Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch

Product Guide (withdrawn product)

The Lenovo® Flex System Fabric EN4093R 10Gb Scalable Switch provides unmatched scalability, port flexibility, and performance. The switch also delivers innovations to help address several networking concerns today and provides capabilities that help you prepare for the future.

This switch can support up to 64x 10 Gb Ethernet connections while offering Layer 2/3 switching, in addition to OpenFlow and "easy connect" modes. It installs within the I/O module bays of the Flex System™ Enterprise Chassis. This switch can help clients migrate to a 10 Gb or 40 Gb Ethernet infrastructure, offers cloud-ready virtualization features (such as Virtual Fabric and VMready®), and is Software Defined Network (SDN) ready.

The EN4093R 10Gb Scalable Switch is shown in the following figure.

Figure 1. Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch

Did you know?

The base switch configuration comes standard with 24x 10 GbE port licenses that can be assigned to internal connections or external SFP+ or QSFP+ ports with flexible port mapping. For example, this feature allows you to trade off four 10 GbE ports for one 40 GbE port (or vice versa) or trade off one external 10 GbE SFP+ port for one internal 10 GbE port (or vice versa). You then have the flexibility of turning on more ports when you need them by using Lenovo's Features on Demand upgrade licensing capabilities that provide “pay as you grow” scalability without the need to buy more hardware.

The EN4093R is cloud ready with support for VM aware networking and advanced NIC virtualization technologies, such as Unified Fabric Port (UFP). In addition, the switch offers different operational modes (from "easy connect" transparent networking connectivity to Layer 3 functionality) to satisfy diverse client networking requirements.

The EN4093R switch is SDN-ready with support for OpenFlow. OpenFlow is the protocol that enables the network administrator to easily configure and manage virtual networks that control traffic on a "per-flow" basis. OpenFlow creates multiple independent virtual networks and related policies without dealing with the complexities of the underlying physical network and protocols.

With support for Converged Enhanced Ethernet (CEE), the EN4093R can be used as an FCoE transit device and is ideal for network-attached storage (NAS) and iSCSI environments.

Key features

The Flex System Fabric EN4093R 10Gb Scalable Switch is considered particularly suited for the following customers:

- Customers who want to use 10 GbE communications between compute nodes in the chassis but still require upstream 1 GbE connections to their infrastructure.
- Customers who are implementing a virtualized environment.
- Customers who require investment protection for 40 GbE external ports.
- Customers who want to reduce total cost of ownership (TCO) and improve performance while maintaining high levels of availability and security.
- Customers who are interested in Software Defined Networking by using the OpenFlow standard.
- Customers who want to avoid or minimize oversubscription, which can result in congestion and loss of performance.
- Customers who want to implement a converged infrastructure with NAS, iSCSI or FCoE. For FCoE implementations, the EN4093R acts as a transit switch that forwards FCoE traffic upstream to other devices, such as the Lenovo RackSwitch™ G8264CS, Brocade VDX, or Cisco Nexus 5548/5596, where the FC traffic is broken out.

The switches offer the following key features and benefits:

- Increased performance
  With the growth of virtualization and the evolution of cloud, many of today's applications require low latency and high bandwidth performance. The EN4093R is the embedded 10 GbE switch for a compute node chassis to support sub-microsecond latency and up to 1.28 Tbps. It also delivers full line rate performance, which makes it ideal for managing dynamic workloads across the network. This switch also provides a rich Layer 2 and Layer 3 feature set that is ideal for many of today's data centers, and offers industry-leading external bandwidth by being the first integrated switch to support 40 GbE external ports.

- "Pay as you grow" investment protection and lower TCO
  The EN4093R flexible port mapping allows customers to buy only the ports that they need, when they need them, to lower acquisition and operational costs. The base switch configuration includes 24x 10 GbE port licenses that can be assigned to internal connections and 10 GbE or even 40 GbE (by using four 10 GbE licenses per 40 GbE port) external ports. Customers then have the flexibility of turning on more 10 GbE internal connections and more 10 GbE or 40 GbE external ports when needed by using Lenovo Features on Demand licensing capabilities that provide "pay as you grow" scalability without the need for more hardware.

- Cloud ready, optimized network virtualization with virtual NICs
  With the majority of IT organizations implementing virtualization, there is an increased need to reduce the cost and complexity of their environments. Lenovo is helping to address these requirements by removing multiple physical I/O ports. Virtual Fabric provides a way for companies to carve up 10 GbE ports into virtual NICs (vNICs) to meet those requirements with Intel processor-based compute nodes.

  To help deliver maximum performance per vNIC and provide higher availability and security with isolation between vNICs, the switch uses the capabilities of its Networking Operating System. For large-scale virtualization, the Flex System solution can support up to 48 vNICs by using a pair of CN4058S 10Gb Virtual Fabric Adapters in each compute node and four EN4093R 10Gb Scalable Switches in the chassis.

  The EN4093R switch offers the benefits of next-generation vNIC - Unified Fabric Port (UFP). UFP is an advanced, cost-effective solution that provides a flexible way for clients to allocate, reallocate, and adjust bandwidth to meet their ever-changing data center requirements.

- Cloud ready, VM-aware networking
  VMready software on the module simplifies configuration and improves security in virtualized environments. VMready automatically detects virtual machine movement between physical servers and instantly reconfigures each VM's network policies across VLANs to keep the network up and running without interrupting traffic or affecting performance. VMready works with all leading VM providers, such as VMware, Citrix Xen, and Microsoft Hyper-V.

  Support for Edge Virtual Bridging (EVB) that is based on the IEEE 802.1Qbg standard enables scalable, flexible management of networking configuration and policy requirements per VM and eliminates many of the networking challenges that are introduced with server virtualization.

- Simplified network infrastructure
  The EN4093R 10Gb Scalable Switch simplifies deployment and growth because of its innovative scalable architecture. This architecture helps increase return on investment by reducing the qualification cycle, while providing investment protection for more I/O bandwidth requirements in the future. The extreme flexibility of the switch comes from the ability to turn on more ports as required, both down to the compute node and for upstream connections (including 40 GbE). Also, as you consider migrating to a converged LAN and SAN, the EN4093R switch supports the newest protocols, including Data Center Bridging/Converged Enhanced Ethernet (DCB/CEE) that can be used in a converged iSCSI, Fibre Channel over Ethernet (FCoE), or NAS environment.

  EN4093R's stacking capabilities simplify management for clients by stacking up to eight switches that share one IP address and one management interface. Support for Switch Partition (SPAR) allows clients to virtualize the switch with partitions that isolate communications for multi-tenancy environments.

- Transparent networking capability
  With a simple configuration change to "easy connect" mode, the EN4093R switch becomes a transparent network device that is invisible to the core and eliminates network administration concerns of Spanning Tree Protocol configuration and interoperability, VLAN assignments, and avoidance of possible loops.

  By emulating a host NIC to the data center core, it accelerates the provisioning of VMs by eliminating the need to configure the typical access switch parameters.

- SDN ready, OpenFlow enabled
  The EN4093R switch is Lenovo's first 10 GbE Flex System offering with OpenFlow. OpenFlow is the new open protocol that enables the network administrator to easily configure and manage virtual networks that control traffic on a "per-flow" basis. OpenFlow creates multiple independent virtual networks and related policies without dealing with the complexities of the underlying physical network and protocols.

- Advanced network management
  Switch Center application is used for advanced levels of provisioning, management, and control, which can significantly reduce deployment and day-to-day maintenance times while providing in-depth visibility into the network performance and operations of Lenovo switches. When tools, such as VMware vRealize product suite, vCenter Server (formerly VMware Virtual Center) or vSphere are used, Switch Center provides more integration for better optimization.

  The Lenovo Networking Content Pack for VMware vRealize Log Insight enables administrators to use VMware vRealize Log Insight with their Lenovo Networking deployments. This applies to VMware administrators, system administrators, and network administrators. This capability delivers automated log management that helps to provide operational efficiency in dynamic, hybrid cloud environments.

  The Lenovo Networking Content Pack for VMware vRealize Log Insight is custom-designed by Lenovo Networking to provide information that is specific to Lenovo Networking switches and switch configurations. When used with Log Insight, the Lenovo Networking Content Pack provides monitoring and analyses of syslogs that are issued by Lenovo Networking switches and switch configurations.

Components and connectors

The front panel of the Flex System Fabric EN4093R 10Gb Scalable Switch is shown in the following figure.

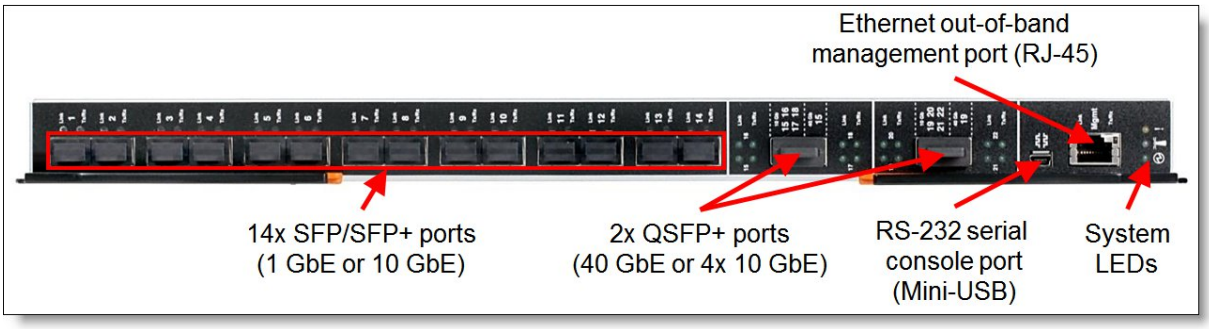

Figure 2. Front panel of the Flex System Fabric EN4093R 10Gb Scalable Switch

The front panel includes the following components:

- System LEDs that display the status of the switch module and the network.
- One mini-USB RS-232 console port that provides another means to configure the switch module.
- 14x SFP/SFP+ ports to attach SFP/SFP+ transceivers for 1 GbE or 10 GbE connections or SFP+ DAC cables for 10 GbE connections.
- 2x QSFP+ ports to attach QSFP+ transceivers or DAC cables for 40 GbE or 4x 10 GbE connections.
- 1x RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.

System specifications

The following table lists the EN4093R system specifications.

Table 1. System specifications

Component	Specification
Form factor	Flex System embedded I/O module
Ports	Internal ports: 42x 10 Gb Ethernet ports External ports: • 14x SFP/SFP+ ports • 2x QSFP+ ports
Media types (external ports)	40 Gb Ethernet QSFP+: • 40 GbE short-range (SR) QSFP+ bi-directional (BiDi) transceivers • 40 GbE short-range (SR4/iSR4/eSR4) QSFP+ transceivers • 40 GbE long-range (LR4) QSFP+ transceivers • 40 GbE QSFP+ to QSFP+ active optical cables (AOCs) • 40 GbE QSFP+ to 4x 10 GbE SFP+ active optical breakout cables • 40 GbE QSFP+ to QSFP+ direct attach copper (DAC) cables • 40 GbE QSFP+ to 4x 10 GbE SFP+ DAC breakout cables 10 Gb Ethernet SFP+: • 10 GbE short-range (SR) SFP+ transceivers • 10 GbE long-range (LR) SFP+ transceivers • 10 GbE RJ-45 SFP+ transceivers • 10 GbE SFP+ active optical cables • 10 GbE SFP+ DAC cables 1/10 Gb Ethernet SFP+: • 1/10 GbE SX/SR SFP+ transceivers 1 Gb Ethernet SFP: • 1 GbE short-wavelength (SX) SFP transceivers • 1 GbE long-wavelength (LX) SFP transceivers • 1 GbE RJ-45 SFP transceivers
Port speeds	• Internal 10 GbE ports: 1 Gbps or 10 Gbps • 40 GbE QSFP+ SR BiDi/SR4/LR4 transceivers: 40 GbE • 40 GbE QSFP+ iSR4/eSR4 transceivers, DAC cables and AOCs: 40 GbE or 4x 10 GbE • 10 GbE SFP+ transceivers, DAC cables and AOCs: 10 Gbps • 1/10 GbE SFP+ transceivers: 1 Gbps or 10 Gbps • 1 GbE SFP transceivers: 1 Gbps
Switching method	Cut-through.
Data traffic types	Unicast, multicast, broadcast.
Software features	Lenovo Networking OS: Layer 2 switching, Layer 3 switching, virtual local area networks (VLANs), VLAN tagging, spanning tree protocol (STP), link aggregation (trunk) groups (LAGs), virtual LAGs (vLAGs), Hot Links, Layer 2 failover, quality of service (QoS), stacking, Edge Virtual Bridging (EVB), VMready, Switch Partitioning (SPAR), stacking, Flexible Port Mapping, OpenFlow, IPv4/IPv6 management, IPv4/IPv6 routing, IPv4 virtual router redundancy protocol (VRRP), IPv4 policy-based routing (PBR), virtual NICs, Unified Fabric Port (UFP), Converged Enhanced Ethernet, Fibre Channel over Ethernet (FCoE) transit switch operations.

Component	Specification
Performance	Non-blocking architecture with wire-speed forwarding of traffic: • Up to 1.28 Tbps aggregated throughput • 100% line rate performance with sub-microsecond switching latency • Up to 960 Million packets per second (Mpps) • Up to 9,216-byte jumbo frames • Receive buffer size: 9 MB
Scalability	• MAC address forwarding database entries: 128,000 • VLANs: 4,095 • Per VLAN Rapid Spanning Tree (PVRST) instances: 256 • Multiple STP (MSTP) instances: 32 • Link aggregation groups: 64 • Ports in a link aggregation group: 32
Hot-swap parts	SFP/SFP+/QSFP+ transceivers, SFP+/QSFP+ DAC cables.
Management ports	2x GbE internal ports connected to the chassis management module; 1x 10/100/1000 Mb Ethernet EXTM external port (RJ-45); 1x RS-232 external port (Mini-USB).
Management interfaces	Industry standard command line interface (isCLI); SNMP v1 and v3; Netconf (XML). Optional Lenovo Switch Center. Optional Lenovo XClarity.
Security features	Secure Shell (SSH); Secure Copy (SCP); Secure FTP (sFTP); user level security; LDAP, RADIUS, and TACACS+ authentication; access control lists (ACLs); port-based network access control (IEEE 802.1x).
Warranty	One-year customer-replaceable unit limited warranty. When installed in a supported chassis, the switch assumes the chassis' base warranty and any warranty service upgrade; warranty includes Networking OS software upgrades.
Mean Time Between Failures	236,805 hours with ambient operating temperature of 40° C.
Memory	RAM: 2 GB; Flash memory: 1 GB.
Dimensions	Height: 30 mm (1.2 in.); width: 401 mm (15.8 in.); depth: 317 mm (12.5 in.)
Weight	3.7 kg (8.1 lb).

Models

The EN4093R switch is initially licensed for 24x 10 GbE ports. More ports can be enabled with Upgrade 1 and Upgrade 2 license options. Upgrade 1 must be applied before Upgrade 2 can be applied. The part numbers and feature codes for ordering the switch and the upgrades are listed in the following table.

Table 2. Part numbers and feature codes for ordering

Description	Part number	Feature code
Switch module		
Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch	00FM514	ASUU
Features on Demand upgrades		
Flex System Fabric EN4093 10Gb Scalable Switch (Upgrade 1)	49Y4798	A1EL
Flex System Fabric EN4093 10Gb Scalable Switch (Upgrade 2)	88Y6037	A1EM

The part number for the switch includes the following items:

- One Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch
- Documentation package

Note: QSFP+ and SFP/SFP+ transceivers and DAC cables are not included and should be ordered together with the switch (see Transceivers and cables for details).

The switch does not include a serial management cable; the optional Flex System Management Serial Access Cable (part number 90Y9338) is supported and includes two cables: a mini-USB-to-RJ-45 serial cable and a mini-USB-to-DB9 serial cable. These cables can be used to connect to the switch locally for configuration tasks and firmware updates.

The part numbers for the upgrades (part numbers 49Y4798 and 88Y6037) include the following items:

- Features on Demand Activation Flyer
- Upgrade authorization letter

The base switch and upgrades feature the following default configurations:

- Part number 00FM514 is for the base physical device and includes 14 internal 10 GbE ports enabled (one to each compute node) and 10 external 10 GbE ports enabled.
- Part number 49Y4798 (Upgrade 1) can be applied on the base switch when you use 4-port adapters that are installed in each compute node. This upgrade enables 14 more internal ports, for a total of 28 ports. The upgrade also enables two 40 GbE external ports. This upgrade requires the base switch.
- Part number 88Y6037 (Upgrade 2) can be applied on top of the Upgrade 1 when you need more external bandwidth on the switch or if you need more internal bandwidth to the compute nodes with the 6-port capable adapters. The upgrade enables the remaining four external 10 GbE external ports and 14 internal 10 GbE ports for a total of 42 internal ports (three to each compute node).

With flexible port mapping, customers have more flexibility in assigning ports that they licensed on the EN4093R, which can help eliminate or postpone the need to purchase upgrades. Although the base model and upgrades still activate specific ports, flexible port mapping provides clients with the capability of reassigning ports as needed by moving internal and external 10 GbE ports, or trading off four 10 GbE ports for the use of an external 40 GbE port. This feature is valuable when you consider the flexibility with the base license and with Upgrade 1.

Note: Flexible port mapping is supported in Stacking mode with Networking OS version 8.3 or later.

With flexible port mapping, clients have the following licenses for a specific number of ports:

- Part number 00FM514 is for the base switch and it provides 24x 10 GbE port licenses that can enable any combination of internal and external 10 GbE ports and external 40 GbE ports (with the use of four 10 GbE port licenses per one 40 GbE port).
- Part number 49Y4798 (Upgrade 1) upgrades the base switch by activating 14 internal 10 GbE ports and two external 40 GbE ports, which is equivalent to adding 22 10 GbE port licenses for a total of 46x 10 GbE port licenses. Any combination of internal and external 10 GbE ports and external 40 GbE ports (with the use of four 10 GbE port licenses per one 40 GbE port) can be enabled with this upgrade. This upgrade requires the base switch.
- Part number 88Y6037 (Upgrade 2) requires the base switch and that Upgrade 1 is activated. Upgrade 2 activates all of the ports on the EN4093R, which is 42 internal 10 GbE ports, 14 external SFP+ ports, and 2 external QSFP+ ports.

Note: When Upgrade 1 and Upgrade 2 are activated, flexible port mapping is no longer used because all the ports on the EN4093R are enabled.

The supported port combinations on the switch and required upgrades are listed in the following tables.

Table 3. Supported port combinations: Default port mapping

Supported port combinations (Default port mapping)	Quantity required		
	Base switch, 00FM514	Upgrade 1, 49Y4798	Upgrade 2, 88Y6037
• 14x internal 10 GbE ports • 10x external 10 GbE ports	1	0	0
• 28x internal 10 GbE ports • 10x external 10 GbE ports • 2x external 40 GbE ports	1	1	0
• 42x internal 10 GbE ports† • 14x external 10 GbE ports • 2x external 40 GbE ports	1	1	1

† This configuration leverages six of the eight ports on the CN4058S adapter.

Table 4. Supported port combinations: Flexible port mapping

Supported port combinations (Flexible port mapping)	Quantity required		
	Base switch, 00FM514	Upgrade 1, 49Y4798	Upgrade 2, 88Y6037*
• 24x 10 GbE ports (internal and external) or • 20x 10 GbE ports (internal and external) • 1x external 40 GbE ports or • 16x 10 GbE ports (internal and external) • 2x external 40 GbE ports	1	0	0
• 46x 10 GbE ports (internal and external) or • 42x 10 GbE ports (internal and external) • 1x external 40 GbE ports or • 38x 10 GbE ports (internal and external) • 2x external 40 GbE ports	1	1	0

* Upgrade 2 is not used with flexible port mapping because with Upgrade 2, all ports on the switch become licensed and there is no need to reassign ports.

Transceivers and cables

With the flexibility of the EN4093R switch, customers can use the following connectivity technologies:

- For 1 GbE links, customers can use RJ-45 SFP transceivers with UTP cables up to 100 meters. Customers that need longer distances can use a 1000BASE-SX transceiver, which can drive distances up to 220 meters with 62.5 µ multi-mode fiber (OM1) and up to 550 meters with 50 µ multi-mode fiber (OM2), or the 1000BASE-LX transceivers that support distances up to 10 kilometers with single-mode fiber (1310 nm).
- For 10 GbE links (on external SFP+ ports), customers can use SFP+ direct-attached copper (DAC) cables for in-rack cabling for distances up to 7 meters or SFP+ active optical cables (AOCs) for distances up to 20 meters. These cables have SFP+ connectors on each end, and they do not need separate transceivers. For distances up to 30 meters, the 10GBASE-T SFP+ transceiver can be used with Category 6a or 7 RJ-45 UTP cables. For longer distances, the 10GBASE-SR transceiver supports distances up to 300 meters over OM3 multimode fiber or up to 400 meters over OM4 multimode fiber. The 10GBASE-LR transceivers can support distances up to 10 kilometers on single mode fiber.

  To increase the number of available 10 GbE ports, customers can split out four 10 GbE ports for each 40 GbE port by using QSFP+ DAC or active optical breakout cables for distances up to 5 meters. For distances up to 100 meters, the 40GBASE-iSR4 QSFP+ transceivers can be used with OM3 optical MPO-to-LC breakout cables or up to 150 meters with OM4 optical MPO-to-LC breakout cables. For longer distances, the 40GBASE-eSR4 transceivers can be used with OM3 optical MPO-to-LC breakout cables for distances up to 300 meters or OM4 optical MPO-to-LC breakout cables for distances up to 400 meters.
- For 40 GbE to 40 GbE connectivity, customers can use the affordable QSFP+ to QSFP+ DAC cables for distances up to 7 meters or QSFP+ to QSFP+ active optical cables for distances up to 20 meters.

  With multimode fiber LC cables, customers can use the 40GBASE QSFP+ bi-directional transceivers for distances up to 100 meters with OM3 MMF LC cables or up to 150 meters with OM4 MMF LC cables.

  With multimode fiber MPO cables, customers can use the 40GBASE-SR4/iSR4 QSFP+ transceivers for distances up to 100 meters with OM3 MMF MPO cables or up to 150 meters with OM4 MMF MPO cables. For distances up to 300 meters, the 40GBASE-eSR4 QSFP+ transceiver can be used with OM3 MMF MPO cables or up to 400 meters with OM4 MMF MPO cables.

  For distances up to 10 kilometers, the 40GBASE-LR4 QSFP+ transceiver can be used with single mode fiber LC cables.

The supported transceivers and cables are listed in the following table.

Table 5. Supported transceivers and direct-attach cables

Description	Part number	Feature code	Maximum quantity supported
Serial console cables			
Flex System Management Serial Access Cable Kit	90Y9338	A2RR	1
SFP transceivers - 1 GbE			
Lenovo 1000BASE-T (RJ-45) SFP Transceiver (no 10/100 Mbps support)	00FE333	A5DL	14
Lenovo 1000BASE-SX SFP Transceiver	81Y1622	3269	14
Lenovo 1000BASE-LX SFP Transceiver	90Y9424	A1PN	14
SFP+ transceivers - 10 GbE			
Lenovo Dual Rate 1/10Gb SX/SR SFP+ Transceiver	00MY034	ATTJ	14
Lenovo 10Gb SFP+ SR Transceiver (10GBASE-SR)	46C3447	5053	14
Lenovo 10GBASE-LR SFP+ Transceiver	00FE331	B0RJ	14
Lenovo 10Gb SFP+ LR Transceiver (10GBASE-LR)	90Y9412	A1PM	14
Lenovo 10GBASE-T SFP+ Transceiver	7G17A03130	AVV1	14
Optical cables for 1 GbE SX SFP, 10 GbE SR SFP+, and 40 GbE SR QSFP+ BiDi transceivers			
Lenovo 1m LC-LC OM3 MMF Cable	00MN502	ASR6	14
Lenovo 3m LC-LC OM3 MMF Cable	00MN505	ASR7	14
Lenovo 5m LC-LC OM3 MMF Cable	00MN508	ASR8	14
Lenovo 10m LC-LC OM3 MMF Cable	00MN511	ASR9	14
Lenovo 15m LC-LC OM3 MMF Cable	00MN514	ASRA	14
Lenovo 25m LC-LC OM3 MMF Cable	00MN517	ASRB	14
Lenovo 30m LC-LC OM3 MMF Cable	00MN520	ASRC	14
SFP+ active optical cables - 10 GbE			
Lenovo 1m SFP+ to SFP+ Active Optical Cable	00YL634	ATYX	14
Lenovo 3m SFP+ to SFP+ Active Optical Cable	00YL637	ATYY	14
Lenovo 5m SFP+ to SFP+ Active Optical Cable	00YL640	ATYZ	14
Lenovo 7m SFP+ to SFP+ Active Optical Cable	00YL643	ATZ0	14
Lenovo 15m SFP+ to SFP+ Active Optical Cable	00YL646	ATZ1	14
Lenovo 20m SFP+ to SFP+ Active Optical Cable	00YL649	ATZ2	14
SFP+ direct-attach cables - 10 GbE			
Lenovo 1m Passive SFP+ DAC Cable	90Y9427	A1PH	14
Lenovo 1.5m Passive SFP+ DAC Cable	00AY764	A51N	14
Lenovo 2m Passive SFP+ DAC Cable	00AY765	A51P	14
Lenovo 3m Passive SFP+ DAC Cable	90Y9430	A1PJ	14
Lenovo 5m Passive SFP+ DAC Cable	90Y9433	A1PK	14
Lenovo 7m Passive SFP+ DAC Cable	00D6151	A3RH	14
QSFP+ transceivers - 40 GbE			
Lenovo 40GBase QSFP+ Bi-Directional Transceiver	00YL631	ATYW	2
Lenovo 40GBASE-SR4 QSFP+ Transceiver	49Y7884	A1DR	2

Description	Part number	Feature code	Maximum quantity supported
Lenovo 40GBASE-iSR4 QSFP+ Transceiver	00D9865	ASTM	2
Lenovo 40GBASE-eSR4 QSFP+ Transceiver	00FE325	A5U9	2
Lenovo 40GBASE-LR4 QSFP+ Transceiver	00D6222	A3NY	2
Optical cables for 40 GbE QSFP+ SR4/iSR4/eSR4 transceivers			
Lenovo 10m QSFP+ MPO-MPO OM3 MMF Cable	00VX003	AT2U	2
Lenovo 30m QSFP+ MPO-MPO OM3 MMF Cable	00VX005	AT2V	2
Optical breakout cables for 40 GbE QSFP+ iSR4/eSR4 transceivers			
Lenovo 1m MPO-4xLC OM3 MMF Breakout Cable	00FM412	A5UA	2
Lenovo 3m MPO-4xLC OM3 MMF Breakout Cable	00FM413	A5UB	2
Lenovo 5m MPO-4xLC OM3 MMF Breakout Cable	00FM414	A5UC	2
QSFP+ active optical cables - 40 GbE			
Lenovo 1m QSFP+ to QSFP+ Active Optical Cable	7Z57A04256	AX42	2
Lenovo 3m QSFP+ to QSFP+ Active Optical Cable	00YL652	ATZ3	2
Lenovo 5m QSFP+ to QSFP+ Active Optical Cable	00YL655	ATZ4	2
Lenovo 7m QSFP+ to QSFP+ Active Optical Cable	00YL658	ATZ5	2
Lenovo 15m QSFP+ to QSFP+ Active Optical Cable	00YL661	ATZ6	2
Lenovo 20m QSFP+ to QSFP+ Active Optical Cable	00YL664	ATZ7	2
QSFP+ active optical breakout cables - 40 GbE to 4x10 GbE			
Lenovo 1M QSFP+ to 4xSFP+ Active Optical Cable	00YL667	ATZ8	2
Lenovo 3M QSFP+ to 4xSFP+ Active Optical Cable	00YL670	ATZ9	2
Lenovo 5M QSFP+ to 4xSFP+ Active Optical Cable	00YL673	ATZA	2
QSFP+ direct-attach cables - 40 GbE			
Lenovo 1m Passive QSFP+ DAC Cable	49Y7890	A1DP	2
Lenovo 3m Passive QSFP+ DAC Cable	49Y7891	A1DQ	2
Lenovo 5m Passive QSFP+ DAC Cable	00D5810	A2X8	2
Lenovo 7m Passive QSFP+ DAC Cable	00D5813	A2X9	2
QSFP+ breakout cables - 40 GbE to 4x10 GbE			
Lenovo 1m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7886	A1DL	2
Lenovo 3m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7887	A1DM	2
Lenovo 5m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7888	A1DN	2

The network cables that can be used with the switch are listed in the following table.

Table 6. EN4093R network cabling requirements

Transceiver	Standard	Cable	Connector
40 Gb Ethernet			
40Gb SR QSFP+ BiDi (00YL631)	40GBASE-SR BiDi	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	LC
40Gb SR4 QSFP+ (49Y7884)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	MPO
40Gb iSR4 QSFP+ (00D9865)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables or MPO-4xLC breakout cables up to 5 m supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	MPO
40Gb eSR4 QSFP+ (00FE325)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables or MPO-4xLC breakout cables up to 5 m supplied by Lenovo (see Table 5); up to 300 m with OM3 or up to 400 m with OM4 multimode fiber optic cable.	MPO
40Gb LR4 QSFP+ (00D6222)	40GBASE-LR4	1310 nm single-mode fiber optic cable up to 10 km.	LC
Active optical cable	40GBASE-SR4	QSFP+ to QSFP+ active optical cables up to 1 m; QSFP+ to 4x SFP+ active optical break-out cables up to 5 m for 4x 10 GbE SFP+ connections out of a 40 GbE port (see Table 5)	QSFP+
Direct attach copper cable	40GBASE-CR4	QSFP+ to QSFP+ DAC cables up to 7 m; QSFP+ to 4x SFP+ DAC break-out cables up to 5 m for 4x 10 GbE SFP+ connections out of a 40 GbE port (see Table 5).	QSFP+
10 Gb Ethernet			
10Gb SR SFP+ (46C3447) 1/10Gb SFP+ (00MY034)	10GBASE-SR	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); up to 300 m with OM3 or up to 400 m with OM4 multimode fiber optic cable.	LC
10Gb LR SFP+ (00FE331, 90Y9412)	10GBASE-LR	1310 nm single-mode fiber optic cable up to 10 km.	LC
10Gb RJ-45 SFP+ (7G17A03130)	10GBASE-T	UTP Category 6a or 7 up to 30 meters.	RJ-45
Active optical cable	10GBASE-SR	SFP+ active optical cables up to 20 m (see Table 5)	SFP+
Direct attach copper cable	10GSFP+Cu	SFP+ DAC cables up to 7 m (see Table 5).	SFP+
1 Gb Ethernet			
1Gb RJ-45 SFP (00FE333)	1000BASE-T	UTP Category 5, 5E, or 6 up to 100 meters.	RJ-45
1Gb SX SFP (81Y1622) 1/10Gb SFP+ (00MY034)	1000BASE-SX	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); 850 nm multimode fiber cable 50 µ (OM2) up to 550 m or 62.5 µ (OM1) up to 220 m.	LC
1Gb LX SFP (90Y9424)	1000BASE-LX	1310 nm single-mode fiber optic cable up to 10 km.	LC
Management ports			
1 GbE management port	1000BASE-T	UTP Category 5, 5E, or 6 up to 100 meters.	RJ-45
RS-232 management port	RS-232	DB-9-to-mini-USB or RJ-45-to-mini-USB console cable (comes with the optional Cable Kit, 90Y9338).	Mini-USB

Software features

Note: The features that are listed in this section are based on Networking OS version 8.4.

The Flex System Fabric EN4093R 10Gb Scalable Switch includes the following software features:

- Scalability and performance:
  - Media access control (MAC) address learning with automatic updates
  - Up to 128 IP interfaces per switch
  - Static and LACP (IEEE 802.3ad) link aggregation
  - Broadcast and multicast storm control
  - IGMP snooping to limit flooding of IP multicast traffic
  - IGMP filtering to control multicast traffic for hosts that are participating in multicast groups
  - Configurable traffic distribution schemes over trunk links that are based on source or destination IP or MAC addresses, or both
  - Fast port forwarding and fast uplink convergence for rapid STP convergence
- Availability and redundancy:
  - IEEE 802.1D STP for providing L2 redundancy
  - IEEE 802.1s Multiple STP (MSTP) for topology optimization
  - IEEE 802.1w Rapid STP (RSTP) provides rapid STP convergence for critical delay-sensitive traffic, such as voice or video
  - Per-VLAN Rapid STP (PVRST) enhancements
  - Layer 2 Trunk Failover to support active/standby configurations of NIC teaming on compute nodes
  - Hot Links provides basic link redundancy with fast recovery for network topologies that require Spanning Tree to be turned off
- VLAN support:
  - Up to 4095 VLANs supported per switch, with VLAN numbers 1 - 4095 (4095 is used for management module's connection only)
  - 802.1Q VLAN tagging support on all ports
  - Full private VLANs
- Security:
  - VLAN-based, MAC-based, and IP-based access control lists (ACLs)
  - 802.1x port-based authentication
  - Multiple user IDs and passwords
  - User access control
  - Radius, TACACS+, and LDAP authentication and authorization
  - NIST 800-131A Encryption
  - Selectable encryption protocol; SHA 256 enabled as default
- Quality of Service (QoS):
  - Support for IEEE 802.1p, IP ToS/DSCP, and ACL-based (MAC/IP source and destination addresses, VLANs) traffic classification and processing
  - Traffic shaping and re-marking based on defined policies
  - Eight Weighted Round Robin (WRR) priority queues per port for processing qualified traffic
  - IPv4/IPv6 ACL metering
- IP v4 Layer 3 functions:
  - Host management
  - IP forwarding
  - IP filtering with ACLs; up to 256 ACLs supported
  - Virtual Router Redundancy Protocol (VRRP) for router redundancy
  - Support for up to 128 static routes
  - Routing protocols: RIP v1, RIP v2, OSPF v2, and BGP-4; up to 2,000 dynamic routes
  - DHCP Relay
  - IGMP snooping and IGMP relay
  - Protocol Independent Multicast (PIM) in Sparse Mode (PIM-SM) and Dense Mode (PIM-DM)

- IPv6 Layer 3 functions:
  - IPv6 host management (except default switch management IP address)
  - IPv6 forwarding
  - Up to 128 static routes
  - Support for OSPF v3 routing protocol
  - IPv6 filtering with ACLs; up to 128 ACLs supported
- OpenFlow support:
  - OpenFlow 1.0 and 1.3.1
  - OpenFlow hybrid mode
- Virtualization:
  - Virtual NICs (vNICs): Ethernet, iSCSI, or FCoE traffic is supported on vNICs (adapter-specific)
  - Unified fabric ports (UFPs):
    - Up to eight UFP virtual ports (vPorts) per 10 GbE physical port (adapter-specific)
    - Ethernet, iSCSI, or FCoE traffic is supported on vPorts
    - Supports up to 1,024 VLAN for the virtual ports
    - Integration with L2 failover
  - Virtual link aggregation groups (vLAGs)
    - Two switches (vLAG peers) act as a single virtual entity for a multi-port aggregation
    - vLAG Peer Gateway for improved usage of the link between the vLAG peers
    - Two-tier vLAGs with VRRP enables active/active VRRP to reduce routing latency
  - 802.1Qbg Edge Virtual Bridging (EVB) is an emerging IEEE standard for allowing networks to become virtual machine (VM)-aware:
    - Virtual Ethernet Bridging (VEB) and Virtual Ethernet Port Aggregator (VEPA) are mechanisms for switching between VMs on the same hypervisor.
    - Edge Control Protocol (ECP) is a transport protocol that operates between two peers over an IEEE 802 LAN that provides reliable, in-order delivery of upper layer protocol data units.
    - Virtual Station Interface (VSI) Discovery and Configuration Protocol (VDP) centralizes configuration of network policies that persist with the VM, independent of its location.
    - EVB Type-Length-Value (TLV) is used to discover and configure VEPA, ECP, and VDP.
  - VMready:
    - Up to 4,096 virtual entities (VEs)
    - Automatic VE discovery
    - Up to 4,096 local or distributed VM groups for VEs
    - NMotion® feature for automatic network configuration migration
  - Switch partitioning (SPAR):
    - SPAR forms separate virtual switching contexts by segmenting the data plane of the module. Data plane traffic is not shared between SPARs on the same switch.
    - SPAR operates as a Layer 2 broadcast network. Hosts on the same VLAN that are attached to a SPAR can communicate with each other and with the upstream switch. Hosts on the same VLAN but attached to different SPARs communicate through the upstream switch.
    - SPAR is implemented as a dedicated VLAN with a set of internal compute node ports and a single external port or link aggregation (LAG). Multiple external ports or LAGs are not allowed in SPAR. A port can be a member of only one SPAR.
- Converged Enhanced Ethernet:
  - Priority-Based Flow Control (PFC) (IEEE 802.1Qbb) extends 802.3x standard flow control to allow the switch to pause traffic that is based on the 802.1p priority value in each packet's VLAN tag.
  - Enhanced Transmission Selection (ETS) (IEEE 802.1Qaz) provides a method for allocating link bandwidth that is based on the 802.1p priority value in each packet's VLAN tag.
  - Data Center Bridging Capability Exchange Protocol (DCBX) (IEEE 802.1AB) allows neighboring network devices to exchange information about their capabilities.

- Fibre Channel over Ethernet (FCoE):
  - FC-BB5 FCoE specification compliant
  - FCoE transit switch operations
  - FCoE Initialization Protocol (FIP) support for automatic ACL configuration
  - FCoE Link Aggregation Group (LAG) support
  - Multi-hop RDMA over Converged Ethernet (RoCE) with LAG support
  - Supports 2,000 secure FCoE sessions with FIP Snooping by using Class ID ACLs
- Stacking:
  - Up to eight switches in a stack; single IP management
  - Hybrid stacking support (from two to six EN4093R switches with two CN4093 switches)
  - FCoE support
  - FCoE LAG on external ports
  - 802.1Qbg support
  - vNIC and UFP support:
    - Support for UFP with 802.1Qbg
    - Support for UFP with private VLANs
- Manageability:
  - Simple Network Management Protocol (SNMP V1 and V3)
  - Telnet interface for CLI
  - Secure Shell (SSH)
  - Secure FTP (sFTP)
  - Service Location Protocol (SLP)
  - Serial interface for CLI
  - Scriptable CLI
  - Firmware image update (TFTP and FTP)
  - Network Time Protocol (NTP) and Precision Time Protocol (PTP) for switch clock synchronization
  - Lenovo Switch Center and XClarity support
- Monitoring:
  - Switch LEDs for external port status and switch module status indication
  - Remote Monitoring (RMON) agent to collect statistics and proactively monitor performance
  - Port mirroring for analyzing network traffic that is passing through switch
  - Change tracking and remote logging with syslog feature
  - Support for sFLOW agent for monitoring traffic in data networks (separate sFLOW analyzer required elsewhere)
  - POST diagnostics

The following features are not supported with IPv6:

- Default switch management IP address
- SNMP trap host destination IP address
- Bootstrap Protocol (BOOTP) and DHCP
- RADIUS, TACACS+ and LDAP
- QoS metering and re-marking ACLs for out-profile traffic
- VMware Virtual Center (vCenter) for VMready
- Routing Information Protocol (RIP)
- Internet Group Management Protocol (IGMP)
- Border Gateway Protocol (BGP)
- Virtual Router Redundancy Protocol (VRRP)
- sFLOW

The following features are not supported with Stacking (for more information about limitations, see the Networking OS Application Guide):

- Converged Enhanced Ethernet (CEE)
- IGMP Relay, IGMP Querier, and IGMPv3
- IPv6
- Policy-based routing
- Routing protocols (RIP, OSPF, BGP)
- sFLOW
- Switch partitioning (SPAR)
- Virtual Router Redundancy Protocol (VRRP)

Ethernet standards

The switch supports the following standards:

- IEEE 802.1AB Data Center Bridging Capability Exchange Protocol (DCBX)
- IEEE 802.1D Spanning Tree Protocol (STP)
- IEEE 802.1p Class of Service (CoS) prioritization
- IEEE 802.1s Multiple STP (MSTP)
- IEEE 802.1Q Tagged VLAN (frame tagging on all ports when VLANs are enabled)
- IEEE 802.1Qbg Edge Virtual Bridging
- IEEE 802.1Qbb Priority-Based Flow Control (PFC)
- IEEE 802.1Qaz Enhanced Transmission Selection (ETS)
- IEEE 802.1x port-based authentication
- IEEE 802.1w Rapid STP (RSTP)
- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3ab 1000BASE-T copper twisted pair Gigabit Ethernet
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3ae 10GBASE-KR backplane 10 Gb Ethernet
- IEEE 802.3ae 10GBASE-SR short range fiber optics 10 Gb Ethernet
- IEEE 802.3ae 10GBASE-LR long range fiber optics 10 Gb Ethernet
- IEEE 802.3ba 40GBASE-SR4 short range fiber optics 40 Gb Ethernet
- IEEE 802.3ba 40GBASE-CR4 copper 40 Gb Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE 802.3x Full-duplex Flow Control
- IEEE 802.3z 1000BASE-SX short range fiber optics Gigabit Ethernet
- IEEE 802.3z 1000BASE-LX long range fiber optics Gigabit Ethernet
- SFF-8431 10GSFP+Cu SFP+ Direct Attach Cable

Warranty

The EN4093R carries a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported chassis, these I/O modules assume your system’s base warranty and any warranty service upgrade.

Physical specifications

The switch features the following approximate dimensions and weight:

- Height: 30 mm (1.2 in.)
- Width: 401 mm (15.8 in.)
- Depth: 317 mm (12.5 in.)
- Weight: 3.7 kg (8.1 lb)

The switch features the following approximate shipping dimensions and weight:

- Height: 114 mm (4.5 in.)
- Width: 508 mm (20.0 in.)
- Depth: 432 mm (17.0 in.)
- Weight: 4.1 kg (9.1 lb)

Agency approvals

The switch conforms to the following regulations:

- United States FCC 47 CFR Part 15, Subpart B, ANSI C63.4 (2003), Class A
- IEC/EN 60950-1, Second Edition
- Canada ICES-003, issue 4, Class A
- Japan VCCI, Class A
- Australia/New Zealand AS/NZS CISPR 22:2006, Class A
- Taiwan BSMI CNS13438, Class A
- CE Mark (EN55022 Class A, EN55024, EN61000-3-2, EN61000-3-3)
- CISPR 22, Class A
- China GB 9254-1998
- Turkey Communique 2004/9; Communique 2004/22
- Saudi Arabia EMC.CVG, 28 October 2002

Chassis and adapters

The switches are installed in I/O module bays in the rear of the Flex System Chassis, as shown in the following figure. Switches are normally installed in pairs because ports on the I/O adapters that are installed in the compute nodes are routed to two I/O bays for redundancy and performance.

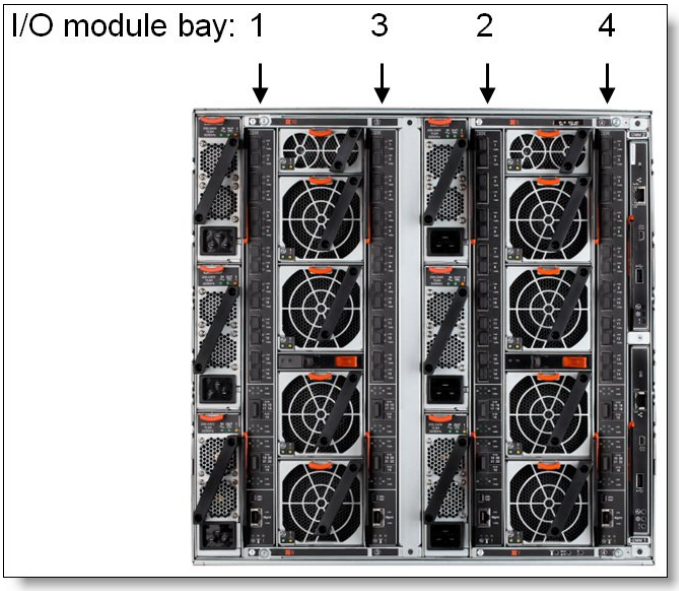

Figure 3. Location of the I/O bays in the Flex System Enterprise Chassis

The EN4093R switches can be installed in bays 1, 2, 3, and 4 of the Enterprise chassis. A supported adapter must be installed in the corresponding slot of the compute node. Each adapter can use up to four lanes to connect to the respective I/O module bay. The EN4093R can use up to three of the four lanes.

In compute nodes that have an integrated dual-port 10 GbE network interface controller (NIC), NIC ports are routed to bays 1 and 2 with a specialized periscope connector, and the adapter is not required. However, the periscope connector can be replaced with the adapter when needed. In such a case, integrated NIC is disabled.

With flexible port mapping, there is no need to buy switch upgrades for 4-port and 8-port adapters if the total number of port licenses on the switch does not exceed the number of external (upstream network ports) and internal (compute node network ports) connections that are used.

The following table shows compatibility information for the EN4093R and Flex System chassis.

Table 7. Flex System chassis compatibility

Description	Part number	Enterprise Chassis with CMM	Enterprise Chassis with CMM2	Carrier-grade Chassis with CMM2
Flex System Fabric EN4093R 10Gb Scalable Switch	00FM514	No	Yes	Yes

The midplane connections between the adapters that are installed in the compute nodes to the I/O module bays in the chassis are listed in the following table. Half-wide compute nodes support up to two adapters, and full-wide compute nodes support up to four adapters.

Table 8. Adapter to I/O bay correspondence

I/O adapter slot in the compute node	Port on the adapter	Corresponding I/O module bay in the chassis			
		Bay 1	Bay 2	Bay 3	Bay 4
Slot 1	Port 1	Yes			
	Port 2		Yes		
	Port 3	Yes			
	Port 4		Yes		
	Port 5	Yes			
	Port 6		Yes		
	Port 7*				
	Port 8*				
Slot 2	Port 1			Yes	
	Port 2				Yes
	Port 3			Yes	
	Port 4				Yes
	Port 5			Yes	
	Port 6				Yes
	Port 7*				
	Port 8*				
Slot 3 (full-wide compute nodes only)	Port 1	Yes			
	Port 2		Yes		
	Port 3	Yes			
	Port 4		Yes		
	Port 5	Yes			
	Port 6		Yes		
	Port 7*				
	Port 8*				
Slot 4 (full-wide compute nodes only)	Port 1			Yes	
	Port 2				Yes
	Port 3			Yes	
	Port 4				Yes
	Port 5			Yes	
	Port 6				Yes
	Port 7*				
	Port 8*				

* Ports 7 and 8 are routed to I/O bays 1 and 2 (Slot 1 and Slot 3) or 3 and 4 (Slot 2 and Slot 4), but these ports cannot be used with the EN4093R switch.

The following table lists the adapters that are supported by the I/O module.

Table 9. Network adapters

Description	Part number	Feature code
50 Gb Ethernet		
ThinkSystem QLogic QL45212 Flex 50Gb 2-Port Ethernet Adapter	7XC7A05843	B2VT
ThinkSystem QLogic QL45262 Flex 50Gb 2-Port Ethernet Adapter with iSCSI/FCoE	7XC7A05845	B2VV
25 Gb Ethernet		
ThinkSystem QLogic QL45214 Flex 25Gb 4-Port Ethernet Adapter	7XC7A05844	B2VU
10 Gb Ethernet		
Embedded 10Gb Virtual Fabric Adapter (2-port)†	None	None
Flex System CN4022 2-port 10Gb Converged Adapter	88Y5920	A4K3
Flex System CN4052 2-port 10Gb Virtual Fabric Adapter	00JY800	A5RP
Flex System CN4052S 2-port 10Gb Virtual Fabric Adapter	00AG540	ATBT
Flex System CN4052S 2-port 10Gb Virtual Fabric Adapter Advanced	01CV780	AU7X
Flex System CN4054 10Gb Virtual Fabric Adapter (4-port)	90Y3554	A1R1
Flex System CN4054R 10Gb Virtual Fabric Adapter (4-port)	00Y3306	A4K2
Flex System CN4054S 4-port 10Gb Virtual Fabric Adapter	00AG590	ATBS
Flex System CN4054S 4-port 10Gb Virtual Fabric Adapter Advanced	01CV790	AU7Y
Flex System CN4058S 8-port 10Gb Virtual Fabric Adapter	94Y5160	A4R6
Flex System EN4132 2-port 10Gb Ethernet Adapter	90Y3466	A1QY
Flex System EN4172 2-port 10Gb Ethernet Adapter	00AG530	A5RN
1 Gb Ethernet		
Embedded 1 Gb Ethernet controller (2-port)*	None	None
Flex System EN2024 4-port 1Gb Ethernet Adapter	49Y7900	A10Y

† The Embedded 10Gb Virtual Fabric Adapter is built into selected compute nodes.
* The Embedded 1 Gb Ethernet controller is built into selected compute nodes.

Related publications and links

For more information, see the following Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch product publications that are available from the Flex System Information Center:
http://flexsystem.lenovofiles.com/help/topic/com.lenovo.acc.en4093.doc/IO_Module_EN4093R.html

- *Flex System Fabric EN4093R 10Gb Scalable Switch Installation Guide*
- *Flex System Fabric EN4093R 10Gb Scalable Switch Application Guide*
- *Flex System Fabric EN4093R 10Gb Scalable Switch Industry Standard CLI Command Reference*

For additional Flex System information, see these resources:

- *Flex System Enterprise Chassis* Product Guide:
  http://lenovopress.com/tips0865
- *Flex System Products and Technology*, SG24-8255:
  http://lenovopress.com/sg248255
- Flex System Interoperability Guide:
  http://lenovopress.com/fsig
- Product Guides for Flex System compute nodes and options:
  http://lenovopress.com/flexsystem

Related product families

Product families related to this document are the following:

- 10 Gb Embedded Connectivity
- Blade Networking Modules

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