

IBM Flex System EN2092 1Gb Ethernet Scalable Switch

IBM Redbooks Product Guide

The IBM Flex System™ EN2092 1Gb Ethernet Scalable Switch enables administrators to offer full Layer 2 and 3 switching and routing capability with combined 1 Gb and 10 Gb uplinks in an IBM Flex System Enterprise Chassis. Such consolidation simplifies the data center infrastructure and helps reduce the number of discrete devices, management consoles, and management systems while leveraging the 1 Gb Ethernet infrastructure. In addition, the next-generation switch module hardware supports IPv6 Layer 3 frame forwarding protocols. This Scalable Switch delivers port flexibility, efficient traffic management, increased uplink bandwidth, and strong Ethernet switching price/performance.

Figure 1 shows the switch module.



Figure 1. IBM Flex System EN2092 1Gb Ethernet Scalable Switch

Did you know?

The EN2092's flexible port licensing allows you buy only the ports that you need when you need them. The base switch configuration includes fourteen 1 GbE connections to the servers and ten 1 GbE uplinks. You then have the flexibility of turning on more 1 GbE connections to the server and more 1 GbE or 10 GbE uplinks when you need them using IBM® Feature on Demand licensing capabilities providing “pay as you grow” scalability.

IBM Flex System, a new category of computing and the next generation of Smarter Computing, offers intelligent workload deployment and management for maximum business agility. This chassis delivers high-speed performance complete with integrated servers, storage, and networking for multi-chassis management in data center compute environments. Furthermore, its flexible design can meet the needs of varying workloads with independently scalable IT resource pools for higher utilization and lower cost per workload. While increased security and resiliency protect vital information and promote maximum uptime, the integrated, easy-to-use management system reduces setup time and complexity, providing a quicker path to ROI.

Part number information

The part numbers to order the switch and optional upgrades are shown in Table 1.

Table 1. Part numbers and feature codes for ordering

Description	Part number	Feature codes*
IBM Flex System EN2092 1Gb Ethernet Scalable Switch	49Y4294	A0TF / 3598
IBM Flex System EN2092 1Gb Ethernet Scalable Switch (Upgrade 1)	90Y3562	A1QW / 3594
IBM Flex System EN2092 1Gb Ethernet Scalable Switch (10Gb Uplinks)	49Y4298	A1EN / 3599

* The first feature code listed is for configurations ordered through the IBM System x® sales channel. The second feature code is for configurations ordered through the IBM Power Systems™ sales channel.

The part number for the switch, 49Y4294, includes the following items:

- One IBM Flex System EN2092 1Gb Ethernet Scalable Switch
- Important Notices Flyer
- Warranty Flyer
- Documentation CD-ROM

The switch does not include a serial management cable. However, the optional IBM Flex System Management Serial Access Cable, 90Y9338, is supported and contains two cables, a mini-USB-to-RJ45 serial cable and a mini-USB-to-DB9 serial cable, either of which can be used to connect to the switch locally for configuration tasks and firmware updates.

The part numbers for the upgrades, 90Y3562 and 49Y4298, include the following items:

- Feature on Demand Activation Flyer
- Upgrade activation key

The base switch and upgrades are as follows:

- 49Y4294 is the part number for the physical device and comes with 14 internal 1 GbE ports enabled, one to each compute node and ten external 1 GbE ports enabled to connect to a top-of-rack switch or other 1 GbE devices. All external 1 GbE ports have RJ-45 connectors.
- 90Y3562 (Upgrade 1) can be applied on the base switch to take full advantage of four-port adapter cards installed in each compute node. This upgrade enables 14 additional internal ports, for a total of 28 ports. The upgrade also enables 10 additional external 1 GbE ports for a total of twenty 1 GbE uplinks. This upgrade requires the base switch.
- 49Y4298 (10Gb Uplinks or Upgrade 2) can be applied on the base switch when you need more uplink bandwidth. The upgrade enables four external 10 Gb uplinks with SFP+ connectors (SFP+ transceivers or DAC cables are not included). This upgrade requires the base switch.

The following table lists supported port combinations on the switch and required upgrades.

Table 2. Supported port combinations

Supported port combinations	Upgrade required	Quantity		
		Base switch, 49Y4294	Upgrade 1, 90Y3562	10Gb Uplinks, 49Y4298
<ul style="list-style-type: none"> 14x internal 1 GbE 10x external 1 GbE 		1	0	0
<ul style="list-style-type: none"> 28x internal 1 GbE 20x external 1 GbE 		1	1	0
<ul style="list-style-type: none"> 14x internal 1 GbE 10x external 1 GbE 4x external 10 GbE 		1	0	1
<ul style="list-style-type: none"> 28x internal 1 GbE 20x external 1 GbE 4x external 10 GbE 		1	1	1

If the 10Gb Uplinks upgrade (49Y4298) is used, then either SFP+ transceivers or DAC cables are required to provide outside connectivity. The following table lists supported SFP+ and DAC options.

Table 3. Supported SFP transceivers and DAC cables

Part number	Feature code*	Description
SFP transceivers - 1 GbE		
81Y1618	3268 / EB29	IBM SFP RJ45 Transceiver (does not support 10/100 Mbps)
81Y1622	3269 / EB2A	IBM SFP SX Transceiver
90Y9424	A1PN / None	IBM SFP LX Transceiver
SFP+ transceivers - 10 GbE		
46C3447	5053 / EB28	IBM SFP+ SR Transceiver
90Y9412	A1PM / None	IBM SFP+ LR Transceiver
44W4408	4942 / 3382	10GbE 850 nm Fiber SFP+ Transceiver (SR)
SFP+ Direct-attach copper (DAC) cables - 10 GbE		
90Y9427	A1PH / ECB4	1m IBM Passive DAC SFP+
90Y9430	A1PJ / ECB5	3m IBM Passive DAC SFP+
90Y9433	A1PK / None	5m IBM Passive DAC SFP+

* The first feature code listed is for configurations ordered through System x sales channels. The second feature code is for configurations ordered through the IBM Power Systems sales channel.

Benefits

The IBM Flex System EN2092 1Gb Scalable Switch is considered particularly suited for these clients:

- Clients who want to leverage GbE in their infrastructure
- Clients who are implementing a virtualized environment and require multiple GbE ports
- Clients who require investment protection for 10 Gb uplinks
- Clients who want to reduce TCO and improve performance while maintaining high levels of availability and security
- Clients who want to avoid or minimize oversubscription, which can result in congestion and loss of performance

The switch offers the following key benefits:

- Increases network performance

With the growth of virtualization and the evolution of cloud, many of today's applications require low latency and high-bandwidth performance. The EN2092 delivers non-blocking architecture with 176 Gbps throughput and full line rate performance, making it ideal for managing dynamic workloads across the network. In addition, the switch provides a rich Layer 2 and Layer 3 feature set that is ideal for many of today's data centers, plus it offers a combined uplink bandwidth of 60 Gb.

- Pay as you grow flexibility

The EN2092's flexible port licensing allows you buy only the ports that you need when you need them. The base switch configuration includes fourteen 1 GbE connections to the servers and ten 1 GbE uplinks. You then have the flexibility of turning on more 1 GbE connections to the server and more 1 GbE or 10 GbE uplinks when you need them using IBM Feature on Demand licensing capabilities providing pay as you grow scalability.

- VM-aware networking

Delivering advanced virtualization awareness helps simplify management and automates VM mobility by making the network VM aware with IBM VMready® which works with all the major hypervisors. For companies using VMware, IBM System Networking's Distributed Virtual Switch 5000V (sold separately) enables network administrators to simplify management by having a consistent virtual and physical networking environment. 5000V virtual and physical servers use the same configurations, policies, and management tools. Network policies migrate automatically along with virtual machines (VMs) to ensure that security, performance, and access remain intact as VMs move from server to server.

- Simplifies network infrastructure

The EN2092 1Gb Scalable Switch simplifies deployment and growth by using its innovative scalable architecture. This architecture helps increase return on investment by reducing the qualification cycle, while providing investment protection for additional I/O bandwidth requirements in the future. The extreme flexibility of the switch comes from the ability to turn on additional ports as required, both down to the server and for upstream connections (including 10 GbE).

- Integrates network management

A key challenge is the management of a discrete network environment. The EN2092 1Gb Scalable Switch is tightly integrated and managed through the IBM Flex System Manager. The switch also supports a command-line interface (CLI) for integration into existing scripting and automation. Network management can be simplified by using port profiles, topology views, and virtualization management.

For more advanced levels of management and control, IBM offers IBM System Networking Element Manager (SNEM), which can significantly reduce deployment and day-to-day maintenance times, while providing in-depth visibility into the network performance and operations of IBM switches. Plus, when leveraging tools like VMware vCenter Server (formerly VMware VirtualCenter) or vSphere, SNEM provides additional integration for better optimization.

Features and specifications

The EN2092 Scalable Switch has the following features and specifications:

- Internal ports
 - Twenty-eight internal full-duplex Gigabit ports (14 ports are enabled by default. An optional FoD license is required to activate another 14 ports.)
 - Two internal full-duplex 1 GbE ports connected to the chassis management module
- External ports
 - Four ports for 1 Gb or 10 Gb Ethernet SFP+ transceivers (support for 1000BASE-SX, 1000BASE-LX, 1000BASE-T, 10GBASE-SR, or 10GBASE-LR) or SFP+ copper direct-attach cables (DAC). These ports are disabled by default. An optional FoD license is required to activate them. SFP+ modules are not included and must be purchased separately.
 - Twenty external 10/100/1000 1000BASE-T Gigabit Ethernet ports with RJ-45 connectors (10 ports are enabled by default. An optional FoD license is required to activate another 10 ports..)
 - One RS-232 serial port (mini-USB connector) that provides an additional means to configure the switch module.
- Scalability and performance
 - Fixed-speed external 10 Gb Ethernet ports for maximum uplink bandwidth
 - Autosensing 10/1000/1000 external Gigabit Ethernet ports for bandwidth optimization
 - Non-blocking architecture with wire-speed forwarding of traffic
 - Media access control (MAC) address learning: automatic update, support of up to 32,000 MAC addresses
 - Up to 128 IP interfaces per switch
 - Static and LACP (IEEE 802.3ad) link aggregation, up to 60 Gb of total uplink bandwidth per switch, up to 64 trunk groups, up to 16 ports per group
 - Support for jumbo frames (up to 9,216 bytes)
 - Broadcast/multicast storm control
 - IGMP snooping for limit flooding of IP multicast traffic
 - IGMP filtering to control multicast traffic for hosts participating in multicast groups
 - Configurable traffic distribution schemes over trunk links based on source/destination IP or MAC addresses or both
 - Fast port forwarding and fast uplink convergence for rapid STP convergence

- Availability and redundancy
 - Virtual Router Redundancy Protocol (VRRP) for Layer 3 router redundancy
 - IEEE 802.1D STP for providing L2 redundancy
 - IEEE 802.1s Multiple STP (MSTP) for topology optimization, up to 32 STP instances supported by single switch
 - IEEE 802.1w Rapid STP (RSTP) (provides rapid STP convergence for critical delay-sensitive traffic like voice or video)
 - Per-VLAN Rapid STP (PVRST) enhancements
 - Layer 2 Trunk Failover to support active/standby configurations of network adapter 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 1024 VLANs supported per switch, with VLAN numbers ranging from 1 to 4095 (4095 is used for management module's connection only)
 - 802.1Q VLAN tagging support on all ports
 - Private VLANs
- Security
 - VLAN-based, MAC-based, and IP-based ACLs
 - 802.1x port-based authentication
 - Multiple user IDs and passwords
 - User access control
 - Radius, TACACS+ and LDAP authentication and authorization
- 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
- IP v4 Layer 3 functions
 - Host management
 - IP forwarding
 - IP filtering with ACLs, up to 896 ACLs supported
 - VRRP for router redundancy
 - Support for up to 128 static routes
 - Routing protocol support (RIP v1, RIP v2, OSPF v2, BGP-4), up to 2048 entries in a routing table
 - Support for DHCP Relay

- Support for IGMP snooping and IGMP relay
- Support for Protocol Independent Multicast (PIM) in Sparse Mode (PIM-SM) and Dense Mode (PIM-DM).
- IP v6 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
- Virtualization
 - VMready
- Manageability
 - Simple Network Management Protocol (SNMP V1, V2, and V3)
 - HTTP browser GUI
 - Telnet interface for CLI
 - SSH and SSHv2
 - Serial interface for CLI
 - Scriptable CLI
 - Firmware image update (TFTP and FTP)
 - Network Time Protocol (NTP) for switch clock synchronization
- Monitoring
 - Switch LEDs for external port status and switch module status indication
 - Remote Monitoring (RMON) agent to collect statistics and proactively monitor switch performance
 - Port mirroring for analyzing network traffic passing through the switch
 - Change tracking and remote logging with the syslog feature
 - Support for the 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

Standards supported

The switch supports the following IEEE standards:

- IEEE 802.1D Spanning Tree Protocol (STP)
- IEEE 802.1s Multiple STP (MSTP)
- IEEE 802.1w Rapid STP (RSTP)
- IEEE 802.1p Class of Service (CoS) prioritization
- IEEE 802.1Q Tagged VLAN (frame tagging on all ports when VLANs are enabled)
- IEEE 802.1x port-based authentication
- IEEE 802.2 Logical Link Control
- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE 802.3ab 1000BASE-T copper twisted pair Gigabit Ethernet
- IEEE 802.3z 1000BASE-SX short range fiber optics Gigabit Ethernet
- IEEE 802.3z 1000BASE-LX long range fiber optics Gigabit Ethernet
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3x Full-duplex Flow Control
- IEEE 802.3ae 10GBASE-SR short range fiber optics 10 Gb Ethernet
- IEEE 802.3ae 10GBASE-LR long range fiber optics 10 Gb Ethernet
- 10GSFP+Cu SFP+ Direct Attach copper

Supported chassis and adapter cards

The switches are installed in switch bays in the rear of the IBM Flex System Enterprise Chassis, as shown in the following figure. Switches are normally installed in pairs because I/O adapter cards installed in the compute nodes route to two switch bays for redundancy and performance.

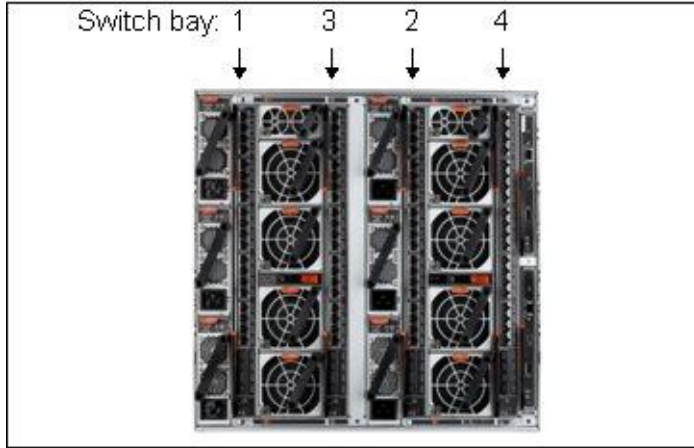


Figure 2. Location of the switch bays in the IBM Flex System Enterprise Chassis

The connections between the adapters installed in the compute nodes to the switch bays in the chassis are shown diagrammatically in the following figure. The figure shows both half-wide servers, such as the x240 with two adapters, and full-wide servers, such as the p460 with four adapters.

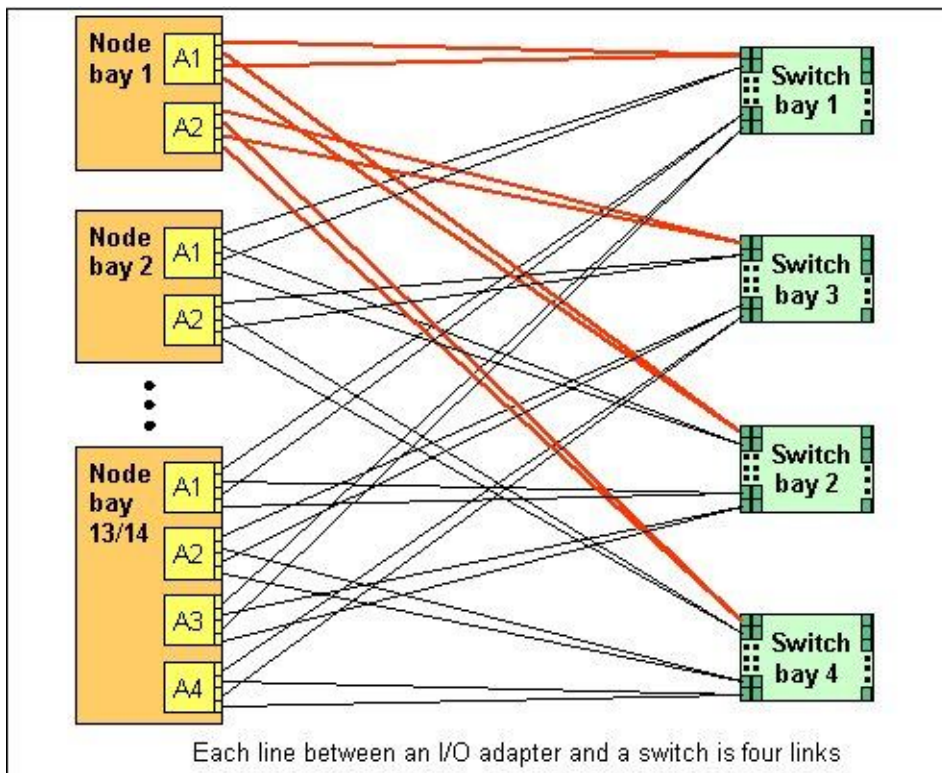


Figure 3. Logical layout of the interconnects between I/O adapters and I/O modules

The IBM Flex System EN2092 Scalable Switch can be installed in bays 1, 2, 3, and 4 of the Enterprise

chassis. A supported adapter card must be installed in a corresponding slot of the compute node (slot A1 when switches are installed in bays 1 and 2 or slot A2 when switches are in bays 3 and 4). In addition, an optional Upgrade 1 (90Y3562) is required for the switch to allow communications on all four ports on a four-port adapter.

In compute nodes that have an integrated dual-port 10 GbE network interface controller (NIC), NIC's ports are routed to bays 1 and 2 with a specialized periscope connector, and the adapter card in slot A1 is not required. However, when needed, the periscope connector can be replaced with the adapter card. In such a case integrated NIC will be disabled.

The following table shows the connections between adapters installed in the compute nodes to the switch bays in the chassis.

Table 4. Adapter to I/O bay correspondence

I/O adapter slot in the server	Port on the adapter	Corresponding I/O module bay in the chassis
Slot 1	Port 1	Module bay 1
	Port 2	Module bay 2
	Port 3*	Module bay 1
	Port 4*	Module bay 2
Slot 2	Port 1	Module bay 3
	Port 2	Module bay 4
	Port 3*	Module bay 3
	Port 4*	Module bay 4
Slot 3 (full-wide compute nodes only)	Port 1	Module bay 1
	Port 2	Module bay 2
	Port 3*	Module bay 1
	Port 4*	Module bay 2
Slot 4 (full-wide compute nodes only)	Port 1	Module bay 3
	Port 2	Module bay 4
	Port 3*	Module bay 3
	Port 4*	Module bay 4

* Ports 3 and 4 require Upgrade 1 of the EN2092 1Gb switch.

The following table lists the I/O adapters supported by the EN2092 1Gb Scalable Switch. 10 GbE adapters operate at 1 Gb speeds when used with this switch.

Table 5. Network adapters

Description	Part number	System x feature code	Power Systems feature code	Support for EN2092 switch
10 Gb Ethernet				
Embedded 10Gb Virtual Fabric Adapter (2-port)	None	None	None	Yes*
IBM Flex System Embedded 10Gb Virtual Fabric Upgrade (Feature on Demand to provide FCoE and iSCSI support)	90Y9310	A2TD	None	No
IBM Flex System CN4054 10Gb Virtual Fabric Adapter (4-port)	90Y3554	A1R1	None	Yes
IBM Flex System CN4054 Virtual Fabric Adapter (SW Upgrade) (Feature on Demand to provide FCoE and iSCSI support)	90Y3558	A1R0	None	No
IBM Flex System EN4054 4-port 10Gb Ethernet Adapter	None	None	1762	Yes
IBM Flex System EN4132 2-port 10Gb Ethernet Adapter	90Y3466	A1QY	None	No
1 Gb Ethernet				
IBM Flex System EN2024 4-port 1Gb Ethernet Adapter	49Y7900	A10Y	1763	Yes

* The Embedded 10Gb Virtual Fabric Adapter is included in models of the x240 with model numbers of the form x2x.

The adapters are installed in slots in each compute node. The following figure shows the locations of the slots in the x240 Compute Node. The positions of the adapters in the other supported servers are similar.

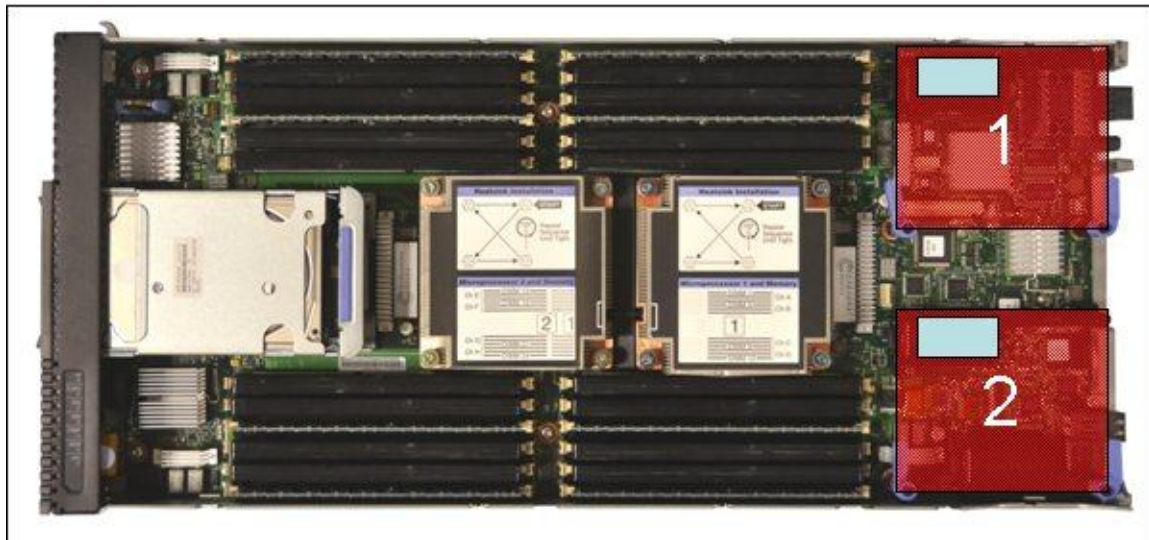


Figure 4. Location of the I/O adapter slots in the IBM Flex System x240 Compute Node

Connectors and LEDs

Figure 5 shows the front panel of the IBM Flex System EN2092 1Gb Ethernet Scalable Switch .

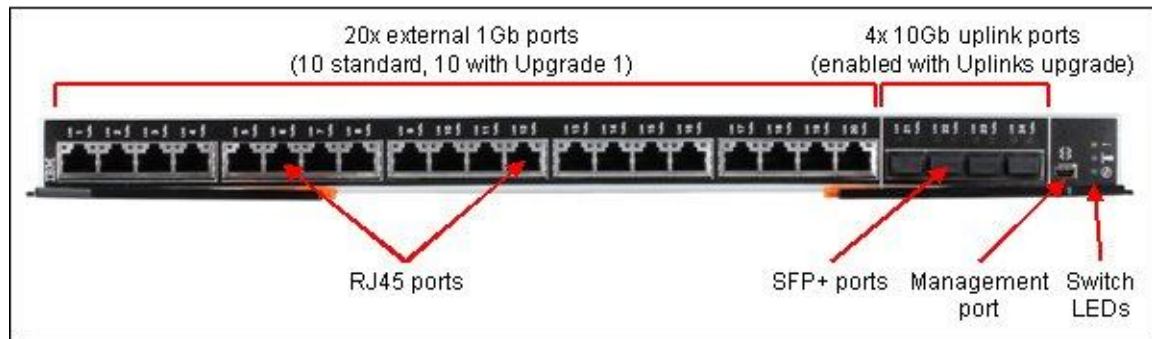


Figure 5. Front panel of the IBM Flex System EN2092 1Gb Ethernet Scalable Switch

The front panel contains the following components:

- LEDs that display the status of the switch module and the network:
 - OK LED indicates that the switch module has passed the power-on self-test (POST) with no critical faults and is operational.
 - Identify: This blue LED can be used to identify the switch physically, by illuminating via the management software.
 - Error LED (switch module error) indicates that the switch module has failed the POST or detected an operational fault.
- One mini-USB RS-232 console port that provides an additional means to configure the switch module. This mini-USB-style connector enables connection of a special serial cable. (The cable is optional and it is not included with the switch. See the "Part number information" section for details).
- Twenty external 1000BASE-T Ethernet ports for 10/100/1000 Mbps connections to external Ethernet devices.
- Four external SFP+ port connectors to attach SFP+ modules for 1 Gb or 10 Gb connections to external Ethernet devices.
- An Ethernet link OK LED and an Ethernet Tx/Rx LED for each external port on the switch module.

Network cabling requirements

The network cables that can be used with the switch are as follows (depending on the enabled port combination. See Table 2):

- 10GBASE-SR (requires optional 10 GbE SFP transceiver modules listed in Table 3)
 - 850 nm communication using multimode fiber cable (50 μ or 62.5 μ) up to 300 m, LC duplex connector
- 10GBASE-LR (requires optional 10 GbE SFP+ transceiver modules listed in Table 3)
 - 1310 nm communication using single-mode fiber cable up to 10 km, LC duplex connector
- 1000BASE-SX (requires optional 1 GbE SFP transceiver modules listed in Table 3)
 - 850 nm communication using multimode fiber cable (50 μ or 62.5 μ) up to 550 m, LC duplex connector

- 1000BASE-LX (requires optional 1 GbE SFP transceiver modules listed in Table 3)
 - 1310 nm communication using single-mode fiber cable up to 10 km, LC duplex connector
- 1000BASE-T (external 1 GbE RJ-45 ports, optional RJ-45 SFP transceivers)
 - UTP Category 6
 - UTP Category 5e (100 meters maximum)
 - UTP Category 5 (100 meters maximum)
 - EIA/TIA-568B 100-ohm STP (100 meters maximum)
- 10GSFP+Cu
 - Up to 5 m SFP+ copper direct attach cables listed in Table 3
- RS-232 serial cable: Console cable DB-9-to-mini-USB or RJ-45-to-mini-USB (nonstandard use of USB connector) that comes with optional IBM Flex System Management Serial Access Cable, 90Y9338

Warranty

There is a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a chassis, these switches assume your system's base warranty and any IBM ServicePac® upgrade.

Physical specifications

The approximate dimensions and weight of the switch are as follows:

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

Shipping dimensions and weight (approximate):

- 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)

Regulatory compliance

The switch conforms to the following standards:

- 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 Communiqué 2004/9; Communiqué 2004/22
- Saudi Arabia EMC.CVG, 28 October 2002

Popular configurations

The following figure shows use of the IBM Flex System EN2092 1Gb Scalable Switch to route four ports on each of two adapter cards installed in the compute node. Each compute node has a total of eight 1 GbE ports, and four EN2092 switches are installed in bays 1, 2, 3, and 4 of the Enterprise Chassis. The connections between the adapter card and the switches are internal to the chassis. No cabling is needed.

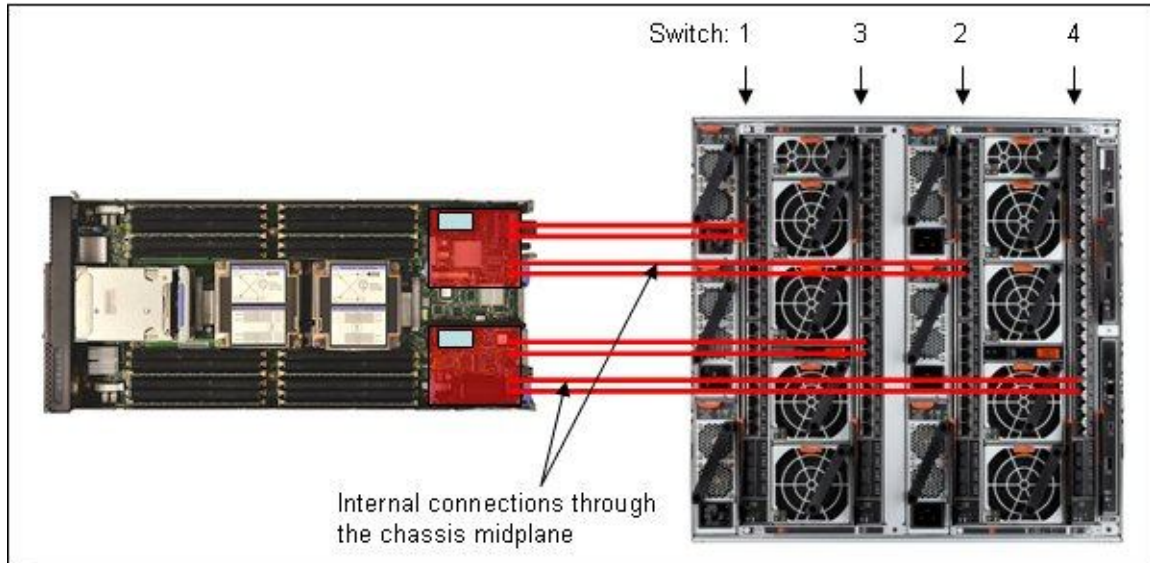


Figure 6. Using EN2092 1Gb Ethernet Scalable Switch with two EN2024 4-port adapter cards

Table 6. Components used when connecting the adapter to the 1 GbE switches

Part number/machine type	Description	Quantity
8737-x1x	IBM Flex System x240 Compute Node or other supported server (without Embedded 10Gb Virtual Fabric Adapter)	1 to 14
49Y7900	IBM Flex System EN2024 4-port 1Gb Ethernet Adapter	2 per server
8721-A1x	IBM Flex System Enterprise Chassis	1
49Y4294	IBM Flex System EN2092 1Gb Ethernet Scalable Switch	4
90Y3562	IBM Flex System EN2092 1Gb Ethernet Scalable Switch (Upgrade 1)	4

Related publications

For more information see the following IBM Flex System EN2092 1Gb Ethernet Scalable Switch product publications, available from the IBM Flex System Information Center:

<http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>

- *Installation Guide*
- *Application Guide*
- *Command Reference*

Other documents:

- US Announcement Letter 112-053
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-053>
- IBM Flex System Enterprise Chassis Product Guide
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