete isolation among devices that are connected to the same physical SAN.
  • Intelligent packet inspection at the port level, including the application of access control lists (ACLs) for hardware enforcement of zones, VSANs, and advanced port security features.
  • Extended zoning capabilities help ensure that broadcasts are restricted to the selected zones (the broadcast zones).
- FC-SP provides switch-to-switch and host-to-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication supporting RADIUS or TACACS+ to help ensure that only authorized devices access protected storage networks.

- High-availability platform for mission-critical environments
  - Nondisruptive software upgrades.
  - Hot-swappable, redundant fans and power supplies.
  - Ability to automatically restart failed processes.

- Simplified management
  - Consistent, logical CLI.
  - Quick Configuration Wizard.
  - Cisco DCNM can be licensed for management of a combination of SAN and LAN environments.
  - An extensive set of APIs for integration with third-party and user-developed management tools.

For the most up-to-date information on supported features, consult the [EMC Support Matrix](https://support.emc.com) located on the E-Lab Interoperability Navigator.

For the most up-to-date information on unsupported features, consult the [EMC Connectrix MDS 9124 SAN-OS Release Notes](https://support.emc.com) release notes on EMC Online Support at [https://support.emc.com](https://support.emc.com).
System architecture

Performance and port configurations
- Port speed: 4-, 2-, and 1-Gb/s autosensing with 4 Gb/s of dedicated bandwidth per port
- Buffer credits: Up to 64 for a group of 4 ports, with a default of 16 buffer credits per port
- Ports per chassis: Up to 24 ports (base configuration with 8 ports; additional ports in 8-port increments with the port activation license)
- PortChannels: Up to 16 ports in a PortChannel

Security
- VSANs
- Zoning
  - Hardware-enforced zoning
  - Logical-unit-number (LUN) zoning and read-only zones
- FC-SP for host-to-switch and switch-to-switch authentication
- Port security
- Management access
  - SSHv2
  - SNMPv3
  - IP ACLs

Fabric services
- Name server
- Registered state change notification (RSCN)
- Login services
- Public loop
- Broadcast
- In-order delivery
- Name-server zoning

Diagnostics and troubleshooting tools
- POST diagnostics
- Online diagnostics
- Internal loopbacks
- SPAN
- Fibre Channel Traceroute
- Fibre Channel Ping
- Fibre Channel Debug
- Cisco Fabric Analyzer
- Syslog
- Port-level statistics

Management

Access methods
- Out-of-band 10/100 Ethernet port
- EIA/TIA-232 serial console port
- In-band IP over Fibre Channel

Access protocols
- CLI
- SNMP
- SMI-S

Security
- RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions
- VSAN-based roles
- SSHv2
- SNMPv3

Management applications
- MDS 9000 Family CLI
- Cisco Device Manager
- Cisco Fabric Manager
- Cisco DCNM for SAN Essentials Edition
- Cisco DCNM for SAN Advanced Edition (optional software package)
Availability
- Nondisruptive software upgrades
- Stateful process restart
- Per-VSAN fabric services
- Redundant, hot-swappable power supplies and fans (optional)
- Hot-swappable SFP optics
- PortChannels aggregating up to 16 ports
- Online diagnostics
- NPVmode with F-Port trunking and channeling (edge switch deployment only)

Serviceability
- Configuration file management
- Call Home
- Port beaconing
- System LEDs
- SNMP traps for alerts

Environmental
- Ambient operating temperature is 32 to 104 degrees F (0 to 40 degrees C)
- Ambient nonoperating temperature is -40 to 158 degrees F (-40 to 70 degrees C)
- Physical dimensions (H x W x D) of 1RU: 1.75 x 17.5 x 16 in. (4.5 x 44.5 x 40.6 cm)
- Weight: Switch with dual power supplies: 18.5 lb (8.4 KG)

Power and cooling
AC power supplies (300W) (maximum of 2 per switch):
- Input: 100 to 240 VAC nominal (+/-10% for full range)
  - Input current maximum 20A
- Input current steady state
  - 4A @ 110 VAC
  - 2A @ 220 VAC
  - 50 to 60 Hz nominal (+/-3 Hz for full range)
- Output
• Consumption: 80W, 0.73A@110V, 0.36A@220V

◆ DC Power supplies (300W) (maximum of 2 per switch)
  • Input: 8A @-48V to -60V
  • Output: 25A @ 12 VDC

◆ Airflow
  • Front to rear

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connectrix MDS 9513

The MDS 9513 chassis is a Director Class switch capable to support up to 528 ports in a single chassis capable of 1/2/4 Gb speeds. MDS 9513s are installed with Supervisor-2 modules only, and support all of the Cisco line cards Generation 1 and 2 with the caveat that utilizing one or the other, or subsequent mixture of line cards will reduce or increase the number of ports capable of being used.

All line cards supported (12, 16, 24, 32, 48) are capable of 1/2/4 Gb FC and 10 Gb FC. These line cards are also supported in the MDS 9200 and MDS 9500 switches. IPS and 14/2 blades are also supported in the director class MDS-9500 series. The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9513 include:

- Up to 528 ports in a single chassis
- Generation 2 line cards
  - 12-port supports 1/2/4 Gb/s
    - Dedicated bandwidth at 1/2/4 Gb/s
  - 24-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 48-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 2 Gb/s
    - 4:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 4-port supports 10 Gb/s speed
- For 24-port and 48-port modules, Port Bandwidth Reservation feature allows dedicating specific bandwidth to each particular port. This provides the optimal allowed bandwidth allocation for any types of applications as well as high performance ISLs within logical appropriated reason. Each line card has 4-port groups that
accommodates 12.8 Gb/s of shared bandwidth. When using dedicated bandwidth on specific ports, remaining ports within a group will share the remaining available bandwidth.

- **24-port Module**
  4 groups of 6 ports share 12.8 Gb/s of bandwidth
  Port Groupings:
  - Group1: Ports 1-6
  - Group2: Ports 7-12
  - Group3: Ports 13-18
  - Group4: Ports 19-24

- **48-port Module**
  4 groups of 12 ports shares 12.8 Gb/s of bandwidth
  Port Groupings:
  - Group1: Ports 1-12
  - Group2: Ports 13-24
  - Group3: Ports 25-36
  - Group4: Ports 37-48

- 4095 Extended Buffer credits on all the Generation-2 line cards.

- Supports Generation-1 switching Modules and all of their Features
  - Fibre Channel Switching Modules
  - IP Storage Services Modules
  - Multiprotocol Service Module
  - Storage Services Module

- Up to 20 VSAN per switch
- Redundant supervisors also providing non-disruptive upgrade
- Redundant power supplies
- Up to 16 links in a Port-Channel providing up to 64 Gb of bandwidth
- Port mode support of E, TE, FL, F and SD (Span Destination)
Figure 45  MDS 9513 chassis front panel view

<table>
<thead>
<tr>
<th>Legend</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Switching or services modules in slots 1-6</td>
</tr>
<tr>
<td>2</td>
<td>Supervisor-2 modules in slot 7 and slot 8</td>
</tr>
<tr>
<td>3</td>
<td>Switching or services modules in slots 9-13</td>
</tr>
<tr>
<td>4</td>
<td>Fan Tray</td>
</tr>
</tbody>
</table>
Figure 46  MDS 9513 chassis rear panel view

Legend

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<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supplies</td>
</tr>
<tr>
<td>2</td>
<td>Crossbar Module Fans</td>
</tr>
<tr>
<td>3</td>
<td>Crossbar Modules</td>
</tr>
<tr>
<td>4</td>
<td>Clock Module - Clock modules are located inside the air vent panel. You must remove the air vent panel to access the clock modules</td>
</tr>
<tr>
<td>5</td>
<td>Air Vent Panels</td>
</tr>
</tbody>
</table>
Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the EMC Connectrix MDS 9000 SAN-OS Release Notes release notes on EMC Online Support at https://support.emc.com.

System architecture

<table>
<thead>
<tr>
<th>Generation-1 Switching Modules</th>
<th>Generation-2 Switching Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-port FC Module (1/2 Gb)</td>
<td>12-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>32-port FC Module (1/2 Gb)</td>
<td>24-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>Storage Services Module (SSM)</td>
<td>48-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>IP Services 4-port GE Module (IPS4)</td>
<td>4-port FC Module (10 Gb)</td>
</tr>
<tr>
<td>IP Services 8-port GE Module (IPS8)</td>
<td></td>
</tr>
<tr>
<td>Multi-Protocol Services Module (MPS – 14 FC + 2 GE)</td>
<td></td>
</tr>
</tbody>
</table>

With second generation line cards able to be used on first generation chassis, such as the MDS 9506 and MDS 9509, Table 26 on page 252 shows capabilities for all three chassis.

Management

Management software supported

- EMC ControlCenter
- Fabric Manager
- Device Manager
- DCNM
- Web-Based GUI
- Scriptable CLI
- Policy Base Alerts
- Fabric API
- End-to-End Performance Monitoring
- On-line Fault Isolation

**Mechanical specifications**
- Height = 24.5 inches (14RU)
- Weight = 17.37 inches
- Depth = 28.0 inches

**Power**

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Description</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS 9513 Common Equipment</td>
<td>MDS 9513 common equipment includes:</td>
<td>696</td>
</tr>
<tr>
<td>(Use EMC ids for this column)</td>
<td>• DS-C9513 Chassis (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-13SLT-FAN-F (1) : Front Fan Tray</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-13SLT-FAN-R (1) : Rear Fan Tray</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-13SLT-FAB1 (2) : Crossbar Fabric</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-C9513-CL (2) : Clock Module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-X9530-SF2-K9 (2) – Supervisor/Fabric-2</td>
<td></td>
</tr>
<tr>
<td>DS-X9112</td>
<td>MDS 9000 12-port 1/2/4 Gb/s FC Module</td>
<td>132</td>
</tr>
<tr>
<td>DS-X9124</td>
<td>MDS 9000 24-port 1/2/4 Gb/s FC Module</td>
<td>147</td>
</tr>
<tr>
<td>DS-X9148</td>
<td>MDS 9000 48-port 1/2/4 Gb/s FC Module</td>
<td>185</td>
</tr>
<tr>
<td>DS-X9704</td>
<td>MDS 9000 4-port 10 Gb/s FC Module</td>
<td>172</td>
</tr>
</tbody>
</table>
Weight

<table>
<thead>
<tr>
<th>MDS 9513 chassis component</th>
<th>Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis (includes fans and clock modules)</td>
<td>100.0</td>
</tr>
</tbody>
</table>
| Power Supply (6000W AC)
\(^a\)                   | 32.5            |
| Front Fan Tray                                   | 18.0            |
| Rear Fan Tray                                    | 2.25            |
| Crossbar Fabric Module
\(^a\)                        | 5.75            |
| Supervisor-2 Module
\(^a\)                        | 7.25            |
| 12-Port 1/2/4 Gb/s Fibre Channel Module         | 7.75            |
| 24-Port 1/2/4 Gb/s Fibre Channel Module         | 7.75            |
| 48-Port 1/2/4 Gb/s Fibre Channel Module         | 11.0            |
| Line Card Blank Panel                           | 0.5             |

\(^a\) 2 of such units are needed for a normal HA configuration of the switch.

Protocols

- FC
- FICON
- IP-FC
- FCIP
- iSCSI

Further reading

For details on MDS platform features and functionality, refer to Connectrix M release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connectrix MDS 9509

The MDS 9509 chassis is a Director class switch capable to support up to 336 ports in a single chassis capable of 1/2/4 Gb speeds. MDS 9509s are installed with Supervisor-1 or Supervisor-2 modules only and support all of the Cisco line cards Generation 1 and 2 with the caveat that utilizing one or the other, or subsequent mixture of line cards, will reduce or increase the number of ports capable of being used. All line cards supported (12, 16, 24, 32, 48) are capable of 1/2/4 Gb FC and 10 Gb FC. These line cards are also supported in the MDS 9200 and MDS 9500 switches. IPS and 14/2 blades are also supported in the director class MDS-9500 series. The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9509 include:

- Up to 336 ports in a single chassis
- Generation 2 line cards
  - 12-port supports 1/2/4 Gb/s
    - Dedicated bandwidth at 1/2/4 Gb/s
  - 24-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1/2 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 48-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 2 Gb/s
    - 4:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 4-port supports 10 Gb/s speed
- For 24-port and 48-port modules, Port Bandwidth Reservation feature allows dedicating specific bandwidth to each particular port. This provides the optimal allowed bandwidth allocation for any types of applications as well as high performance ISLs within logical appropriated reason. Each line card has 4-port groups that
accommodates 12.8 Gb/s of shared bandwidth. When using dedicated bandwidth on specific ports, remaining ports within a group will share the remaining available bandwidth.

- **24-port module**
  - 4 groups of 6 ports share 12.8 Gb/s of bandwidth
  - Port groupings:
    - Group1: Ports 1-6
    - Group2: Ports 7-12
    - Group3: Ports 13-18
    - Group4: Ports 19-24

- **48-port module**
  - 4 groups of 12 ports share 12.8 Gb/s of bandwidth
  - Port groupings:
    - Group1: Ports 1-12
    - Group2: Ports 13-24
    - Group3: Ports 25-36
    - Group4: Ports 37-48

- 4095 extended buffer credits on all the Generation-2 line cards.
- Supports Generation-1 switching modules and all of their features
  - Fibre Channel Switching Modules
  - IP Storage Services Modules
  - Multiprotocol Service Module
  - Storage Services Module
- Up to 20 VSAN per switch
- Redundant supervisors also providing non-disruptive upgrade
- Redundant power supplies
- Up to 16 links in a port-channel providing up to 64 Gb of bandwidth
- Port mode support of E, TE, FL, F and SD (Span Destination)
Front panel

Figure 47 shows the front panel of the MDS 9509.

**Legend**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Switching or services modules in slots 1-4</td>
</tr>
<tr>
<td>2</td>
<td>Supervisor module in slot 5</td>
</tr>
<tr>
<td>3</td>
<td>Redundant supervisor module in slot 6</td>
</tr>
<tr>
<td>4</td>
<td>Switching or services modules in slots 7-9</td>
</tr>
<tr>
<td>5</td>
<td>Fan module</td>
</tr>
<tr>
<td>6</td>
<td>Power supply 1</td>
</tr>
<tr>
<td>7</td>
<td>ESD socket</td>
</tr>
<tr>
<td>8</td>
<td>Power supply 2 (redundant)</td>
</tr>
</tbody>
</table>
Figure 47 shows the rear panel of the MDS 9509.

Figure 48  MDS 9509 chassis rear panel view

Legend

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clock A (CLK A)</td>
</tr>
<tr>
<td>2</td>
<td>Clock B (CLK B)</td>
</tr>
</tbody>
</table>

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.
Unsupported features

MDS 9509 supports SAN OS 3.0(2) and subsequent releases moving forward. For the most up-to-date information on unsupported features, consult the EMC Connectrix MDS 9000 SAN-OS Release Notes release notes on EMC Online Support at https://support.emc.com.

System architecture

<table>
<thead>
<tr>
<th>Generation-1 Switching Modules</th>
<th>Generation-2 Switching Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-port FC Module (1/2 Gb)</td>
<td>12-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>32-port FC Module (1/2 Gb)</td>
<td>24-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>Storage Services Module (SSM)</td>
<td>48-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>IP Services 4-port GE Module (IPS4)</td>
<td>4-port FC Module (10 Gb)</td>
</tr>
<tr>
<td>IP Services 8-port GE Module (IPS8)</td>
<td></td>
</tr>
<tr>
<td>Multi-Protocol Services Module (MPS – 14 FC + 2 GE)</td>
<td></td>
</tr>
</tbody>
</table>

With second generation line cards able to be used on first generation chassis, such as the MDS 9506 and MDS 9509, Table 26 on page 252 shows chassis support and capabilities.

Management

Management software supported
- EMC ControlCenter
- Fabric Manager
- Device Manager
- DCNM
- Web-Based GUI
- Scriptable CLI
- Policy Base Alerts
- Fabric API
- End-to-End Performance Monitoring
◆ On-line Fault Isolation

**Mechanical specifications**
◆ Height = 24.5 inches (14RU)
◆ Weight = 17.37 inches
◆ Depth = 28.0 inches

**Power**

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Description</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS 9513</td>
<td>MDS 9513 common equipment includes:</td>
<td>696</td>
</tr>
<tr>
<td>Common</td>
<td>• DS-C9513 Chassis (1)</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>• DS-13SLT-FAN-F (1) : Front Fan Tray</td>
<td></td>
</tr>
<tr>
<td>(Use EMC ids</td>
<td>• DS-13SLT-FAN-R (1) : Rear Fan Tray</td>
<td></td>
</tr>
<tr>
<td>for this column)</td>
<td>• DS-13SLT-FAB1 (2) : Crossbar Fabric</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-C9513-CL (2) : Clock Module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DS-X9530-SF2-K9 (2) – Supervisor/Fabric-2</td>
<td></td>
</tr>
<tr>
<td>DS-X9112</td>
<td>MDS 9000 12-port 1/2/4 Gb/s FC Module</td>
<td>132</td>
</tr>
<tr>
<td>DS-X9124</td>
<td>MDS 9000 24-port 1/2/4 Gb/s FC Module</td>
<td>147</td>
</tr>
<tr>
<td>DS-X9148</td>
<td>MDS 9000 48-port 1/2/4 Gb/s FC Module</td>
<td>185</td>
</tr>
<tr>
<td>DS-X9704</td>
<td>MDS 9000 4-port 10 Gb/s FC Module</td>
<td>172</td>
</tr>
</tbody>
</table>
Weight

<table>
<thead>
<tr>
<th>MDS 9513 chassis component</th>
<th>Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis (includes fans and clock modules)</td>
<td>100.0</td>
</tr>
<tr>
<td>Power Supply (6000W AC)a</td>
<td>32.5</td>
</tr>
<tr>
<td>Front Fan Tray</td>
<td>18.0</td>
</tr>
<tr>
<td>Rear Fan Tray</td>
<td>2.25</td>
</tr>
<tr>
<td>Crossbar Fabric Modulea</td>
<td>5.75</td>
</tr>
<tr>
<td>Supervisor-2 Modulea</td>
<td>7.25</td>
</tr>
<tr>
<td>12-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>7.75</td>
</tr>
<tr>
<td>24-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>7.75</td>
</tr>
<tr>
<td>48-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>11.0</td>
</tr>
<tr>
<td>Line Card Blank Panel</td>
<td>0.5</td>
</tr>
</tbody>
</table>

a. 2 of such units are needed for a normal HA configuration of the switch.

Protocols

- FC
- FICON
- IP-FC
- FCIP
- iSCSI

Further reading

For details on MDS platform features and functionality, refer to Connectrix M release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connectrix MDS 9506

The MDS 9506 chassis is a Director class switch capable to support up to 192 ports in a single chassis capable of 1/2/4 Gb speeds. MDS 9506s can be installed with Supervisor-1 or 2 modules and support all of the Cisco line cards Generation 1 and 2 with the caveat that utilizing one or the other, or subsequent mixture of line cards, will reduce or increase the number of ports capable of being used. All line cards supported (12, 16, 24, 32, 48) are capable of 1/2/4 Gb FC and 10 Gb FC. These line cards are also supported in the MDS 9200 and MDS 9500 switches. IPS and 14/2 blades are also supported in the director class MDS-9500 series. The following information will help guide implementers design SAN environments and topologies by utilizing the features provided by MDS platform. For more information on the MDS hardware can be found at www.cisco.com.

Key features

Key features of the MDS 9506 include:

- Up to 192 ports in a single chassis
- Generation 2 line cards
  - 12-port supports 1/2/4 Gb/s
    - Dedicated bandwidth at 1/2/4 Gb/s
  - 24-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1/2 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 48-port supports 1/2/4 Gb/s speeds
    - Dedicated bandwidth at 1 Gb/s
    - 2:1 shared (oversubscribed) bandwidth at 2 Gb/s
    - 4:1 shared (oversubscribed) bandwidth at 4 Gb/s
  - 4-port supports 10 Gb/s speed
- For 24-port and 48-port modules, Port Bandwidth Reservation feature allows dedicating specific bandwidth to each particular port. This provides the optimal allowed bandwidth allocation for any types of applications as well as high performance ISLs within logical appropriated reason. Each line card has 4-port groups that
accommodates 12.8 Gb/s of shared bandwidth. When using dedicated bandwidth on specific ports, remaining ports within a group will share the remaining available bandwidth.

- **24-port module**
  4 groups of 6 ports share 12.8 Gb/s of bandwidth
  Port groupings:
  - Group1: Ports 1-6
  - Group2: Ports 7-12
  - Group3: Ports 13-18
  - Group4: Ports 19-24

- **48-port module**
  4 groups of 12 ports share 12.8 Gb/s of bandwidth
  Port groupings:
  - Group1: Ports 1-12
  - Group2: Ports 13-24
  - Group3: Ports 25-36
  - Group4: Ports 37-48

- 4095 extended buffer credits on all the Generation-2 line cards.
- Supports Generation-1 switching modules and all of their features
  - Fibre Channel switching modules
  - IP Storage services modules
  - Multiprotocol service module
  - Storage services module

- Up to 20 VSAN per switch
- Redundant supervisors also providing non-disruptive upgrade
- Redundant power supplies
- Up to 16 links in a port channel providing up to 64 Gb of bandwidth
- Port mode support of E, TE, FL, F and SD (Span Destination)
Front panel

Figure 49 shows the front panel of the MDS 9506.

Figure 49  MDS 9506 chassis front panel view

<table>
<thead>
<tr>
<th>Legend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Switching or services modules in slots 1-4</td>
</tr>
<tr>
<td>2</td>
<td>Supervisor modules in slot 5 and slot 6</td>
</tr>
<tr>
<td>3</td>
<td>Fan module</td>
</tr>
<tr>
<td>4</td>
<td>ESD Socket</td>
</tr>
<tr>
<td>5</td>
<td>Power supplies (in back)</td>
</tr>
<tr>
<td>6</td>
<td>Location of power entry modules (PEMs) — one PEM shown and one filler panel shown.</td>
</tr>
</tbody>
</table>
Rear panel

Figure 50 shows the front panel of the MDS 9506.

![MDS 9506 chassis rear panel view](image)

**Legend**

| 1 | Clock module |

**Supported features**

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.

**Unsupported features**

MDS 9506 supports SAN OS 3.0(2) and subsequent releases moving forward. For the most up-to-date information on unsupported features, consult the *EMC Connectrix MDS 9000 SAN-OS Release Notes* release notes on EMC Online Support at [https://support.emc.com](https://support.emc.com).
**System architecture**

<table>
<thead>
<tr>
<th>Generation-1 Switching Modules</th>
<th>Generation-2 Switching Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-port FC Module (1/2 Gb)</td>
<td>12-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>32-port FC Module (1/2 Gb)</td>
<td>24-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>Storage Services Module (SSM)</td>
<td>48-port FC Module (1/2/4 Gb)</td>
</tr>
<tr>
<td>IP Services 4-port GE Module (IPS4)</td>
<td>4-port FC Module (10 Gb)</td>
</tr>
<tr>
<td>IP Services 8-port GE Module (IPS8)</td>
<td></td>
</tr>
<tr>
<td>Multi-Protocol Services Module (MPS – 14 FC + 2 GE)</td>
<td></td>
</tr>
</tbody>
</table>

With second generation line cards able to be used on first generation chassis, such as the MDS 9506 and MDS 9509, Table 26 shows capabilities for all three chassis.

**Table 26**  
Chassis capabilities (page 1 of 6)
## Table 26  Chassis capabilities (page 2 of 6)

<table>
<thead>
<tr>
<th>Feature</th>
<th>MDS 9506</th>
<th>MDS 9500</th>
<th>MDS 9513</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre Channel standard port Types E, F, FL, B, Private loop (B Port and Private loop not supported)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fibre Channel standard port Types SD, ST, TE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FC Ports per blade</td>
<td>14, 16, or 32</td>
<td>14, 16, or 32</td>
<td>14, 16, or 32</td>
</tr>
<tr>
<td>GE Ports per blade (4-port GigE module discontinued)</td>
<td>2 or 8</td>
<td>2 or 8</td>
<td>2 or 8</td>
</tr>
<tr>
<td>Port blades per chassis</td>
<td>4</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td><strong>Fibre Channel Ports (Generation 2 Switching Modules)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Speed</td>
<td>1 Gb/s/2 Gb/s autosensing</td>
<td>1 Gb/s/2 Gb/s autosensing</td>
<td>1 Gb/s/2 Gb/s autosensing</td>
</tr>
<tr>
<td>CWDM</td>
<td>Yes, 100 Km, 1 &amp; 2 Gb/s only</td>
<td>Yes, 100 Km, 1 &amp; 2 Gb/s only</td>
<td>Yes, 100 Km, 1 &amp; 2 Gb/s only</td>
</tr>
<tr>
<td>DWDM</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fibre Channel standard port Types E, F, FL</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fibre Channel standard port Types SD, ST, TE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FC Ports per blade</td>
<td>12, 24, 48 1/2/4 Gb/s ports, 4 10 Gb/s ports</td>
<td>12, 24, 48 1/2/4 Gb/s ports, 4 10 Gb/s ports</td>
<td>12, 24, 48 1/2/4 Gb/s ports, 4 10 Gb/s ports</td>
</tr>
<tr>
<td>Port blades per chassis</td>
<td>4</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td><strong>Performance (Generation 2)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabric Bandwidth</td>
<td>1.4 Tb/s</td>
<td>1.4 Tb/s</td>
<td>2.2 Tb/s</td>
</tr>
<tr>
<td>Fully Non-Blocking</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Virtual Output Queues</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data Rate 12-Port Module</td>
<td>Full line rate at all supported speeds</td>
<td>Full line rate at all supported speeds</td>
<td>Full line rate at all supported speeds</td>
</tr>
<tr>
<td>Feature</td>
<td>MDS 9506</td>
<td>MDS 9500</td>
<td>MDS 9513</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Data Rate 24-Port Module</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 4 Gb/s</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 4 Gb/s</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 4 Gb/s</td>
</tr>
<tr>
<td>Data Rate 48-Port Module</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 2 Gb/s 4:1 Oversubscribed at 4 Gb/s</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 2 Gb/s 4:1 Oversubscribed at 4 Gb/s</td>
<td>Full line rate at 1/2 Gb/s speeds 2:1 Oversubscribed at 2 Gb/s 4:1 Oversubscribed at 4 Gb/s</td>
</tr>
<tr>
<td>Ethernet Ports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Speed</td>
<td>1 Gb/s</td>
<td>1 Gb/s</td>
<td>1 Gb/s</td>
</tr>
<tr>
<td>Long Wave SFP</td>
<td>10 Km</td>
<td>10 Km</td>
<td>10 Km</td>
</tr>
<tr>
<td>CWDM</td>
<td>Yes, 100 Km</td>
<td>Yes, 100 Km</td>
<td>Yes, 100 Km</td>
</tr>
<tr>
<td>DWDM</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FCIP Support</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>iSCSI Support</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EtherChannel Support</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Virtual ISL per port (FCIP)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ports per blade</td>
<td>2 or 8</td>
<td>2 or 8</td>
<td>2 or 8</td>
</tr>
<tr>
<td>Ports per chassis</td>
<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Max Ports per chassis</td>
<td>24</td>
<td>48</td>
<td>80</td>
</tr>
<tr>
<td>Features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtual SANs (VSAN)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Port Channel with Multipath Load Balancing</td>
<td>Up to 16 ports per Port Channel across switching modules</td>
<td>Up to 16 ports per Port Channel across switching modules</td>
<td>Up to 16 ports per Port Channel across switching modules</td>
</tr>
<tr>
<td>QoS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 26  Chassis capabilities  (page 4 of 6)

<table>
<thead>
<tr>
<th></th>
<th>MDS 9506</th>
<th>MDS 9500</th>
<th>MDS 9513</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max BB_Credits per port (Without using Licensed Extended Buffer Credit feature)</strong></td>
<td>255 per port in the 16-Port Module</td>
<td>255 per port in the 16-Port Module</td>
<td>255 per port in the 16-Port Module</td>
</tr>
<tr>
<td></td>
<td>12 per port in the 32-Port Module</td>
<td>12 per port in the 32-Port Module</td>
<td>12 per port in the 32-Port Module</td>
</tr>
<tr>
<td></td>
<td>255 per port in MPS-14/2-Module</td>
<td>255 per port in MPS-14/2-Module</td>
<td>255 per port in MPS-14/2-Module</td>
</tr>
<tr>
<td></td>
<td>250 per port in the 12-Port Module</td>
<td>250 per port in the 12-Port Module</td>
<td>250 per port in the 12-Port Module</td>
</tr>
<tr>
<td></td>
<td>250 per port in dedicated mode for 24-Port and 48-Port Module</td>
<td>250 per port in dedicated mode for 24-Port and 48-Port Module</td>
<td>250 per port in dedicated mode for 24-Port and 48-Port Module</td>
</tr>
<tr>
<td><strong>Extended Buffer Credit (Licensed feature)</strong></td>
<td>Up to 4095 Buffer Credits per port. Supported on all Generation-2 switching modules.</td>
<td>Up to 4095 Buffer Credits per port. Supported on all Generation-2 switching modules.</td>
<td>Up to 4095 Buffer Credits per port. Supported on all Generation-2 switching modules.</td>
</tr>
<tr>
<td></td>
<td>Up to 3500 per port supported on MPS-14/2 module.</td>
<td>Up to 3500 per port supported on MPS-14/2 module.</td>
<td>Up to 3500 per port supported on MPS-14/2 module.</td>
</tr>
</tbody>
</table>

### Zoning

<table>
<thead>
<tr>
<th></th>
<th>MDS 9506</th>
<th>MDS 9500</th>
<th>MDS 9513</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N_Port WWN</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>F_Port WWN</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>N_Port FCID</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>Port</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>Broadcast</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>Default</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>LUN</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
<tr>
<td><strong>Read Only</strong></td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
<td>Yes, HW enforced</td>
</tr>
</tbody>
</table>
## Table 26  Chassis capabilities (page 5 of 6)

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<th>MDS 9500</th>
<th>MDS 9513</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-level Management Access Control</td>
<td>Yes, Role-based</td>
<td>Yes, Role-based</td>
<td>Yes, Role-based</td>
</tr>
<tr>
<td>VSAN-Based Access Control</td>
<td>Yes, release 1.2 and higher</td>
<td>Yes, release 1.2 and higher</td>
<td>Yes, release 3.0</td>
</tr>
<tr>
<td>Port Security</td>
<td>Yes, release 1.2 and higher</td>
<td>Yes, release 1.2 and higher</td>
<td>Yes, release 3.0</td>
</tr>
<tr>
<td>RADIUS Support</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>TACACS Support</td>
<td>Yes, release 1.3 and higher</td>
<td>Yes, release 1.3 and higher</td>
<td>Yes, release 3.0</td>
</tr>
<tr>
<td>SNMPv3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>RBAC</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FC-SP for switch-to-switch and host-to-switch authentication</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SSH</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SFTP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Platform High Availability Features</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot-swap Supervisor Modules</td>
<td>Yes, non-disruptive</td>
<td>Yes, non-disruptive</td>
<td>Yes, non-disruptive</td>
</tr>
<tr>
<td>Hot-swap Optics</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot-swap Power</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot-swap Fan Assemblies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot-swap Line Cards</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot-swap Cross-bars</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dual OOB Management Channels</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dual System Clocks</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stateful Process Restartability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Serviceability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-disruptive processor failover</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>MDS 9506</td>
<td>MDS 9500</td>
<td>MDS 9513</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Non-disruptive code load</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-disruptive code activation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-disruptive line card replacement</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SNMP traps for alerts</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Configuration file management</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Network Boot</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Call Home</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Diagnostics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FC Ping</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FC Traceroute</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Port Beacon</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Online Port Loopback</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Port Level Statistics</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>On-Line System Health</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Real Time Protocol Debug</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SPAN</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Remote SPAN</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Embedded Protocol Analyzer</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Embedded CLI Audit</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Syslog</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Management

Management software supported
- EMC ControlCenter
- Fabric Manager
- Device Manager
- DCNM
- Web-Based GUI
- Scriptable CLI
- Policy Base Alerts
- Fabric API
- End-to-End Performance Monitoring
- On-line Fault Isolation

Mechanical specifications
- Height = 24.5 inches (14RU)
- Weight = 17.37 inches
- Depth = 28.0 inches

Power

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Description</th>
<th>Power (W)</th>
</tr>
</thead>
</table>
| MDS 9513 Common Equipment | MDS 9513 common equipment includes:  
- DS-C9513 Chassis (1)  
- DS-13SLT-FAN-F (1) : Front Fan Tray  
- DS-13SLT-FAN-R (1) : Rear Fan Tray  
- DS-13SLT-FAB1 (2) : Crossbar Fabric  
- DS-C9513-CL (2) : Clock Module  
- DS-X9530-SF2-K9 (2) – Supervisor/Fabric-2 | 696 |
| DS-X9112 | MDS 9000 12-port 1/2/4 Gb/s FC Module | 132 |
| DS-X9124 | MDS 9000 24-port 1/2/4 Gb/s FC Module | 147 |
| DS-X9148 | MDS 9000 48-port 1/2/4 Gb/s FC Module | 185 |
| DS-X9704 | MDS 9000 4-port 10 Gb/s FC Module | 172 |
Weight

<table>
<thead>
<tr>
<th>MDS 9513 chassis component</th>
<th>Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis (includes fans and clock modules)</td>
<td>100.0</td>
</tr>
<tr>
<td>Power Supply (6000W AC)</td>
<td>32.5</td>
</tr>
<tr>
<td>Front Fan Tray</td>
<td>18.0</td>
</tr>
<tr>
<td>Rear Fan Tray</td>
<td>2.25</td>
</tr>
<tr>
<td>Crossbar Fabric Modulea</td>
<td>5.75</td>
</tr>
<tr>
<td>Supervisor-2 Modulea</td>
<td>7.25</td>
</tr>
<tr>
<td>12-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>7.75</td>
</tr>
<tr>
<td>24-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>7.75</td>
</tr>
<tr>
<td>48-Port 1/2/4 Gb/s Fibre Channel Module</td>
<td>11.0</td>
</tr>
<tr>
<td>Line Card Blank Panel</td>
<td>0.5</td>
</tr>
</tbody>
</table>

a. 2 of such units are needed for a normal HA configuration of the switch.

Protocols

- FC
- FICON
- IP-FC
- FCIP
- iSCSI

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connetrix MDS 9216

The MDS 9216 fabric switch has a fixed non-redundant supervisor card coupled with a built-in 16-port Fibre Channel switch, dual system clocks, a single field-replaceable power supply, and a non-redundant, hot-swappable fan assembly. An empty port card slot can accommodate a 16-port or 32-port line card, providing up to 48 ports in the 3U switch.

Figure 51 MDS 9216

E-Lab Navigator lists specific versions of supported firmware, as well as fabric topology constraints associated with the MDS 9216.

Supervisor module

The supervisor module is a fixed non-redundant module with a built-in 16-port Fibre Channel switch.

Module status LED (green/amber/red)
Fibre Channel port (1 Gb/s or 2 Gb/s)
Port speed LED
Link status LED

Figure 52 MDS 9216 supervisor module

The supervisor module functions the same as MDS 9500 supervisor module, and has dual system clocks.
Interface module

The interface module is a fixed, non-redundant module.

![MDS 9216 interface module](image)

Fibre Channel line cards

The ports are auto-configurable to 1 GB/s to 2 Gb/s, and can carry standard port types, as well as SFP optical interfaces.

**16-port line card**

The 16-port line card defaults with Fx_Ports configured for 16 BB_Credits, but the card can be set for up to 255 BB_Credits using TE_Port or E_port configurations.

![MDS 9216 16-port line card](image)
32-port line card
The 32-port line card defaults with Fx_Ports, and is fixed with 12 BB_Credits per port.

Module status LED (green/amber/red)
Fibre Channel port (1 Gb/s or 2 Gb/s)
Port speed LED
Link status LED

Figure 55 MDS 9216 32-port line card

Supported features
For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features
For the most up-to-date information on unsupported features, consult the EMC Connectrix MDS 9000 SAN-OS Release Notes release notes on EMC Online Support at https://support.emc.com.

Management

Management software supported
◆ EMC ControlCenter
◆ Fabric Manager
◆ Device Manager
◆ DCNM
◆ Web-Based GUI
◆ Scriptable CLI
◆ Policy Base Alerts
◆ Fabric API
◆ End-to-End Performance Monitoring
On-line Fault Isolation

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(Use EMC ids for this column) | MDS 9513 common equipment includes:  
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</tr>
<tr>
<td>Line Card Blank Panel</td>
<td>0.5</td>
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a. 2 of such units are needed for a normal HA configuration of the switch.

Protocols
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- FICON
- IP-FC
- FCIP
- iSCSI

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes on EMC Online Support at https://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
The MDS 9250i Multiservice Fabric Switch is an optimized platform for deploying high-performance SAN extension solutions, distributed intelligent fabric services, and cost-effective multiprotocol connectivity for both open systems and mainframe environments. The MDS 9250i is an ideal solution for departmental and remote branch-office SANs as well as in large-scale SANs in conjunction with the MDS 9710 Multilayer Director.

The MDS 9250i offers up to forty 16-Gbps Fibre Channel ports, two 1/10 Gigabit Ethernet IP storage services ports, and eight 10 Gigabit Ethernet Fibre Channel over Ethernet (FCoE) ports in a fixed two-rack-unit (2RU) form factor. The MDS 9250i connects to existing native Fibre Channel networks, protecting current investments in storage networks.

The Cisco SAN Extension over IP application package license is enabled as standard on the two fixed 1/10 Gigabit Ethernet IP storage services ports, enabling features such as Fibre Channel over IP (FCIP) and compression on the switch without the need for additional licenses. Also, using the eight 10 Gigabit Ethernet FCoE ports, the MDS 9250i platform attaches to directly connected FCoE and Fibre Channel storage devices and supports multitiered unified network fabric connectivity directly over FCoE.

Figure 56  MDS 9250i

E-Lab Navigator lists specific versions of supported firmware, as well as fabric topology constraints associated with the MDS 9250i.
Key features and benefits

The MDS 9250i provides unique multiservice and multiprotocol functions in a compact 2RU form factor, including:

- SAN consolidation with integrated multiprotocol support.
- High-density Fibre Channel switch with 16-Gbps connectivity.
- Intelligent application services engine.
- Hardware-based virtual fabric isolation with virtual SANs (VSANs) and Fibre Channel routing with Inter-VSAN Routing (IVR).
- Remote SAN extension with high-performance FCIP.
- Cost-effective iSCSI connectivity to Ethernet-attached servers.
- Advanced FICON services.
- Platform for intelligent fabric applications.
- In Service Software Upgrade (ISSU) for Fibre Channel interfaces.
- Intelligent network services.
- High-performance ISLs.
- Comprehensive network security framework.
- IP Version 6 (IPv6) capable.
- FIPS compliance.
- Sophisticated diagnostics.

For more details on these features, refer to the Cisco MDS 9250i Multiservice Fabric Switch Data Sheet located at www.cisco.com.

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the EMC Connectrix MDS 9250i Release Notes release notes at EMC Online Support at http://support.emc.com.
Management

For complete product specifications, including protocols, fabric services, diagnostic and troubleshooting tools, network security, and performance, refer to the Cisco MDS 9250i Multiservice Fabric Switch Data Sheet located at www.cisco.com.

Mechanical specifications

- Dimensions: (H x W x D): 3.84 x 17.22 x 21.4 in. (9.75 x 43.74 x 54.36 cm), 2RUs; all units rack mountable in standard 19-inch Electronic Industries Alliance [EIA] rack
- Weight of fully configured chassis: 22.4 lb (10.2 kg)

Power

- Power supply: 300W AC
- Power cord: Notched C15 socket connector connecting to C16 plug on power supply
- AC input characteristics
  - 100 to 240V AC (10% range)
  - 50 to 60 Hz (nominal)
- Airflow (front to back)
  - 200 linear feet per minute (LFM) through system fan assembly
- It is recommended to maintain a minimum air space of 2.5 in. (6.4 cm) between walls and chassis air vents and a minimum horizontal separation of 6 in. (15.2 cm) between two chassis to prevent overheating.

Environmental

- Temperature, ambient operating: 32 to 104 degrees F (0 to 40 degrees C)
- Temperature, ambient nonoperating and storage: 40 to 158 degrees F (-40 to 70 degrees C)
- Relative humidity, ambient (noncondensing) operating: 10 to 90%
- Relative humidity, ambient (noncondensing) nonoperating and storage: 10 to 95%
- Altitude, operating: -197 to 6500 ft (-60 to 2000m)
Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes at EMC Online Support at http://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
Connectrix MDS 9706

The Connectrix MDS 9706 Multilayer Director (Figure 57 on page 270) is a director-class SAN switch designed for deployment in small to medium-sized storage networks that can support enterprise clouds and business transformation. It layers a comprehensive set of intelligent features onto a high-performance, protocol-independent switch fabric.

MDS 9706 addresses the stringent requirements of large virtualized data center storage environments. It delivers uncompromising availability, security, scalability, ease of management, and transparent integration of new technologies for extremely flexible data center SAN solutions. It shares the same operating system and management interface with other Connectrix MDS data center switches. The MDS 9706 lets you transparently deploy unified fabrics with Fibre Channel, IBM Fibre Connection (FICON), and Fibre Channel over Ethernet (FCoE) connectivity for low total cost of ownership (TCO).

The MDS 9706 offers a number of important features:

◆ Lower TCO with SAN consolidation
◆ Scalable expansion with outstanding investment protection
◆ Enterprise-class availability
◆ Business transformation with Enterprise Cloud deployment
◆ Convergence with multihop FCoE
◆ Comprehensive solution for robust security

For more details on these features and benefits, refer to the Cisco MDS 9706 Multilayer Director Data Sheet located at www.cisco.com.

Key features and benefits

The MDS 9706 offers the following main features and benefits:

◆ Outstanding SAN performance
◆ High availability
◆ Multiprotocol architecture
◆ Integrated mainframe support
◆ Advanced traffic management
Industry-leading scalability
Intelligent network services
Virtual machine transparency
Comprehensive security
Sophisticated diagnostics
Ease of management

For more details on these features and benefits, refer to the *Cisco MDS 9706 Multilayer Director Data Sheet* located at [www.cisco.com](http://www.cisco.com).

**Figure 57** shows the MD 9706 multilayer director.

---

**Figure 57**  
MDS 9706 Multilayer Director

---

**Supported features**

For the most up-to-date information on supported features, consult the *EMC Support Matrix* located on the E-Lab Interoperability Navigator.
Unsupported features

For the most up-to-date information on unsupported features, consult the appropriate EMC Connectrix MDS Release Notes release notes at EMC Online Support at http://support.emc.com.

System architecture

Performance and scalability
- Up to 12-Tbps front-panel Fibre Channel switching bandwidth and 10.5 Tbps of FCoE bandwidth
- Supported Fibre Channel port speeds
  - 2/4/8-Gbps autosensing; optionally configurable
  - 4/8/16-Gbps autosensing; optionally configurable
  - 10-Gbps Fibre channel
- Buffer credits: 48-port line-rate 16-Gbps advanced Fibre Channel module
  - Up to 500 per port (dedicated-mode ports) standard
  - Up to 4095 on an individual port (dedicated-mode ports with optional Cisco MDS 9700 Series Enterprise Package license activated)
- Ports per chassis
  - Up to 192 ports, which can be Fibre Channel (2/4/8-Gbps, 4/8/16-Gbps, or 10-Gbps), FCoE (10 Gigabit Ethernet), or a mix of both
- Ports per rack
  - Up to 768 Fibre Channel (2/4/8-Gbps, 4/8/16-Gbps, or 10-Gbps) or 10 Gigabit Ethernet FCoE ports
- PortChannel: Up to 16 ports (the channel can span any speed-matched port on any module in the chassis)

Fabric services
- Name server
- Registered State Change Notification (RSCN)
- Login services
- Fabric configuration server (FCS)
- Broadcast
- In-order delivery

**Advanced functions**
- VSAN
- IVR
- PortChannel with multipath load balancing
- QoS: flow-based and zone-based
- N-Port ID virtualization

**Diagnostics and troubleshooting tools**
- POST diagnostics
- Online diagnostics
- Internal port loopbacks
- SPAN and RSPAN
- Fibre Channel Traceroute
- Fibre Channel Ping
- Fibre Channel Debug
- Cisco Fabric Analyzer
- Syslog
- Online system health
- Port-level statistics
- Real-Time Protocol Debug

**Network security**
- VSANs
- ACLs
- Per-VSAN RBAC
- Fibre Channel zoning
- N-Port Worldwide Name (WWN)
- N-port FC-ID
- Fx-port WWN
- Fx-port WWN and interface index
- Fx-port domain ID and interface index
- Fx-port domain ID and port number
- FC-SP1
- DH-CHAP switch-switch authentication
- DH-CHAP host-switch authentication
- Port security and fabric binding
- Management access
- SSHv2 implementing Advanced Encryption Standard (AES)
- SNMPv3 implementing AES
- SFTP
- Cisco TrustSec Fibre Channel Link Encryption

**IBM FICON**
- FC-SB-3 compliant
- Cascaded FICON fabrics
- Intermix of FICON and Fibre Channel FCP traffic
- FICON CUP management interface
- Exchange-based-routing ready

**Serviceability**
- Configuration file management
- Nondisruptive software upgrades for Fibre Channel interfaces
- Call Home
- Power-management LEDs
- Port beaconing
- System LEDs
- SNMP traps for alerts
- Network boot

**Management**

For complete product specifications, including protocols, fabric services, diagnostic and troubleshooting tools, network security, and performance, refer to the *Cisco MDS 9706 Multiservice Fabric Switch Data Sheet* located at [www.cisco.com](http://www.cisco.com).
Access methods
- Access methods through Cisco MDS 9700 Series Supervisor-1 Module
  - Out-of-band 10/100/1000 Ethernet port
  - RS-232 serial console port
  - In-band IP over Fibre Channel
- Access methods through MDS 9700 Series Fibre Channel switching module
  - In-band FICON CUP over Fibre Channel
  - CLI using console and Ethernet ports

Access protocols
- SNMPv3 using Ethernet port and in-band IP over Fibre Channel access
- FICON CUP
- Distributed Device Alias service
- Network security
- Per-VSAN role-based access control using RADIUS-based and TACACS+-based authentication, authorization, and accounting (AAA) functions
- SFTP
- SSHv2 implementing AES
- SNMPv3 implementing AES
- Management applications
- MDS 9000 Family CLI
- Cisco Prime DCNM

Mechanical specifications
Physical dimensions
- Chassis dimensions (9RU): 15.6 x 17.3 x 32.0 in. (39.62 x 43.9 x 81.3 cm)
- Chassis depth including cable management and chassis doors is 38 in. (96.52 cm)
- Unit is rack mountable in a standard 19-inch (482.6-mm) EIA rack, Unit is also 2-post rack mountable
Weight
- Chassis only: 145 lb (65.8 kg)
- Fully configured: 325 lb

Power and cooling
- Power supplies (3000W AC and DC)
- Input: 100 to 240V AC nominal (±10% for full range); 16A nominal; 50 to 60 Hz nominal (±3 Hz for full range)
- Output: 1451W 50V ±4%/28A, 3.4V ±4%/15A (100 to 120V AC input), 3051W 50V ±4%/60A, and 3.4V ±- 4%/15A (200 to 240V AC input)
- Airflow: Front-to-back
  - The MDS 9706 provides x linear feet per minute (LFM) average system velocity, and y cubic feet per minute (CFM) total flow through each line-card slot depending on the line-card type and fan-speed setting.

Environmental
- Temperature, ambient operating: 32 to 104°F (0 to 40°C)
- Temperature, ambient nonoperating and storage: -40 to 158°F (-40 to 70°C)
- Relative humidity, ambient (noncondensing) operating: 10 to 90%
- Relative humidity, ambient (noncondensing) nonoperating and storage: 10 to 95%
- Altitude, operating: -197 to 6500 ft (-60 to 2000m)

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes at EMC Online Support at [http://support.emc.com](http://support.emc.com).

Other white papers, data sheets, and configuration guides can be accessed at [www.cisco.com](http://www.cisco.com) in the Technical Support and Documentation section.
Connectrix MDS 9710

The MDS 9710 Multilayer Director (Figure 58) is a director-class SAN switch designed for deployment in large-scale storage networks to enable enterprise clouds and business transformation. Layering a comprehensive set of intelligent features onto a high-performance, protocol-independent switch fabric, the MDS 9710 addresses the stringent requirements of large virtualized data center storage environments: uncompromising high availability, security, scalability, ease of management, and transparent integration of new technologies for extremely flexible data center SAN solutions.

Sharing the same operating system and management interface with other MDS data center switches, the MDS 9710 enables seamless deployment of unified fabrics with high performance Fibre Channel, IBM Fibre Connectivity (FICON), and Fibre Channel over Ethernet (FCoE) connectivity to achieve low total cost of ownership (TCO).
Key features and benefits

The MDS 9710 offers the following main features and benefits:

◆ Outstanding SAN performance.
◆ High availability.
◆ Industry-leading scalability.
◆ Intelligent network services.
◆ Virtual machine transparency.
◆ Comprehensive security.
◆ Unified SAN management.
◆ Sophisticated diagnostics.
◆ Multiprotocol architecture.

For more details on these features and benefits, refer to the Cisco MDS 9710 Multiservice Fabric Switch Data Sheet located at www.cisco.com.

Management

For complete product specifications, including protocols, fabric services, diagnostic and troubleshooting tools, network security, and performance, refer to the Cisco MDS 9710 Multiservice Fabric Switch Data Sheet located at www.cisco.com.

Mechanical specifications

Physical dimensions

◆ Chassis dimensions (14 rack units [14RU]): 24.35 x 17.3 x 34.0 in. (61.9 x 43.9 x 86.4 cm)
◆ MDS 9700 48-Port 16-Gbps Fibre Channel Line Card: 1.75 x 15.9 x 21.8 in. (4.4 x 40.39 x 55.37 cm)
◆ Power supply (3000W AC): 22.04 x 3.95 x 1.6 in. (55.98 x 10.03 x 4.06 cm)
◆ Power supply (3000W DC): 23.54 x 3.95 x 1.6 in. (59.79 x 10.03 x 4.06 cm)
◆ Fabric-1 module: 18.09 x 2.02 x 9.22 in. (45.95 x 5.13 x 23.42 cm)
◆ Supervisor-1 module: 2.04 x 7.5 x 21.8 in. (5.18 x 19.05 x 55.37 cm)
◆ Fan tray: 23.54 x 5.15 x 4.09 in. (59.79 x 13.08 x 10.39 cm)
SFP+: 0.49 x 0.54 x 2.22 in. (1.25 x 1.36 x 5.65 cm)

**Weight**
- Chassis (includes fans): 185.5 lb (84.2 kg)
- 48-port 16-Gbps Fibre Channel line card: 17 lb (7.71 kg)
- Power supply (3000W AC): 6 lb (2.7 kg)
- Fabric-1 module: 11 lb (5.0 kg)
- Supervisor-1 module: 7 lb (3.2 kg)
- Fan tray: 8.5 lb (3.86 kg)
- Supervisor blank cover: 1.25 lb (0.57 kg)
- Line card blank cover: 4.5 lb (2.04 kg)

**Power**
- Power supplies (3000W AC)
  - Input: 100 to 240V AC nominal (±10% for full range); 16A nominal; 50 to 60 Hz nominal (±3 Hz for full range)
  - Output: 1451W 50V ±4%/28A, 3.4V ±4%/15A (100 to 120V AC input), 3051W 50V ±4%/60A, and 3.4V ±-4%/15A (200 to 240V AC input)

**Airflow**
The MDS 9710 provides 700 linear feet per minute (LFM) average system velocity, and between 40 and 160 cubic feet per minute (CFM) total flow through each line-card slot depending on the line-card type and fan-speed setting.

With the MDS 9710 using front-to-back cold-aisle and hot-aisle air flow, Cisco recommends that you maintain a minimum air space of 7 inches (17.78 cm) between walls, such as in a cabinet, and the chassis front and back air vents.

**Environmental**
- Temperature, ambient operating: 32 to 104 degrees (0 to 40 degrees C)
- Temperature, ambient nonoperating and storage: 40 to 158 degrees F (-40 to 70 degrees C)
- Relative humidity, ambient (noncondensing) operating: 10 to 90%
- Relative humidity, ambient (noncondensing) nonoperating and storage: 10 to 95%
Altitude, operating: -197 to 6500 ft (-60 to 2000m)

Supported features

For the most up-to-date information on supported features, consult the EMC Support Matrix located on the E-Lab Interoperability Navigator.

Unsupported features

For the most up-to-date information on unsupported features, consult the EMC Connectrix MDS 9710 Release Notes release notes at EMC Online Support at http://support.emc.com.

Further reading

For details on MDS platform features and functionality, refer to Connectrix MDS release notes at EMC Online Support at http://support.emc.com.

Other white papers, data sheets, and configuration guides can be accessed at www.cisco.com in the Technical Support and Documentation section.
MDS management

This section contains the following information:

◆ “Features” on page 280
◆ “Cisco Prime Data Center Network Manager (DCNM)” on page 280
◆ “Troubleshooting with the SysLog” on page 284

Features

Management features include:

◆ Command line interface (CLI)
  • Adheres to the syntax of Cisco IOS CLI
  • Multiple connection options and protocols:
    – Direct or serial link — VT100
    – Secure shell access — SSH (encrypted)
    – Terminal Telnet — TCP/IP over Ethernet or Fibre Channel
    – Over 1700 commands based on Cisco IOS
    – Exec mode (operations other than config)
    – Configuration mode (all parameters)
    – Help facility (help, errors, and history)

◆ SNMPv3 secures communications with switches

◆ Management access
  • SSHv2
  • RADIUS
  • SNMPv1,2,3
  • Role-based access

Cisco Prime Data Center Network Manager (DCNM)

For detailed information on DCNM, refer to the Cisco Prime Data Center Network Manager Data Sheet at http:cisco.com.

This section contains the following information:

◆ “Overview” on page 281
◆ “Features and benefits” on page 282
◆ “Supported technologies and platforms” on page 283
◆ “System requirements” on page 284
Overview

Cisco Prime Data Center Network Manager (DCNM) combines management of both Ethernet and storage networks in a single dashboard. The dashboard enables network and storage administrators to troubleshoot health and performance across the whole range of Cisco NX-OS Software platforms, including the Cisco Nexus and Cisco MDS 9000 Families, regardless of protocol type such as Fibre Channel, Fibre Channel over Ethernet (FCoE), Ethernet, IBM Fibre Connection (FICON), and Small Computer System over IP (iSCSI). By using Cisco DCNM, IT administrators can identify available port capacity, reclaim orphaned ports, and maintain inventory of logical and physical switch components.

Cisco DCNM also simplifies deployment of SAN and LAN components by providing wizard- and template-based provisioning and configuration. Role-based access control (RBAC) helps separate configuration of LAN and SAN networks on converged network switches. DCNM supports TACACS+, RADIUS, and now Lightweight Directory Access Protocol (LDAP) remote authentication protocols to help manage user access to switching infrastructure.

Cisco Prime DCNM can be licensed for SAN and LAN environments separately or together. Majority of DCNM features used for provisioning and discovery are available for free with base image (essentials edition) while advanced features need an advanced edition license to unlock. DCNM is priced by switch platform and licensed per number of switches. In addition, a yearly service contract is required to upgrade from one major release to another.
### Features and benefits

Table 27 lists main features and benefits for Cisco Prime DCNM.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
</table>
| Operation Event Management          | • Provides real-time network health summary with detailed view of individual network components enabling operations staff to respond quickly to events based on their severity  
• Ability to Acknowledge working on the alert and when resolved delete it  
• Forward syslog alerts based on monitored facility                                                                 |
| Web Templates                       | • Pre-built Templates for provisioning LAN and SAN components  
• Pre-built Template deployment scheduler and rollback mechanism  
• Customizable Templates with conditional statements  
• Create new templates using template editor  
• Import configuration script and turn it into Template                                                                 |
| Dashboards                          | • Provides operational monitoring views of SAN, LAN, and server environments  
• Domain driven dashboards for host, storage, and switch  
• Context driven searches launch with domain dashboards                                                                 |
| Performance and Capacity            | • Provides detailed visibility into real-time and historical performance statistics in the data center  
• Provides insight into port and bandwidth utilization, error count, traffic statistics, etc.  
• Includes scheduled custom reports that can be offloaded for post processing                                                                 |
| Capacity Manager                    | • Track port utilization by port tier and predict when an individual tier pool will be consumed  
• Chart view of port consumption based on custom groupings                                                                 |
| VMpath Analysis for LAN and SAN     | • Provides view of virtual machine path through physical network to storage array and to the data store  
• Provides capability to view performance for every switch hop all the way to the individual VMware ESX server and virtual machine                                                                 |
| Topology View                       | • Displays real-time operationally focused topology of the data center infrastructure  
• Offers Layer 2 overlay topology maps to streamline the troubleshooting process and reduce the mean time to repair; roll the cursor over the topology to view detailed information about paths and switch attributes |
| Reports                             | • Lets you build custom reports from predefined templates  
• Provides easy-to-schedule reports that can be exported for postprocessing or sent by mail                                   |
Cisco Prime DCNM is designed to help customers efficiently implement and manage next-generation virtualized data centers. It provides timely management support for data center hardware platforms and Cisco NX-OS features.

Cisco Prime DCNM supports a variety of Cisco hardware platforms, including:

- Cisco MDS 9500 Series Multilayer Directors and Cisco MDS 9200 and 9100 Series Multilayer Switches
- Cisco Nexus 1000V Series Switches; Cisco Nexus 1010 Virtual Services Appliance; Cisco Nexus 2000 Series Fabric Extenders; Cisco Nexus 3000, 4000, 5000, and 7000 Series Switches
- Cisco Catalyst 6500 Series Switches
- Cisco UCS 6100 and 6200 Series Fabric Interconnects
- Cisco FWSM - FireWall Service Module

### Table 27: Cisco Prime DCNM features and benefits (page 2 of 2)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
</table>
| Automated Discovery                  | • Using automated network discovery, provides up-to-date physical and logical inventory information  
• Tracks inventory and performance information in real time; information can be used as a source of truth for asset tracking or as a data source for a configuration management database (CMDB) |
| Configuration and Change Management  | • Provides pre-deployment validation of configuration changes, reducing opportunities for human error  
• Using historical configuration archive coupled with configuration comparison, enables you to identify the last-known good state if configuration problems occur |
| Image Management                     | • Enables easy-to-perform, nondisruptive (In-Service Software Upgrade [ISSU]) mass deployment of Cisco NX-OS Software images, which can be scheduled to run on demand |
| Web Services APIs                    | • Abstracts the network to implement an IT service management framework (Information Technology Infrastructure Library [ITIL]) with a CMDB at its center as well as to integrate with business intelligence reporting solutions  
• Enables easy integration with third-party applications, allowing accurate flow-through provisioning and data mining  
• Enables integration into enterprise storage management systems through Storage Management Initiative Specification (SMI-S) based APIs |
| Event Forwarding                     | • Enables integration with enterprise operations console (NOC) for alerts and events  
• Uses email and traps to notify operations staff of service disruptions  
• Add context to path alert by indentifying name of host, ISL, and storage entity |

Supported technologies and platforms
System requirements

Cisco Prime DCNM is a Java-based client-server application that can be deployed on Windows or Linux operating systems, or as a virtual service blade on Nexus 1010 appliance LAN and SAN java clients provide advanced monitoring and provisioning capability and Dashboard to monitor health and performance of data center. DCNM scale-out architecture grows with the expansion of the network while maintaining a single Data Center view. Table 28 lists the Cisco Prime DCNM requirements.

Table 28  Cisco Prime DCNM requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Small: Up to 50 Switches</th>
<th>Medium: 100 Switches</th>
<th>Large: 100 Switches and above</th>
<th>Client Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>Dual-core CPUs; 2 GHz</td>
<td>Quad-Core CPUs; 2 GHz</td>
<td>Federation/Clustering:</td>
<td>2 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Up to 10 nodes (SAN) and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>above (LAN)</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>8 GB</td>
<td>12 GB minimum</td>
<td>12 GB minimum</td>
<td>1 GB</td>
</tr>
<tr>
<td>Free Hard Disk</td>
<td>40 GB</td>
<td>60 GB</td>
<td>60 GB</td>
<td>1 GB</td>
</tr>
<tr>
<td>Operating System</td>
<td>• Microsoft Windows 2008 (32-bit and 64-bit)</td>
<td>• Red Hat Enterprise Linux AS release 5.4 (64-bit)</td>
<td>• Hypervisor support same as gues OS</td>
<td>Microsoft Windows 7</td>
</tr>
<tr>
<td></td>
<td>• Red Hat Enterprise Linux AS release 5.4 (64-bit)</td>
<td>• Hypervisor support same as gues OS</td>
<td></td>
<td>Red Hat Enterprise Linux AS Release 5.4 (64-bit)</td>
</tr>
<tr>
<td>Other</td>
<td>• PostgreSQL 8.4</td>
<td>• Oracle 10g and 11g Standard and Enterprise</td>
<td>• Oracle 11g Real Application Clusters (RAC)</td>
<td>Java 6.29</td>
</tr>
<tr>
<td></td>
<td>• Oracle 10g and 11g XE</td>
<td></td>
<td></td>
<td>Internet Explorer, Safari, Firefox</td>
</tr>
</tbody>
</table>

Troubleshooting with the SysLog

- Chronological log of system messages
- Details of SysLog depend on configuration
- Eight severity levels from debug to critical events
- User can limit severity levels per specific service
- Syslog messages can be stored on disk, server, or sent to a console for immediate view by the user
- Radius Accounting Records to SysLog service
- Syslog analyzer tool
- Filters logged messages
- Displays explanations of probable causes and recommended actions
- Manual parsing of Syslog files
This chapter includes information on the EC-1700 cabinet system.

- Connectrix EC-1700 overview ........................................................ 286
- EC-1700-B base configuration ........................................................ 287
- EC-1700-C base configuration ........................................................ 288

Note: For more detailed information, refer to the appropriate installation and set up manual located on EMC Online Support at https://support.emc.com.
Connectrix EC-1700 overview

The EMC Connectrix EC-1700 cabinet provides a central installation platform for mounting Connectrix B Series and Connectrix MDS Series Fibre Channel directors.

Features

The EC-1700-B, is designed to support the B-Series 4 slot and 8 slot FC Director products.

Features of the EC-1700-B cabinet include:

- Mechanical, power, and cooling capacity for up to 1100 ports of director-class Fibre Channel switching.
- The EC-1700-B is designed to optimize air-flow and cooling for the ED-DCX-B, ED-DCX-4S-B, ED-DCX8510-8B, and ED-DCX8510-4B.
- Specially perforated front and rear doors to optimize air flow in and out of the cabinet.
- Fiber cable entry access through floor or ceiling via perforated top panels that are removable.
- Open floor pan for airflow and cable egress.
EC-1700-B base configuration

The EC-1700-B comes from the factory with cable management fingers to support two fully populated B-Series directors for upwards of 1000+ fiber cables.

Other base configuration equipment includes four 30amp single phase PDUs for connection of the director power cords. Table 29 describes the EC-1700-B cabinet.

<table>
<thead>
<tr>
<th>Table 29</th>
<th>EC-1700-B cabinet models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Description</td>
</tr>
</tbody>
</table>
EC-1700-C base configuration

The current release of the EC-1700, the EC-1700-C, is designed to support the MDS 95xx directors, as described in Table 30.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC-1700-C</td>
<td>Enterprise cabinet for Connectrix MDS Series directors</td>
<td>Directors: MDS-9513, MDS-9509, MDS-9506</td>
</tr>
</tbody>
</table>

The EC-1700-C comes from the factory with cable management fingers and trays to support two fully populated MDS-9513 directors, 1000+ fiber cables. Other base configuration equipment includes:

- Specially cut-out vertical NEMA mounting rails to provide air passages to the sides of the MDS directors.
- Pre-loaded directional air-baffles to direct hot exhaust air out the rear and top of cabinet.
- Specially perforated front and rear doors to optimize air flow in and out of the cabinet.
- Pre-loaded L-Brackets for mounting the 9513 or 9509 directors into the EC-1700-C.

Each EC-1700-C cabinet can hold up to:

- Two MDS 9509 directors
- Two MDS 9513 directors
- One 9513 and one 9509
- One MDS 9513 or MDS 9509 and one or two MDS 9506 directors