

IBM Power System H922 server offers a superior on-premises infrastructure for a hybrid multicloud platform, delivering high security and reliability, industry-leading PCIe Gen4 IO, and a built-in cloud-optimized hypervisor

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At a glance

The IBM^(R) Power^(R) System H922 (9223-22S) server, the most recent addition to the SAP HANA platform, easily integrates into your organization's cloud and cognitive strategy and delivers industry-leading price and performance for your mission-critical workloads.

- Gain faster insights from your data with up to 4 TB of in-memory database capabilities for SAP HANA, IBM Db2^(R), Oracle, and a variety of open-source databases.
- Deliver superior price and performance for your mission-critical applications with room to scale in IBM AIX^(R), IBM i, and Linux^(R) environments.
- Prevent security threats with advanced security features combined with unmatched reliability and resiliency.
- Harness the integrated virtualization capabilities of the server to rapidly deploy, optimize, and recover workloads.
- Migrate from previous IBM Power Systems servers with Live Partition Mobility (LPM) capabilities. Every new Power H922 server comes with a temporary IBM PowerVM^(R) license for your old server to support a seamless move to IBM POWER9TM technology-based servers.
- Use this cloud-enabled server to build an agile, containerized cloud on a server platform that is optimized for data and cognitive services.
- Twice as much bandwidth for a seamless integration between on-premises and public clouds with a new back-end PCIe Gen4 switch.
- More NVMe adapters with ten PCIe Gen4 slots in the back plus four PCI Gen4-capable U.2 front-accessible drives.
- Up to 89.6 TB of NVMe Enterprise Class Storage capacity.
- New cost-effective 800 GB data center PCIe Gen3 NVMe device supported for AIX, IBM VIOS, or Linux environments.

Overview

Power Systems has always been focused on reliability and performance. The Power H922 server is primed with POWER9 processor, displaying a technology designed from the ground up for data-intensive workloads such as operational databases, advanced analytics, and business applications. The system is built with

innovations that deliver the highest security and reliability standards for future-driven enterprises.

When it comes to virtualization technology, Power Systems are unmatched. With a built-in PowerVM hypervisor, clients have been relying on IBM for years to provide consumability and agility in IT data centers. Today, leveraging IBM's unique, comprehensive approach to the cloud, from on-premises IT to public cloud provider, we are taking one step forward.

The new Power H922, powered by PCIe Gen4 switches, delivers a seamless and lightspeed throughput I/O between multiple on-premises and public clouds applications.

The Power H922 (9223-22S) server provides:

A superior on-premises infrastructure for a hybrid cloud

- Twice as fast back-end I/O enables seamless maximum speed and throughput between on-premises and multiple public cloud infrastructures with high availability (HA).
- Largest memory bandwidth and memory storage in the market together with up to 14 (four U.2 NVMe plus up to ten PCIe add-in cards) NVMe adapters allows a huge virtual machine (VM), container, and bare metal consolidation, saving data center space and networking costs.
- Supports multiple OS instances without processing overhead in the server.
- PowerVM hypervisor is built in at no extra charge, so every POWER9 workload is virtualized, mobile, and cloud ready.
- IBM VM Recovery Manager, built on PowerVM, provides easy, low-cost solutions for HA and disaster recovery (DR) operations.
- IBM PowerHA^(R) for AIX and IBM i are the low-cost, highly automated solutions to deliver HA features to your mission-critical applications.

Increased performance and flexibility for your key workloads

- Upgrade AIX and IBM i installations to speed up your journey to a hybrid multicloud environment
- Optimize performance and license costs with Oracle applications through Shared Utility Capacity
- New Red Hat^(R) Enterprise Linux and Red Hat OpenShift^(R) deployments
- Increased performance and reduced footprint to run IBM Cloud^(R) Paks
- High performance for IBM Spectrum^(R) Scale offerings
- SAP HANA environments with external storage and multiple nodes

Key features

The Power H922 server is a robust 2-socket system that meets today's growth and tomorrow's processing needs. It ships with up to 22 powerful cores and I/O configuration flexibility in a 19-inch rackmount, 2U (EIA units) form factor. The server supports:

- One processor socket populated with the following POWER9 processor module:
 - 4-core typical 2.8 to 3.8 GHz (max)
- One or two processor sockets populated with the following POWER9 processor modules:
 - 11-core typical 2.8 to 3.8 GHz (max)
 - 10-core typical 2.9 to 3.8 GHz (max)
 - 8-core typical 3.4 to 3.9 GHz (max)

Note: Power Management mode is set to Max Performance by default in the system. This mode can dynamically optimize the processor frequency at any given time based on CPU utilization and operating environmental conditions.

For a description of this feature and other power management options available for this server, see the [IBM EnergyScale for POWER9 Processor-Based Systems](#) website.

- Up to 4.0 TB of system memory distributed across 32 DDR4 DIMM slots. Supports different memory DIMM sizes, such as 16 GB, 32 GB, 64 GB, and 128 GB, running at different speeds of 2133, 2400, and 2666 Mbps.
- Multiple I/O options:
 - Three x16 Gen4 low-profile, half-length slots (CAPI)
 - Two x16 Gen4 low-profile, half-length slots
 - One x8 Gen4 low-profile, half-length slot (with x16 connectors) (CAPI)
 - One x8 Gen4 low-profile, half-length slot (with x16 connectors)
 - Four x8 Gen4 low-profile, half-length slots (One of these slots is used for the required base LAN adapter.)
- Storage features:
 - Storage backplane with two or four front PCIe Gen4 capable NVMe U.2 drive slots
 - Eight 2.5-inch SFF-3 (Gen3 carrier) disk bays
 - Base 8 SFF-3 bays
 - RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2 support
 - Split feature to 4+4 SFF bays: Add a second SAS controller
 - Expanded function 8 SFF-3 bays/dual IOA with write cache and optional external SAS port
 - Expansion capabilities for the EXP12SX/EXP24SX SFF Gen2-bay drawer
 - Hot-plug PCIe Gen4 capable U.2 slots
- Integrated technologies and features:
 - Service processor
 - EnergyScale
 - Hot-plug and redundant cooling
 - Two front and two rear USB 3.0 ports
 - Two HMC ports
 - One system port with RJ45 connector
- 1+1 redundant hot-plug AC power supplies in each enclosure
- PowerVM integrated virtualization with minimum processing overhead

Key requirements

Linux is required as the primary operating system with a minimum of 75% of total cores activated.

IBM AIX and IBM i can be chosen as secondary operating systems, with a maximum of 25% of total cores activated across both.

Planned availability date

November 20, 2020

Availability of programs with an encryption algorithm in France is subject to French government approval.

Description

The POWER9 scale-out family is the first set of servers that comes completely cloud enabled out of the box with integrated PowerVM Enterprise capabilities. These servers have a native hypervisor included at no additional license cost. Additionally, on-chip analytics and algorithms combined with a sophisticated PCIe Gen4 I/O architecture help clients run their workloads at an optimized processor frequency for performance and throughput. In combination with the DDR4 memory footprint of 4 TB, IBM provides a system that is unmatched by the competition in terms of memory scaling as well as the core-to-memory ratio needed for data-centric and in-memory workloads. LPM capabilities help you migrate from previous Power Systems. Every new Power H922 has the option of a temporary PowerVM license for your old server to support a seamless move of workloads to POWER9. The Power H922 server has built-in security that can help you to be ready for current and future security threats.

Summary of standard features for the Power H922 server:

- POWER9 processor modules:
 - 4-core typical 2.8 to 3.8 GHz (max) POWER9 processor (#EP76)
 - 8-core typical 3.4 to 3.9 GHz (max) POWER9 processor (#EP77)
 - 10-core typical 2.9 to 3.8 GHz (max) POWER9 processor (#EP78)
 - 11-core typical 2.8 to 3.8 GHz (max) POWER9 processor (#EP79)
- High-performance Mbps DDR4 ECC memory
 - 16 GB (#EM6J), 32 GB (#EM6K), 64 GB (#EM7B), or 128 GB (#EM7C) memory features - different sizes and configurations run at different frequencies of 2133, 2400, and 2666 Mbps
 - Up to 4 TB of DDR4 memory with two Power Systems processors
 - Up to 2 TB of DDR4 memory with one Power Systems processor
- Storage features:
 - Storage backplane with two or four front PCIe Gen4 capable NVMe U.2 drive slots
 - Eight SFF bays, one integrated SAS controller without cache, and JBOD RAID 0, RAID 5, RAID 6, or RAID 10
 - Option to split the above SFF-3 bays and add a second integrated SAS controller without cache
 - Expanded function storage backplane 8 SFF-3 bays/single IOA with write cache
 - Option to attach an EXP12SX/EXP24SX SAS HDD/SSD expansion drawer to the single IOA
- PCIe slots with single processor:
 - One x16 Gen4 low-profile, half-length slot (CAPI)
 - One x8 Gen4 low-profile, half-length slot (with x16 connector) (CAPI)
 - Two x16 Gen4 low-profile, half-length slots
 - Four x8 Gen4 low-profile, half-length slots (One of these slots is used for the required base LAN adapter.)
- PCIe slots with two processors:
 - Three x16 Gen4 low-profile, half-length slots (CAPI)
 - One x8 Gen4 low-profile, half-length slot (with x16 connectors) (CAPI)
 - One x8 Gen4 low-profile, half-length slot (with x16 connectors)
 - Two x16 Gen4 low-profile, half-length slots
 - Four x8 Gen4 low-profile, half-length slots (One of these slots is used for the required base LAN adapter.)
- Integrated:
 - Service processor
 - EnergyScale technology
 - Hot-plug and redundant cooling

- Two front USB 3.0 ports
- Two rear USB 3.0 ports
- Two HMC 1 GbE RJ45 ports
- One system port with RJ45 connector
- Two hot-plug, redundant power supplies
- Nineteen-inch rack-mounting hardware (2U)

PowerVM

PowerVM, which delivers industrial-strength virtualization for AIX and Linux environments on POWER^(R) processor-based systems, provides a virtualization-oriented performance monitor, and performance statistics are available through the HMC. These performance statistics can be used to understand the workload characteristics and to prepare for capacity planning.

Power H922 Software tier for IBM i

IBM i support is provided at the P10 software tier even though the Power H922 has two sockets. However, there are limitations to the maximum size of the partition, and all I/O must be virtualized through VIOS. Up to four cores per IBM i partition are supported. Multiple IBM i partitions can be created and run concurrently, and each individual partition can have up to four cores.

IBM i QPRCFEAT values are the same numeric value as the feature. IBM i does not support the 4-core processor feature EP76.

IBM i cannot be the primary partition.

Processor modules

A maximum of one processor is allowed. The following defines the allowed quantities of processor activation entitlements:

- One 4-core, typical 2.8 to 3.8 GHz (max) processor (#EP76) requires that four processor activation codes be ordered. A maximum of four processor activations (#EP7C) is allowed.

A maximum of two processors of the same type is allowed. The following defines the allowed quantities of processor activation entitlements:

- One 8-core, typical 3.4 to 3.9 GHz (max) processor (#EP77) requires that eight processor activation codes be ordered. A maximum of eight processor activations (#EP7D) is allowed.
- Two 8-core, typical 3.4 to 3.9 GHz (max) processors (#EP77) require that sixteen processor activation codes be ordered. A maximum of 16 processor activations (#EP7D) is allowed.
- One 10-core, typical 2.9 to 3.8 GHz (max) processor (#EP78) requires that ten processor activation codes be ordered. A maximum of 10 processor activation features (#EP7E) is allowed.
- Two 10-core, typical 2.9 to 3.8 GHz (max) processors (#EP78) require that twenty processor activation codes be ordered. A maximum of 20 processor activation features (#EP7E) is allowed.
- One 11-core, typical 2.8 to 3.8 GHz (max) processor (#EP79) requires that ten processor activation codes be ordered. A maximum of 11 processor activation features (#EP7F) is allowed.
- Two 11-core, typical 2.8 to 3.8 GHz (max) processors (#EP79) require that twenty processor activation codes be ordered. A maximum of 22 processor activation features (#EP7F) is allowed.

System memory

- A minimum of 32 GB of memory is required on the Power H922 system.

- Memory upgrades require memory pairs. Base memory is 2x 16 GB DIMMs (#EM6J) with one socket installed and 4x16 GB DIMMs (#EM6J) with two sockets installed (2 per socket).

Plans for future memory upgrades should be taken into account when deciding which memory feature size to use at the time of initial system order.

Feature description	Feature number	Minimum DIMM quantity	Maximum DIMM quantity
16 GB DDR4 Memory	EM6J	0	32
32 GB DDR4 Memory	EM6K	0	32
64 GB DDR4 Memory	EM7B	0	32
128 GB DDR4 Memory	EM7C	0	32

Note: Different sizes and configurations run at different frequencies of 2133, 2400, and 2666 Mbps.

Power supply

- Two power supplies supporting a rack: 1+1 1400 Watt 200 - 240 Volt (#EB2M)

Redundant fans

Redundant fans are standard.

Power cords

Two power cords are required. The Power H922 server supports power cord 4.3 m (14 ft), Drawer to Wall/IBM PDU (250V/10A) in the base shipment group. See the feature listing for other options.

PCIe slots

The Power H922 server has up to 14 (four U.2 NVMe plus up to ten PCIe add-in cards) PCIe hot-plug slots, providing excellent configuration flexibility and expandability. For more information about PCIe slots, see the Rack-integrated system with I/O expansion drawer section below.

With two POWER9 processor single-chip modules (SCM), eleven PCIe slots are available:

- Three are x16 Gen4 low-profile, half-length slots (CAPI)
- One is an x8 Gen4 low-profile, half-length slot (with x16 connectors) (CAPI)
- One is an x8 Gen4 low-profile, half-length slot (with x16 connectors)
- Two are x16 Gen4 low-profile, half-length slots
- Four are x8 Gen4 low-profile, half-length slots (One of these slots is used for the required base LAN adapter.)

With one POWER9 processor SCM, eight PCIe slots are available:

- One is an x16 Gen4 low-profile, half-length slot (CAPI)
- One is an x8 Gen4 low-profile, half-length slot (with x16 connector) (CAPI)
- Two are x16 Gen4 low-profile, half-length slots
- Four are x8 Gen4 low-profile, half-length slots (One of these slots is used for the required base LAN adapter.)

The x16 slots can provide up to twice the bandwidth of x8 slots because they offer twice as many PCIe lanes. PCIe Gen4 slots can support up to twice the bandwidth of a PCIe Gen3 slot, and PCIe Gen3 slots can support up to twice the bandwidth of a PCIe Gen2 slot, assuming an equivalent number of PCIe lanes.

At least one PCIe Ethernet adapter is required on the server by IBM to ensure proper manufacture, test, and support of the server. One of the x8 PCIe slots is used for this required adapter.

These servers are smarter about energy efficiency when cooling the PCIe adapter environment. They sense which IBM PCIe adapters are installed in their PCIe slots and, if an adapter requires higher levels of cooling, they automatically speed up fans to increase airflow across the PCIe adapters. Note that faster fans increase the sound level of the server. Higher wattage PCIe adapters include the PCIe3 SAS adapters and SSD/flash PCIe adapters (#EJ10, #EJ14, and #EJ0J).

NVMe drive slots, SAS bays, and storage backplane options

- Storage backplane with two front PCIe Gen4 capable NVMe U.2 drive slots (#EJ1V)
- Storage backplane with four front PCIe Gen4 capable NVMe U.2 drive slots (#EJ1W)
- Base storage backplane 8 SFF-3 bays (#EJ1F)
- Split backplane 4 + 4 SFF-3 bays (#EJ1H)
- Expanded function storage backplane 8 SFF-3 bays/single IOA with write cache (#EJ1G)

The backplane option provides SFF-3 SAS bays in the system unit. These 2.5-inch or small form factor (SFF) SAS bays can contain SAS drives (HDD or SSD) mounted on a Gen3 tray or carrier. Thus, the drives are designated SFF-3. SFF-1 or SFF-2 drives do not fit in an SFF-3 bay. All SFF-3 bays support concurrent maintenance or hot-plug capability.

This backplane option uses leading-edge, integrated SAS RAID controller technology designed and patented by IBM. A custom-designed PowerPC^(R)-based ASIC chip is the basis of these SAS RAID controllers and provides RAID 0, RAID 5, RAID 6, and RAID 10 functionality with HDDs and SSDs. Internally, SAS ports are implemented and provide plenty of bandwidth. The integrated SAS controllers are placed in dedicated slots and do not reduce the number of available PCIe slots.

The feature EJ1F storage backplane option provides eight SFF-3 bays and one SAS controller with zero write cache.

By optionally adding the feature EJ1H split backplane, a second integrated SAS controller with no write cache is provided, and the eight SFF-3 bays are logically divided into two sets of four bays. Each SAS controller independently runs one of the four-bay sets of drives.

This backplane option support HDDs or SSDs or a mixture of HDDs and SSDs in the SFF-3 bays. Mixing HDDs and SSDs applies even within a single set of four bays of the split backplane option. Note that if you are mixing HDDs and SSDs, they must be in separate arrays (unless using the Easy Tier^(R) function).

This backplane option can offer different drive protection options: RAID 0, RAID 5, RAID 6, or RAID 10. RAID 5 requires a minimum of three drives of the same capacity. RAID 6 requires a minimum of four drives of the same capacity. RAID 10 requires a minimum of two drives. Hot spare capability is supported with RAID 5, RAID 6, or RAID 10.

Note that RAID 5 and RAID 6 result in more drive write activity than mirroring or than unprotected drives.

This backplane option is supported by AIX, Linux, and VIOS. It is highly recommended but not required that the drives be protected.

If you need a change after the server is installed, the backplane option can be changed. For example, the feature EJ1H split backplane feature can be added to an existing feature EJ1F base storage backplane.

Unlike the hot-plug PCIe slots and SAS bays, concurrent maintenance is not available for the integrated SAS controllers. Scheduled downtime is required if a service action is required for these integrated resources.

In addition to supporting HDDs and SSDs in the SFF-3 SAS bays, the expanded function storage backplane feature EJ1G supports the optional attachment of an EXP12SX/EXP24SX drawer. All bays are accessed by both of the integrated SAS controllers. The bays support concurrent hot-plug maintenance.

Cable management arm

A folding arm is attached to the server's rails at the rear of the server. The server's power cords and the cables from the PCIe adapters or integrated ports run through the arm and into the rack. The arm enables the server to be pulled forward on its rails for service access to PCIe slots, memory, processors, and so on without disconnecting the cables from the server. Approximately 1 meter (3 feet) of cord or cable length is needed for the arm.

Integrated I/O ports

In addition to the integrated SAS controllers and SAS ports associated with the storage backplane, there are two HMC ports, one system port, and three USB ports. The two HMC ports are RJ45 supporting 1 Gb Ethernet connections.

The one system port is RJ45 and is supported by AIX and Linux for attaching serial devices, such as an asynchronous device like a console. If the device does not have an RJ45 connection, a converter cable such as feature 3930 can provide a 9-pin D-shell connection. Note that serial devices can have very individual characteristics (different pin outs), and feature 3930 may not be appropriate for all possible devices. In this case, the user should acquire an OEM converter cable appropriate for their device.

Four USB-3 ports are available for general client use; two are located in front and two in the rear. Additionally, there are two USB-2 ports in the service processor located in the rear of the system. These ports are for limited client use. Converter cable #ECCF provides a USB-to-9-pin D-Shell connection for this function.

Rack-integrated system with I/O expansion drawer

Regardless of the rack-integrated system to which the PCIe Gen3 I/O expansion drawer is attached, if the expansion drawer is ordered as factory integrated, the PDUs in the rack will be placed horizontally by default to enhance cable management.

Expansion drawers complicate the access to vertical PDUs if located at the same height. IBM recommends accommodating PDUs horizontally on racks containing one or more PCIe Gen3 I/O expansion drawers.

After the rack with expansion drawers is delivered, you can rearrange the PDUs from horizontal to vertical. However, the configurator will continue to consider the PDUs as being placed horizontally for the matter of calculating the free space still available in the rack.

Vertical PDUs can be used only if CSRP (#0469) is on the order. When specifying CSRP, you should provide the locations where the PCIe Gen3 I/O expansion drawers must be placed to avoid locating them adjacent to vertical PDU locations, EIA 6 through 16 and 21 through 31.

The I/O expansion drawer can be migrated from a POWER8[®] to a POWER9 processor-based system. Only I/O cards supported on POWER9 in the I/O expansion drawer are allowed. Clients migrating the I/O expansion drawer configuration might have one or two PCIe3 6-slot fanout modules (#EMXF or #EMXG) installed in the rear of the I/O expansion drawer.

For a 2U server configuration with two processor modules, up to one I/O expansion drawer and two fanout modules (#EMXF or #EMXG) connected to two optical cable

adapters (#EJ05) are supported. For a 2U server configuration with one processor module, up to one I/O expansion drawer and one fanout module (#EMXF or #EMXG) connected to one optical cable adapter (#EJ05) is supported (the right PCIe module bay must be populated by a filler module).

For a 2U server configuration with two processor modules, up to two I/O expansion drawers and three fanout modules (#EMXH) connected to three optical cable adapters (#EJ1R) are supported (the right PCIe module bay for the second I/O expansion drawer must be populated by a filler module). For a 2U server configuration with one processor module, up to one I/O expansion drawer and one fanout module (#EMXH) connected to one optical cable adapter (#EJ1R) is supported (the right PCIe module bay must be populated by a filler module).

Limitations:

- Mixing of prior PCIe3 fanout modules (#EMXF or #EMXG) with PCIe3 fanout module (#EMXH) in the same I/O expansion drawer is not allowed.
- Mixing of I/O expansion drawer with prior PCIe3 fanout modules (#EMXF or #EMXG) and I/O expansion drawer with PCIe3 fanout module (#EMXH) in same configuration is allowed.
- PCIe3 optical cable adapters (#EJ1R) require use of optical cables (#ECCX or #ECCY) or copper cable (#ECCS).

RDX docking station

The RDX docking station EUA4 accommodates RDX removable disk cartridges of any capacity. The disk is in a protective rugged cartridge enclosure that plugs into the docking station. The docking station holds one removable rugged disk drive or cartridge at a time. The rugged removable disk cartridge and docking station performs saves, restores, and backups similar to a tape drive. This docking station can be an excellent entry capacity and performance option.

EXP24SX SAS storage enclosure (#ESLS)

The EXP24SX is a storage expansion enclosure with twenty-four 2.5-inch SFF SAS bays. It supports up to 24 hot-plug HDDs or SSDs in only 2 EIA of space in a 19-inch rack. The EXP24SX SFF bays use SFF Gen2 (SFF-2) carriers or trays.

The EXP24SX drawer feature ESLS is supported on the Power S914, Power H922, and Power S924 servers by AIX, IBM i, Linux, and VIOS.

With AIX, Linux, and VIOS, the EXP24SX can be ordered with four sets of 6 bays (mode 4), two sets of 12 bays (mode 2), or one set of 24 bays (mode 1). With IBM i, only one set of 24 bays (mode 1) is supported. It is possible to change the mode setting in the field using software commands along with a specifically documented procedure. The predecessor EXP24S did not support this mode change in the field.

Important: When changing modes, a skilled, technically qualified person should follow the special documented procedures. Improperly changing modes can potentially destroy existing RAID sets, prevent access to existing data, or allow other partitions to access another partition's existing data. Hire an expert to assist if you are not familiar with this type of reconfiguration work.

Four mini-SAS HD ports on the EXP24SX are attached to PCIe Gen3 SAS adapters or attached to an integrated SAS controller in a POWER9 scale-out server, such as the Power H922 or Power H924. The following PCIe3 SAS adapters support the EXP24SX:

- PCIe3 RAID SAS Adapter Quad-port 6 Gb x8 (#EJ0J)
- PCIe3 12 GB Cache RAID Plus SAS Adapter Quad-port 6 Gb x8 (#EJ14)

Earlier-generation PCIe2 or PCIe1 SAS adapters are not supported with the EXP24SX.

The attachment between the EXP24SX and the PCIe3 SAS adapters or integrated SAS controllers is through SAS YO12 or X12 cables. X12 and YO12 cables are designed to support up to 12 Gb SAS. The PCIe Gen3 SAS adapters support up to 6 Gb throughput. The EXP24SX has been designed to support up to 12 Gb throughput if future SAS adapters support that capability. All ends of the YO12 and X12 cables have mini-SAS HD narrow connectors. Cable options are:

- X12 cable: 3 meter copper (#ECDJ)
- YO12 cables: 1.5 meter copper (#ECDT), 3 meter copper (#ECDU)
- 3M 100 GbE Optical Cable QSFP28 (AOC) (#EB5R)
- 5M 100 GbE Optical Cable QSFP28 (AOC) (#EB5S)
- 10M 100 GbE Optical Cable QSFP28 (AOC) (#EB5T)
- 15M 100 GbE Optical Cable QSFP28 (AOC) (#EB5U)
- 20M 100 GbE Optical Cable QSFP28 (AOC) (#EB5V)
- 30M 100 GbE Optical Cable QSFP28 (AOC) (#EB5W)
- 50M 100 GbE Optical Cable QSFP28 (AOC) (#EB5X)
- 100M 100 GbE Optical Cable QSFP28 (AOC) (#EB5Y)

An AA12 cable interconnecting a pair of PCIe3 12 GB cache adapters (two #EJ14) is not attached to the EXP24SX. These higher-bandwidth cables could support 12 Gb throughput if future adapters support that capability. Copper feature ECE0 is 0.6 meters long, ECE3 is 3 meters long, and optical AA12 feature ECE4 is 4.5 meters long.

One no-charge specify code is used with each EXP24SX I/O drawer (#ESLS) to communicate to IBM configurator tools and IBM Manufacturing which mode setting, adapter, and SAS cable are needed. With this specify code, no hardware is shipped. The physical adapters, controllers, and cables must be ordered with their own chargeable feature numbers. There are more technically supported configurations than are represented by these specify codes. IBM Manufacturing and IBM configurator tools such as e-config only understand and support EXP24SX configurations represented by these specify codes.

Specify code	Mode	Adapter/ Controller	Cable to drawer	Environment
#EJW0	Mode 1	CEC SAS Ports	2 YO12 cables	AIX/IBM i/ Linux/VIOS
#EJW1	Mode 1	One (unpaired) #EJ0J/#EJ0M	1 YO12 cable	AIX/IBM i/ Linux/VIOS
#EJW2	Mode 1	Two (one pair) #EJ0J/ #EJ0M	2 YO12 cables	AIX/IBM i/ Linux/VIOS
#EJW3	Mode 2	Two (unpaired) #EJ0J/#EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJW4	Mode 2	Four (two pair) #EJ0J/ #EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJW5	Mode 4	Four (unpaired) #EJ0J/#EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJW6	Mode 2	One (unpaired) #EJ0J/#EJ0M	2 YO12 cables	AIX/Linux/ VIOS
#EJW7	Mode 2	Two (unpaired) #EJ0J/#EJ0M	2 YO12 cables	AIX/Linux/ VIOS
#EJWF	Mode 1	Two (one pair) #EJ14	2 YO12 cables	AIX/IBM i/ Linux/VIOS
#EJWG	Mode 2	Two (one pair) #EJ14	2 X12 cables	AIX/Linux/ VIOS

Specify code	Mode	Adapter/ Controller	Cable to drawer	Environment
#EJWJ	Mode 2	Four (two pair) #EJ14	2 X12 cables	AIX/Linux/ VIOS
#EJWU	Mode 1	Controller #EJ1G	1 YO12 cables	Linux/AIX

All of the above EXP24SX specify codes assume a full set of adapters and cables able to run all the SAS bays configured. The following specify codes communicate to IBM Manufacturing a lower-cost partial configuration is to be configured where the ordered adapters and cables can run only a portion of the SAS bays. The future MES addition of adapters and cables can enable the remaining SAS bays for growth. The following specify codes are used:

Specify	Mode	Adapter/ Controller	Cable to drawer	Environment
#EJWA (1/2 of #EJW7)	Mode 2	One (unpaired) #EJ0J/#EJ0M	1 YO12 cables	AIX/Linux/ VIOS
#EJWB (1/2 of #EJW4)	Mode 2	Two (one pair) #EJ0J/#EJ0M	1 X12 cable	AIX/Linux/ VIOS
#EJWC (1/4 of #EJW5)	Mode 4	One (unpaired) #EJ0J/#EJ0M	1 X12 cable	AIX/Linux/ VIOS
#EJWD (1/2 of #EJW5)	Mode 4	Two (unpaired) #EJ0J/#EJ0M	1 X12 cables	AIX/Linux/ VIOS
#EJWE (3/4 of #EJW5)	Mode 4	Three (unpaired) #EJ0J/#EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJWH (1/2 of #EJWJ)	Mode 2	Two (one pair) #EJ14	1 X12 cables	AIX/Linux/ VIOS

An EXP24SX drawer in mode 4 can be attached to two or four SAS controllers and provide a great deal of configuration flexibility. For example, if using unpaired feature EJ0J adapters, these EJ0J adapters could be in the same server in the same partition, same server in different partitions, or even different servers.

An EXP24SX drawer in mode 2 has similar flexibility. If the I/O drawer is in mode 2, then half of its SAS bays can be controlled by one pair of PCIe3 SAS adapters, such as a 12 GB write cache adapter pair (#EJ14), and the other half can be controlled by a different PCIe3 SAS 12 GB write cache adapter pair or by zero-write-cache PCIe3 SAS adapters.

Note that for simplicity, IBM configurator tools such as e-config assume that the SAS bays of an individual I/O drawer are controlled by one type of SAS adapter. As a client, you have more flexibility than e-config understands.

A maximum of twenty-four 2.5-inch SSDs or 2.5-inch HDDs is supported in the EXP24SX 24 SAS bays. There can be no mixing of HDDs and SSDs in the same mode 1 drawer. HDDs and SSDs can be mixed in a mode 2 or mode 4 drawer, but they cannot be mixed within a logical split of the drawer. For example, in a mode 2 drawer with two sets of 12 bays, one set could hold SSDs and one set could hold HDDs, but you cannot mix SSDs and HDDs in the same set of 12 bays.

The indicator feature EHS2 helps IBM Manufacturing understand where SSDs are placed in a mode 2 or a mode 4 EXP24SX drawer. On one mode 2 drawer, use a quantity of one feature EHS2 to have SSDs placed in just half the bays, and use two EHS2 features to have SSDs placed in any of the bays. Similarly, on one mode 4 drawer, use a quantity of one, two, three, or four EHS2 features to indicate how many bays can have SSDs. With multiple EXP24SX orders, IBM Manufacturing will have to guess which quantity of feature ESH2 is associated with each EXP24SX. Consider using CSP (#0456) to reduce guessing.

Two-and-a-half-inch small form factor (SFF) SAS HDDs and SSDs are supported in the EXP24SX. All drives are mounted on Gen2 carriers/trays and thus named SFF-2 drives.

The EXP24SX drawer has many high-reliability design points:

- SAS drive bays that support hot swap
- Redundant and hot-plug-capable power and fan assemblies
- Dual line cords
- Redundant and hot-plug enclosure service modules (ESMs)
- Redundant data paths to all drives
- LED indicators on drives, bays, ESMs, and power supplies that support problem identification
- Through the SAS adapters and controllers, drives can be protected with RAID and mirroring and hot-spare capability

Order two ESLA features for AC power supplies. The enclosure is shipped with adjustable depth rails and can accommodate 19-inch rack depths from 59.5 - 75 cm (23.4 - 29.5 in.). Slot filler panels are provided for empty bays when initially shipped from IBM.

EXP12SX SAS storage enclosure (#ESLL)

The EXP12SX is a storage expansion enclosure with twelve 3.5-inch LFF SAS bays. It supports up to 12 hot-plug HDDs in only 2 EIA of space in a 19-inch rack. The EXP12SX SFF bays use LFF Gen1 (LFF-1) carriers or trays. The 4k byte sector drives (#4096 or #4224) are supported. SSDs are not supported.

The EXP12SX drawer feature ESLL is supported on the Power S914, Power H922, and Power S924 servers by AIX, Linux, and VIOS.

With AIX, Linux, and VIOS, the EXP12SX enclosure can be ordered with four sets of 3 bays (mode 4), two sets of 6 bays (mode 2), or one set of 12 bays (mode 1). The mode setting can be changed in the field using software commands along with a specifically documented procedure.

Important: When changing modes, it is very important that you follow the documented procedures. Improperly changing modes can potentially destroy existing RAID sets, prevent access to existing data, or allow other partitions to access another partition's existing data. Hire an expert to assist if you are not familiar with this type of reconfiguration work.

Four mini-SAS HD ports on the EXP12SX are attached to PCIe Gen3 SAS adapters or attached to an integrated SAS controller in a POWER9 scale-out server, such as the Power S914, Power H922, or Power S924. The following PCIe3 SAS adapters support the EXP12SX:

- PCIe3 RAID SAS Adapter Quad-port 6 Gb x8 (#EJ0J)
- PCIe3 12 GB Cache RAID Plus SAS Adapter Quad-port 6 Gb x8 (#EJ14)

Earlier-generation PCIe2 or PCIe1 SAS adapters are not supported with the EXP12SX drawer.

The EXP12SX drawer and the PCIe3 SAS adapters or integrated SAS controllers are attached through SAS YO12 or X12 cables. X12 and YO12 cables are designed to support up to 12 Gb. The PCIe Gen3 SAS adapters support up to 6 Gb throughput. The EXP12SX has been designed to support up to 12 Gb throughput if future SAS adapters support that capability. All ends of the YO12 and X12 cables have mini-SAS HD narrow connectors. Cable options are:

- X12 cable: 3 meter copper (#ECDJ)
- YO12 cables: 1.5 meter copper (#ECDT), 3 meter copper (#ECDU)

- 3M 100 GbE Optical Cable QSFP28 (AOC) (#EB5R)
- 5M 100 GbE Optical Cable QSFP28 (AOC) (#EB5S)
- 10M 100 GbE Optical Cable QSFP28 (AOC) (#EB5T)
- 15M 100 GbE Optical Cable QSFP28 (AOC) (#EB5U)
- 20M 100 GbE Optical Cable QSFP28 (AOC) (#EB5V)
- 30M 100 GbE Optical Cable QSFP28 (AOC) (#EB5W)
- 50M 100 GbE Optical Cable QSFP28 (AOC) (#EB5X)
- 100M 100 GbE Optical Cable QSFP28 (AOC) (#EB5Y)

An AA12 cable interconnecting a pair of PCIe3 12 GB cache adapters (two #EJ14) is not attached to the EXP12SX drawer. These higher-bandwidth cables could support 12 Gb throughput if future adapters support that capability. Copper feature ECE0 is 0.6 meters long, feature ECE3 is 3 meters long, and optical AA12 feature ECE4 is 4.5 meters long.

One no-charge specify code is used with each EXP12SX I/O drawer (#ESLL) to communicate to IBM configurator tools and IBM Manufacturing which mode setting, adapter, and SAS cable are needed. With this specify code, no hardware is shipped. The physical adapters, controllers, and cables must be ordered with their own chargeable feature numbers. There are more technically supported configurations than are represented by these specify codes. IBM Manufacturing and IBM configurator tools such as e-config only understand and support EXP12SX configurations represented by these specify codes.

Specify	Mode	Adapter/ Controller	Cable to drawer	Environment
#EJV0	Mode 1	CEC SAS Ports	2 YO12 cables	AIX/Linux/ VIOS
#EJV1	Mode 1	One (unpaired) #EJ0J/#EJ0M	1 YO12 cable	AIX/Linux/ VIOS
#EJV2	Mode 1	Two (unpaired) #EJ0J/#EJ0M	2 YO12 cables	AIX/Linux/ VIOS
#EJV3	Mode 2	Two (one pair) #EJ0J/ #EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJV4	Mode 2	Four (two pair) #EJ0J/ #EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJV5	Mode 4	Four (unpaired) #EJ0J/#EJ0M	2 X12 cables	AIX/Linux/ VIOS
#EJV6	Mode 2	One(unpaired) #EJ0J/#EJ0M	2 YO12 cables	AIX/Linux/ VIOS
#EJV7	Mode 2	Two (unpaired) #EJ0J/#EJ0M	2 YO12 cables	AIX/Linux/ VIOS
#EJV F	Mode 1	Two #EJ14 (one pair)	2 YO12 cables	AIX/Linux/ VIOS
#EJV G	Mode 2	Two #EJ14 (one pair)	2 X12 cables	AIX/Linux/ VIOS
#EJV J	Mode 2	Four #EJ14 (two pair)	2 X12 cable	AIX/Linux/ VIOS
#EJV U	Mode 1	Controller #EJ1G/ #EL67	1 YO12 cables	Linux

All of the above EXP12SX specify codes assume a full set of adapters and cables able to run all the SAS bays configured. The following specify codes communicate to IBM Manufacturing a lower cost, partial configuration is to be configured where the ordered adapters and cables can run only a portion of the SAS bays. The future MES

addition of adapters and cables can enable the remaining SAS bays for growth. The following specify codes are used:

Specify	Mode	Adapter/ Controller	Cable to drawer	Environment
#EJVA (1/2 of #EJV7)	Mode 2	One (unpaired) #EJ0J/#EJ0M	1 YO12 cables	AIX/Linux/VIOS
#EJVB (1/2 of #EJV4)	Mode 2	One pair #EJ0J/#EJ0M	1 X12 cable	AIX/Linux/VIOS
#EJVC (1/4 of #EJV5)	Mode 4	One (unpaired) #EJ0J/#EJ0M	1 X12 cable	AIX/Linux/VIOS
#EJVD (2/4 of #EJV5)	Mode 4	Two (unpaired) #EJ0J/#EJ0M	1 X12 cables	AIX/Linux/VIOS
#EJVE (3/4 of #EJV5)	Mode 4	Three (unpaired) #EJ0J/#EJ0M	2 X12 cables	AIX/Linux/VIOS

An EXP12SX drawer in mode 4 can be attached to two or four SAS controllers and provide a great deal of configuration flexibility. For example, if using unpaired feature EJ0J adapters, these EJ0J adapters could be in the same server in the same partition, same server in different partitions, or even different servers.

An EXP12SX drawer in mode 2 has similar flexibility. If the I/O drawer is in mode 2, then half of its SAS bays can be controlled by one pair of PCIe3 SAS adapters, such as a 12 GB write cache adapter pair (#EJ14), and the other half can be controlled by a different PCIe3 SAS 12 GB write cache adapter pair or by zero-write-cache PCIe3 SAS adapters.

Note that for simplicity, IBM configurator tools such as e-config assume that the SAS bays of an individual I/O drawer are controlled by one type of SAS adapter. As a client, you have more flexibility than e-config understands.

The 3.5-inch large form factor (LFF) SAS HDDs are supported in the EXP24SX. All drives are mounted on Gen1 carriers or trays and thus named LFF-1 drives. Only 4k byte sector drives are supported in the EXP24SX drawer. The 5xx byte sector drives are not announced or planned. Drives are 7,200 rpm and sometimes referred to as *nearline*. These drives provide excellent cost per gigabyte. Note that formatting or rebuilding arrays on large disk drives can take hours. If higher performance is required, consider higher rpm disks or SSDs in the EXP24SX drawer.

The EXP12SX drawer has many high-reliability design points:

- SAS bays that support hot swap
- Redundant and hot-plug power and fan assemblies
- Dual line cords
- Redundant and hot-plug ESMs
- Redundant data paths to all drives
- LED indicators on drives, bays, ESMs, and power supplies that support problem identification
- Through the SAS adapters and controllers, drives can be protected with RAID and mirroring and hot-spare capability

Order two ESLA features for AC power supplies. The enclosure is shipped with adjustable depth rails and can accommodate 19-inch rack depths from 59.5 - 75 cm (23.4 - 29.5 in.). Slot filler panels are provided for empty bays when initially shipped from IBM.

EXP24SX and EXP12SX enclosures can be mixed on the same server. EXP24SX and EXP12SX enclosures can be mixed on the same PCIe3 adapter.

PCIe Gen3 I/O drawer cabling option

A copper cabling option (#ECCS) is available for the scale-out servers. The cable option offers a much lower-cost connection between the server and the PCIe Gen3 I/O drawer fanout modules. The currently available Active Optical Cable (AOC) offers much longer length cables, providing rack placement flexibility. AOC cables are also much thinner and have tighter bend radius and thus are much easier to cable in the rack.

The 3M Copper CXP Cable Pair (#ECCS) has the same performance and same reliability, availability, and serviceability (RAS) characteristics as the AOC cables. One copper cable length of 3 meters is offered. Note that the cable management arm of the scale-out servers requires about 1 meter of cable.

Like the AOC cable pair, the copper pair is cabled in the same manner. One cable attaches to the top CXP port in the PCIe adapter in the x16 PCIe slot in the server system unit and then attaches to the top CXP port in the fanout module in the I/O drawer. Its cable pair attaches to the bottom CXP port of the same PCIe adapter and to the bottom CXP port of the same fanout module. Note that the PCIe adapter providing the CXP ports on the server was named a PCIe3 optical cable adapter. In hindsight, this naming was unfortunate as the adapter's CXP ports are not unique to optical. But at the time, optical cables were the only connection option planned.

Copper and AOC cabling can be mixed on the same server. However, they cannot be mixed on the same PCIe Gen3 I/O drawer or mixed on the same fanout module.

Copper cables have the same operating system software prerequisites as AOC cables.

High-function (switched and monitored) power distribution units (PDUs)

The high-function PDUs provide switching, better monitoring, and 50% more C19 receptacles than previous Power Systems PDUs. Depending on country wiring standards, either two or four full-price features are orderable.

	208 V 3-phase delta	200 V - 240 V 1-phase or 3-phase wye
12xC13	#EPTQ	#EPTN
9xC19	#EPTL	#EPTJ

These PDUs can be mounted vertically in rack-side pockets or they can be mounted horizontally. If mounted horizontally, they each use 1 EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware, which is used when IBM Manufacturing doesn't automatically factory-install the PDU. Two RJ45 ports on the front of the PDU enable you to monitor each receptacle's electrical power usage and to remotely switch any receptacle on or off. These PDUs do provide the same low price as the low-function 12xC13 PDU feature (#7188).

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change the password upon installation.

High-function (switched and monitored) PDUs plus

Hardware

- IEC 62368-1 and IEC 60950 safety standard
- A new product safety approval
- No China 5000 m altitude or tropical restrictions
- Detachable inlet for 3-phase delta-wired PDU with 30A, 50A, and 60A wall plugs
- IBM Technology and Qualification approved components, such as Anti-Sulfur Resistors (ASR)
- Ethernet 10/100/1000 Mb/s

Software

- IPv4 and IPv6 support

- SSH command line
- Ability to change passwords over a network

PDU description	208 V 3-phase delta	200 V - 240 V 1-phase or 3-phase wye
12xC13	#ECJQ/#ECJP	#ECJN/#ECJM
9xC19	#ECJL/#ECJK	#ECJJ/#ECJG

These PDUs can be mounted vertically in rack-side pockets or they can be mounted horizontally. If mounted horizontally, they each use one EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware, which is used when IBM Manufacturing doesn't automatically factory-install the PDU. Two RJ45 ports on the front of the PDU enable the client to monitor each receptacle's electrical power usage and to remotely switch any receptacle on or off.

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change it upon installation.

Existing and new high-function (switched and monitored) PDUs have the same physical dimensions. New high-function (switched and monitored) PDUs can be supported in the same racks as existing PDUs. Mixing of PDUs in a rack on new orders is not allowed.

Also, all factory-integrated orders must have the same PDU line cord.

The PDU features ECJQ/ECJP and ECJL/ECJK with the Amphenol inlet connector require new PDU line cords:

- #ECJ5 - 4.3 m (14-Ft) PDU to Wall 3PH/24A 200-240V Delta-wired Power Cord
- #ECJ7 - 4.3 m (14-Ft) PDU to Wall 3PH/48A 200-240V Delta-wired Power Cord

No pigtail (like feature ELC0) is available because an Amphenol male inline connector is unavailable.

The PDU features ECJJ/ECJG and ECJN/ECJM with the UTG624-7SKIT4/5 inlet connector use the existing PDU line cord features 6653, 6667, 6489, 6654, 6655, 6656, 6657, 6658, 6491, or 6492.

High-function 12xC13 PDU plus 3-phase delta (#ECJQ/#ECJP)

This is an intelligent, switched 200 - 240 volt 3-phase delta AC PDU plus with twelve C13 receptacles on the front of the PDU. The PDU is mounted on the rear of the rack, making the twelve C13 receptacles easily accessible. Each receptacle has a 20 amp circuit breaker. Three-phase delta-wired connectors have 4 pins and use three line conductors and a protective earth. The input is 200 - 240 volt line-to-line and the output is 200 - 240 volt line-to-line for 3-phase delta PDUs.

The PDU can be mounted vertically in rack-side pockets, or it can be mounted horizontally. If mounted horizontally, it uses one EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware.

Device power cords with a C20 plug connect to C19 PDU receptacles and are ordered separately. One wall line cord is also ordered separately and attaches to the Amphenol inlet connector. Supported line cords include features ECJ5 and ECJ7.

Two RJ45 ports on the front of the PDU enable clients to monitor the electrical power usage of each receptacle and to remotely switch any receptacle on or off.

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change it upon installation.

Features ECJP and ECJQ are identical PDUs. Up to one lower-priced feature ECJP can be ordered with a new 7014-T42/T00 rack in place of a no-charge feature 9188 PDU.

For comparison, this is most like the earlier-generation feature EPTP PDU.

Limitation: Some configurations of the Elastic Storage Server (ESS) are delivered with an Intelligent PDU. At this time, the intelligent management capabilities of this PDU are not configured or used by the ESS system. If the ESS customer would like to use this capability, it is the customer's responsibility to configure this PDU. In any case, the Ethernet port on the Intelligent PDU must not be connected to the ESS Management switch.

High-function 9xC19 PDU plus 3-phase delta (#ECJL/#ECJK)

This is an intelligent, switched 200 - 240 volt 3-phase delta AC PDU plus with nine C19 receptacles on the front of the PDU. The PDU is mounted on the rear of the rack, making the nine C19 receptacles easily accessible. Each receptacle has a 20 amp circuit breaker. Three-phase delta-wired connectors have 4 pins and use three line conductors and a protective earth. The input is 200 - 240 volt line-to-line and the output is 200 - 240 volt line-to-line for 3-phase delta PDUs.

The PDU can be mounted vertically in rack-side pockets, or it can be mounted horizontally. If mounted horizontally, it uses one EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware.

Device power cords with a C20 plug connect to C19 PDU receptacles and are ordered separately. One wall line cord is also ordered separately and attaches to the Amphenol inlet connector. Supported line cords include features ECJ5 and ECJ7.

Two RJ45 ports on the front of the PDU enable you to monitor the electrical power usage of each receptacle and to remotely switch any receptacle on or off.

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change it upon installation.

There are also three C13 receptacles on the rear of the PDU positioned toward the middle of the rack. These are not easily accessed, and therefore IBM does not generally recommend their use.

Features ECJK and ECJL are identical PDUs. Up to one lower-priced feature ECJK can be ordered with a new 7014-T42/T00 rack in place of a no-charge feature 9188 PDU.

For comparison, this is most like the earlier-generation feature EPTL PDU.

Limitation: Some configurations of the ESS are delivered with an Intelligent PDU. At this time, the intelligent management capabilities of this PDU are not configured or used by the ESS system. If the ESS customer would like to use this capability, it is the customer's responsibility to configure this PDU. In any case, the Ethernet port on the Intelligent PDU must not be connected to the ESS Management switch.

High-function 9xC19 1-phase or 3-phase wye PDU plus (#ECJJ/#ECJG)

This is an intelligent, switched 200 - 240 volt 1-phase or 380 - 415/220 - 240 volt 3-phase wye AC PDU plus with nine C19 receptacles on the front of the PDU. The PDU is mounted on the rear of the rack, making the nine C19 receptacles easily accessible. Each receptacle has a 20 amp circuit breaker. Depending on country wiring standards, the PDU is 1-phase or 3-phase wye. Three-phase wye-wired connectors have 5 pins and use three line conductors, a neutral, and a protective earth. The input is 380 - 415 volt line-to-line and the output is 220 - 240 volt line-to-neutral for 3-phase wye PDUs.

The PDU can be mounted vertically in rack-side pockets, or it can be mounted horizontally. If mounted horizontally, it uses one EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware.

Device power cords with a C20 plug connect to C19 PDU receptacles and are ordered separately. One country-specific wall line cord is also ordered separately and attaches to a UTG524-7 connector on the front of the PDU. Supported line cords include features 6489, 6491, 6492, 6653, 6654, 6655, 6656, 6657, 6658, and 6667.

Two RJ45 ports on the front of the PDU enable clients to monitor the electrical power usage of each receptacle and to remotely switch any receptacle on or off.

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change it upon installation.

There are also three C13 receptacles on the rear of the PDU positioned toward the middle of the rack. These are not easily accessed, and therefore IBM does not generally recommend their use.

Features ECJG and ECJJ are identical PDUs. Up to one lower-priced feature ECJG can be ordered with a new 7014-T42/T00 rack in place of a no-charge feature 9188 PDU.

For comparison, this is most like the earlier-generation feature EPTJ PDU.

Limitation: Some configurations of the ESS are delivered with an Intelligent PDU. At this time, the intelligent management capabilities of this PDU are not configured or used by the ESS system. If the ESS customer would like to use this capability, it is the customer's responsibility to configure this PDU. In any case, the Ethernet port on the Intelligent PDU must not be connected to the ESS Management switch.

High-function 12xC13 1-phase or 3-phase wye PDU plus (#ECJN/#ECJM)

This is an intelligent, switched 200 - 240 volt 1-phase or 380 - 415/220 - 240 volt 3-phase wye AC PDU plus with twelve C13 receptacles on the front of the PDU. The PDU is mounted on the rear of the rack, making the twelve C13 receptacles easily accessible. Each receptacle has a 20 amp circuit breaker. Depending on country wiring standards, the PDU is 1-phase or 3-phase wye. Three-phase wye-wired connectors have 5 pins and use three line conductors, a neutral, and a protective earth. The input is 380 - 415 volt line-to-line and the output is 220 - 240 volt line-to-neutral for 3-phase wye PDUs.

See 3-phase #ECJP/#ECJQ for countries that do not use wye wiring.

The PDU can be mounted vertically in rack-side pockets, or it can be mounted horizontally. If mounted horizontally, it uses one EIA (1U) of rack space. See feature EPTH for horizontal mounting hardware.

Device power cords with a C14 plug connect to C13 PDU receptacles and are ordered separately. One country-specific wall line cord is also ordered separately and attaches to a UTG524-7 connector on the front of the PDU. Supported line cords include features 6489, 6491, 6492, 6653, 6654, 6655, 6656, 6657, 6658, and 6667.

Two RJ45 ports on the front of the PDU enable you to monitor the electrical power usage of each receptacle and to remotely switch any receptacle on or off.

Recommendation: The PDU is shipped with a generic PDU password. IBM strongly urges you to change it upon installation.

Features ECJM and ECJN are identical PDUs. Up to one lower-priced feature ECJM can be ordered with a new 7014-T42/T00 rack in place of a no-charge feature 9188 PDU.

For comparison, this is most like the earlier-generation feature EPTN PDU.

Limitation: Some configurations of the ESS are delivered with an Intelligent PDU. At this time, the intelligent management capabilities of this PDU are not configured or used by the ESS system. If the ESS customer would like to use this capability, it is the customer's responsibility to configure this PDU. In any case, the Ethernet port on the Intelligent PDU must not be connected to the ESS Management switch.

Reliability, Availability, and Serviceability

Reliability, fault tolerance, and data correction

The reliability of systems starts with components, devices, and subsystems that are designed to be highly reliable. During the design and development process,

subsystems go through rigorous verification and integration testing processes. During system manufacturing, systems go through a thorough testing process to help ensure the highest level of product quality.

Memory subsystem RAS

The memory has error detection and correction circuitry designed such that the failure of any one specific memory module within an ECC word by itself can be corrected absent any other fault.

Mutual surveillance

The service processor monitors the operation of the firmware during the boot process and also monitors the hypervisor for termination. The hypervisor monitors the service processor and reports a service reference code when it detects surveillance loss. In the PowerVM environment, it will perform a reset/reload if it detects the loss of the service processor.

Environmental monitoring functions

The Power Systems family does ambient and over temperature monitoring and reporting.

POWER9 processor functions

As in POWER8, the POWER9 processor has the ability to do processor instruction retry for some transient errors.

Cache availability

The L2 and L3 caches in the POWER9 processor in the memory buffer chip are protected with double-bit detect, single-bit correct error detection code (ECC). In addition, a threshold of correctable errors detected on cache lines can result in the data in the cache lines being purged and the cache lines removed from further operation without requiring a reboot in the PowerVM environment.

Modified data would be handled through Special Uncorrectable Error handling. L1 data and instruction caches also have a retry capability for intermittent errors and a cache set delete mechanism for handling solid failures.

Special Uncorrectable Error handling

Special Uncorrectable Error (SUE) handling prevents an uncorrectable error in memory or cache from immediately causing the system to terminate. Rather, the system tags the data and determines whether it will ever be used again. If the error is irrelevant, it will not force a check stop. If the data is used, termination may be limited to the program/kernel or hypervisor owning the data; or the I/O adapters controlled by an I/O hub controller would freeze if data were transferred to an I/O device.

PCI extended error handling

PCI extended error handling (EEH)-enabled adapters respond to a special data packet generated from the affected PCI slot hardware by calling system firmware, which will examine the affected bus, allow the device driver to reset it, and continue without a system reboot. For Linux, EEH support extends to the majority of frequently used devices, although some third-party PCI devices may not provide native EEH support.

Uncorrectable error recovery

When the auto-restart option is enabled, the system can automatically restart following an unrecoverable software error, hardware failure, or environmentally induced (AC power) failure.

Serviceability

The purpose of serviceability is to efficiently repair the system while attempting to minimize or eliminate impact to system operation. Serviceability includes system installation, MES (system upgrades/downgrades), and system maintenance/repair. Depending upon the system and warranty contract, service may be performed by the client, an IBM representative, or an authorized warranty service provider.

The serviceability features delivered in this system help provide a highly efficient service environment by incorporating the following attributes:

- Design for Customer Set Up (CSU), Customer Installed Features (CIF), and Customer Replaceable Units (CRU)
- Error Detection and Fault Isolation (ED/FI)
- First Failure Data Capture (FFDC)
- Lightpath service indicators
- Service labels and service diagrams available on the system and delivered through IBM Knowledge Center
- Step-by-step service procedures documented in IBM Knowledge Center or available through the Hardware Management Console
- Automatic reporting of serviceable events to IBM through the Electronic Service Agent Call Home application
- CRU videos planned to be available on the web at general availability
- Mobile access to important customer service functions available by scanning a QR label

Service environment

In the PowerVM environment, the HMC is a dedicated server that provides functions for configuring and managing servers for either partitioned or full-system partition using a GUI or command-line interface (CLI) or REST API. An HMC attached to the system allows support personnel (with client authorization) to remotely, or locally to the physical HMC that is in proximity of the server being serviced, log in to review error logs and perform remote maintenance if required.

The POWER9 processor-based platforms support several service environments:

- Attachment to one or more HMCs or vHMCs is a supported option by the system with PowerVM. This is the default configuration for servers supporting logical partitions with dedicated or virtual I/O. In this case, all servers have at least one logical partition.
- For non-HMC systems.
 - Full-system partition with PowerVM: A single partition owns all the server resources, and only one operating system may be installed. The primary service interface is through the operating system and the service processor.

Service interface

Support personnel can use the service interface to communicate with the service support applications in a server using an operator console, a graphical user interface on the management console or service processor, or an operating system terminal. The service interface helps to deliver a clear, concise view of available service applications, helping the support team to manage system resources and service information in an efficient and effective way. Applications available through the service interface are carefully configured and placed to give service providers access to important service functions.

Different service interfaces are used, depending on the state of the system, hypervisor, and operating environment. The primary service interfaces are:

- LEDs
- Operator Panel
- Service Processor menu
- Operating system service menu

- Service Focal Point on the HMC or vHMC with PowerVM

In the light path LED implementation, the system can clearly identify components for replacement by using specific component-level LEDs, and can also guide the servicer directly to the component by signaling (turning on solid) the amber system fault LED, enclosure fault LED, and component FRU fault LED. The servicer can also use the identify function to blink the FRU-level LED. When this function is activated, a roll-up to the blue enclosure locate and system locate LEDs will occur. These enclosure LEDs will turn on solid and can be used to follow the light path from the system to the enclosure and down to the specific FRU in the PowerVM environment.

First Failure Data Capture and error data analysis

First Failure Data Capture (FFDC) is a technique that helps ensure that when a fault is detected in a system, the root cause of the fault will be captured without the need to re-create the problem or run any sort of extending tracing or diagnostics program. For the vast majority of faults, a good FFDC design means that the root cause can also be detected automatically without servicer intervention.

FFDC information, error data analysis, and fault isolation are necessary to implement the advanced serviceability techniques that enable efficient service of the systems and to help determine the failing items.

In the rare absence of FFDC and Error Data Analysis, diagnostics are required to re-create the failure and determine the failing items.

Diagnostics

General diagnostic objectives are to detect and identify problems so they can be resolved quickly. Elements of IBM's diagnostics strategy include:

- Provide a common error code format equivalent to a system reference code with PowerVM, system reference number, checkpoint, or firmware error code.
- Provide fault detection and problem isolation procedures. Support remote connection ability to be used by the IBM Remote Support Center or IBM Designated Service.
- Provide interactive intelligence within the diagnostics with detailed online failure information while connected to IBM's back-end system.

Automatic diagnostics

Because of the FFDC technology designed into IBM servers, it is not necessary to perform re-create diagnostics for failures or require user intervention. Solid and intermittent errors are designed to be correctly detected and isolated at the time the failure occurs. Runtime and boot-time diagnostics fall into this category.

Stand-alone diagnostics with PowerVM

As the name implies, stand-alone or user-initiated diagnostics requires user intervention. The user must perform manual steps, including:

- Booting from the diagnostics CD, DVD, USB, or network
- Interactively selecting steps from a list of choices

Concurrent maintenance

The determination of whether a firmware release can be updated concurrently is identified in the readme information file that is released with the firmware. An HMC is required for the concurrent firmware update with PowerVM. In addition, concurrent maintenance of PCIe adapters is supported with PowerVM. Concurrent maintenance of the Operator Panel is supported through ASMI. Additional concurrent maintenance includes power supplies, fans, and HDD/SSD drives.

Service labels

Service providers use these labels to assist them in performing maintenance actions. Service labels are found in various formats and positions and are intended to transmit readily available information to the servicer during the repair process. Following are some of these service labels and their purpose:

- **Location diagrams:** Location diagrams are located on the system hardware, relating information regarding the placement of hardware components. Location diagrams may include location codes, drawings of physical locations, concurrent maintenance status, or other data pertinent to a repair. Location diagrams are especially useful when multiple components such as DIMMs, CPUs, processor books, fans, adapter cards, LEDs, and power supplies are installed.
- **Remove/replace procedures:** Service labels that contain remove/replace procedures are often found on a cover of the system or in other spots accessible to the servicer. These labels provide systematic procedures, including diagrams detailing how to remove or replace certain serviceable hardware components.
- **Arrows:** Numbered arrows are used to indicate the order of operation and the serviceability direction of components. Some serviceable parts such as latches, levers, and touch points need to be pulled or pushed in a certain direction and in a certain order for the mechanical mechanisms to engage or disengage. Arrows generally improve the ease of serviceability.

QR labels

QR labels are placed on the system to provide access to key service functions through a mobile device. When the QR label is scanned, it will go to a landing page specific to that server which contains many of the service functions of interest while physically located at the server. These include things such as installation and repair instructions, service diagrams, reference code look up, and so on.

Packaging for service

The following service enhancements are included in the physical packaging of the systems to facilitate service:

- **Color coding (touch points):** Blue-colored touch points delineate touchpoints on service components where the component can be safely handled for service actions such as removal or installation.
- **Tool-less design:** Selected IBM systems support tool-less or simple tool designs. These designs require no tools or simple tools such as flathead screw drivers to service the hardware components.
- **Positive retention:** Positive retention mechanisms help to assure proper connections between hardware components such as cables to connectors, and between two cards that attach to each other. Without positive retention, hardware components run the risk of becoming loose during shipping or installation, preventing a good electrical connection. Positive retention mechanisms like latches, levers, thumb-screws, pop Nylatches (U-clips), and cables are included to help prevent loose connections and aid in installing (seating) parts correctly. These positive retention items do not require tools.

Error handling and reporting

In the event of system hardware or environmentally induced failure, the system runtime error capture capability systematically analyzes the hardware error signature to determine the cause of failure. The analysis result will be stored in system NVRAM. When the system can be successfully restarted either manually or automatically, or if the system continues to operate, the error will be reported to the operating system. Hardware and software failures are recorded in the system log. When an HMC is attached in the PowerVM environment, an ELA routine analyzes the error, forwards the event to the Service Focal Point (SFP) application running on the HMC, and notifies the system administrator that it has isolated a likely cause of the system problem. The service processor event log also records unrecoverable checkstop conditions, forwards them to the SFP application, and notifies the system administrator.

The system has the ability to call home through the operating system to report platform-recoverable errors and errors associated with PCI adapters/devices.

In the HMC-managed environment, a call home service request will be initiated from the HMC and the pertinent failure data with service parts information and part locations will be sent to an IBM service organization. Customer contact information and specific system-related data such as the machine type, model, and serial number, along with error log data related to the failure, are sent to IBM Service.

Live Partition Mobility

With Live Partition Mobility, users can migrate an AIX or IBM i partition running on one POWER partition system to another POWER system without disrupting services. The migration transfers the entire system environment, including processor state, memory, attached virtual devices, and connected users. It provides continuous operating system and application availability during planned partition outages for repair of hardware and firmware faults.

Service processor

The service processor provides the capability to diagnose, check the status of, and sense the operational conditions of a system. It runs on its own power boundary and does not require resources from a system processor to be operational to perform its tasks.

Under PowerVM, the service processor supports surveillance of the connection to the HMC and to the system firmware (hypervisor). It also provides several remote power control options, environmental monitoring, reset, restart, remote maintenance, and diagnostic functions, including console mirroring. The service processors menus (ASMI) can be accessed concurrently with system operation, allowing nondisruptive abilities to change system default parameters.

Call home

Call home refers to an automatic or manual call from a client location to the IBM support structure with error log data, server status, or other service-related information. Call home invokes the service organization in order for the appropriate service action to begin. Call home can be done through HMC or most non-HMC-managed systems through Electronic Service Agent running on top of the operating system. While configuring call home is optional, clients are encouraged to implement this feature in order to obtain service enhancements such as reduced problem determination and faster and potentially more accurate transmittal of error information. In general, using the call home feature can result in increased system availability. The Electronic Service Agent application can be configured for automated call home. See the next section for specific details on this application.

IBM Electronic Services

Electronic Service Agent and the IBM Electronic Services web portal comprise the IBM Electronic Services solution, which is dedicated to providing fast, exceptional support to IBM clients. IBM Electronic Service Agent is a no-charge tool that proactively monitors and reports hardware events such as system errors, performance issues, and inventory. Electronic Service Agent can help focus on the client's company business initiatives, save time, and spend less effort managing day-to-day IT maintenance issues.

System configuration and inventory information collected by Electronic Service Agent also can be viewed on the secure Electronic Services web portal and used to improve problem determination and resolution between the client and the IBM support team. As part of an increased focus to provide even better service to IBM clients, Electronic Service Agent tool configuration and activation comes standard with the system. In support of this effort, a new HMC External Connectivity security whitepaper has been published, which describes data exchanges between the HMC and the IBM Service Delivery Center (SDC) and the methods and protocols for

this exchange. To read the whitepaper and prepare for Electronic Service Agent installation, see the "Security" section at the [IBM Electronic Service Agent](#) website.

Select your country. Click "IBM Electronic Service Agent Connectivity Guide."

Benefits: increased uptime

Electronic Service Agent is designed to enhance the warranty and maintenance service by potentially providing faster hardware error reporting and uploading system information to IBM Support. This can optimize the time monitoring the symptoms, diagnosing the error, and manually calling IBM Support to open a problem record. And 24x7 monitoring and reporting means no more dependency on human intervention or off-hours client personnel when errors are encountered in the middle of the night.

Security: The Electronic Service Agent tool is designed to help secure the monitoring, reporting, and storing of the data at IBM. The Electronic Service Agent tool is designed to help securely transmit either through the internet (HTTPS or VPN) or modem to provide clients a single point of exit from their site. Communication is one way. Activating Electronic Service Agent does not enable IBM to call into a client's system.

For additional information, see the [IBM Electronic Service Agent](#) website.

More accurate reporting

Because system information and error logs are automatically uploaded to the IBM Support Center in conjunction with the service request, clients are not required to find and send system information, decreasing the risk of misreported or misdiagnosed errors. Once inside IBM, problem error data is run through a data knowledge management system, and knowledge articles are appended to the problem record.

Customized support

By using the IBMid entered during activation, clients can view system and support information in the "My Systems" and "Premium Search" sections of the Electronic Services website.

The Electronic Services web portal is a single internet entry point that replaces the multiple entry points traditionally used to access IBM internet services and support. This web portal enables you to gain easier access to IBM resources for assistance in resolving technical problems. The newly improved My Systems and Premium Search functions make it even easier for Electronic Service Agent-enabled clients to track system inventory and find pertinent fixes.

My Systems provides valuable reports of installed hardware and software using information collected from the systems by IBM Electronic Service Agent. Reports are available for any system associated with the client's IBMid. Premium Search combines the function of search and the value of Electronic Service Agent information, providing advanced search of the technical support knowledgebase. Using Premium Search and the Service Agent information that has been collected from the system, clients are able to see search results that apply specifically to their systems.

For more information on how to utilize the power of IBM Electronic Services, see the following website or contact an [IBM Systems Services Representative](#).

Product number

The following are newly announced features on the specific models of the IBM Power Systems 9223 machine type:

Machine	Model	Feature
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Description	type	number	number
IBM Power System H922	9223	22S	
USB 3.0 Cable - Internal connector to rear port	9223	22S	EBK8
Enterprise 6.4 TB SSD PCIe4 NVMe U.2 module for AIX/Linux	9223	22S	EC5V
Mainstream 800 GB SSD PCIe3 NVMe U.2 module for AIX/Linux	9223	22S	EC5X
PCIe2 LP 2-Port USB 3.0 Adapter	9223	22S	EC6J
PCIe2 2-Port USB 3.0 Adapter	9223	22S	EC6K
PCIe4 LP 1.6TB NVMe Flash Adapter x8 for AIX/Linux	9223	22S	EC7A
PCIe4 LP 3.2TB NVMe Flash Adapter x8 for AIX/Linux	9223	22S	EC7C
PCIe4 LP 6.4TB NVMe Flash Adapter x8 for AIX/Linux	9223	22S	EC7E
NVMe U.2 Passthru adapter Gen4 capable	9223	22S	EJ1Q
Storage backplane with two front PCIe Gen4 capable NVMe U.2 drive slots	9223	22S	EJ1V
Storage backplane with four front PCIe Gen4 capable NVMe U.2 drive slots	9223	22S	EJ1W
Front IBM Bezel for 4 NVMe-Bay BackPlane	9223	22S	EJUN
Front OEM Bezel for 4 NVMe-Bays BackPlane	9223	22S	EJUP
64 GB DDR4 Memory Dimm	9223	22S	EM7B
128 GB DDR4 Memory Dimm	9223	22S	EM7C
PCIe3 16Gb 2-port Fibre Channel Adapter	9223	22S	EN2A
PCIe3 LP 16Gb 2-port Fibre Channel Adapter	9223	22S	EN2B
4-core Typical 2.8 to 3.8 GHz (max) POWER9 Processor	9223	22S	EP76
8-core Typical 3.4 to 3.9 GHz (max) POWER9 Processor	9223	22S	EP77
10-core Typical 2.9 to 3.8 GHz (max) POWER9 Processor	9223	22S	EP78
11-core Typical 2.8 to 3.8 GHz (max) POWER9 Processor	9223	22S	EP79
One Processor Core Activation for EP76	9223	22S	EP7C
One Processor Core Activation for EP77	9223	22S	EP7D
One Processor Core Activation for EP78	9223	22S	EP7E
One Processor Core Activation for EP79	9223	22S	EP7F
Enterprise 1.6 TB SSD PCIe4 NVMe U.2 module for AIX/Linux	9223	22S	ES1E
Enterprise 1.6 TB SSD PCIe4 NVMe U.2 module for IBM i	9223	22S	ES1F
Enterprise 3.2 TB SSD PCIe4 NVMe U.2 module for AIX/Linux	9223	22S	ES1G
931GB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJJ
1.86TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJL
3.72TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJN
7.44TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJQ
931GB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJS
1.86TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJU
3.72TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJW
7.44TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJY

The following are features already announced for the IBM Power Systems 9223 machine type:

Description	Machine type	Model number	Feature number
EMEA Bulk MES Indicator	9223	22S	0004
One CSC Billing Unit	9223	22S	0010
Ten CSC Billing Units	9223	22S	0011
Special Manufacturing Operations Indicator	9223	22S	0098
AIX Partition Specify	9223	22S	0265

Linux Partition Specify	9223	22S	0266
IBM i Operating System Partition Specify	9223	22S	0267
V.24/EIA232 6.1m (20-Ft) PCI Cable	9223	22S	0348
V.35 6.1m (20-Ft) PCI Cable	9223	22S	0353
X.21 6.1m (20-Ft) PCI Cable	9223	22S	0359
V.24/EIA232 20-Ft. PCI Cable with M3	9223	22S	0368
Customer Specified Placement	9223	22S	0456
19 inch, 1.8 meter high rack	9223	22S	0551
19 inch, 2.0 meter high rack	9223	22S	0553
Rack Filler Panel Kit	9223	22S	0599
Load Source Not in CEC	9223	22S	0719
EXP24S SFF Gen2 Load Source Specify (#5887 or #EL1S)	9223	22S	0728
SAN Load Source Specify	9223	22S	0837
Modem Cable - Austria	9223	22S	1010
Modem Cable - Belgium	9223	22S	1011
Modem Cable - Africa	9223	22S	1012
Modem Cable - Italy	9223	22S	1014
Modem Cable - France	9223	22S	1015
Modem Cable - Germany	9223	22S	1016
Modem Cable - UK	9223	22S	1017
Modem Cable - Iceland/Sweden	9223	22S	1018
Modem Cable - Fin/Nor	9223	22S	1021
Modem Cable - Netherlands	9223	22S	1022
Modem Cable - Swiss	9223	22S	1023
Modem Cable - Denmark	9223	22S	1024
Modem Cable - US/Canada and General Use	9223	22S	1025
USB 500 GB Removable Disk Drive	9223	22S	1107
Custom Service Specify, Rochester Minn, USA	9223	22S	1140
Quantity 150 of #1964	9223	22S	1818
Quantity 150 of #1953	9223	22S	1929
300GB 15k RPM SAS SFF-2 Disk Drive (AIX/Linux)	9223	22S	1953
600GB 10k RPM SAS SFF-2 Disk Drive (AIX/Linux)	9223	22S	1964
Primary OS - Linux	9223	22S	2147
2M LC-SC 50 Micron Fiber Converter Cable	9223	22S	2456
2M LC-SC 62.5 Micron Fiber Converter Cable	9223	22S	2459
3M Asynchronous Terminal/Printer Cable EIA-232	9223	22S	2934
Asynchronous Cable EIA-232/V.24 3M	9223	22S	2936
Serial-to-Serial Port Cable for Drawer/Drawer-3.7M	9223	22S	3124
Serial-to-Serial Port Cable for Rack/Rack- 8M	9223	22S	3125
widescreen LCD Monitor	9223	22S	3632

0.3M Serial Port Converter Cable, 9-Pin to 25-Pin	9223	22S	3925
Serial Port Null Modem Cable, 9-pin to 9-pin, 3.7M	9223	22S	3927
Serial Port Null Modem Cable, 9-pin to 9-pin, 10M	9223	22S	3928
System Serial Port Converter Cable	9223	22S	3930
1.8 M (6-ft) Extender Cable for Displays (15-pin D-shell to 15-pin D-shell)	9223	22S	4242
Extender Cable - USB Keyboards, 1.8M	9223	22S	4256
VGA to DVI Connection Converter	9223	22S	4276
Rack Integration Services	9223	22S	4649
One and only one rack indicator feature is required on all orders (#4650 to #4666).			
Rack Indicator- Not Factory Integrated	9223	22S	4650
Rack Indicator, Rack #1	9223	22S	4651
Rack Indicator, Rack #2	9223	22S	4652
Rack Indicator, Rack #3	9223	22S	4653
Rack Indicator, Rack #4	9223	22S	4654
Rack Indicator, Rack #5	9223	22S	4655
Rack Indicator, Rack #6	9223	22S	4656
Rack Indicator, Rack #7	9223	22S	4657
Rack Indicator, Rack #8	9223	22S	4658
Rack Indicator, Rack #9	9223	22S	4659
Rack Indicator, Rack #10	9223	22S	4660
Rack Indicator, Rack #11	9223	22S	4661
Rack Indicator, Rack #12	9223	22S	4662
Rack Indicator, Rack #13	9223	22S	4663
Rack Indicator, Rack #14	9223	22S	4664
Rack Indicator, Rack #15	9223	22S	4665
Rack Indicator, Rack #16	9223	22S	4666
Power Active Memory Expansion Enablement	9223	22S	4793
Software Preload Required	9223	22S	5000
PowerVM Enterprise Edition	9223	22S	5228
PCIe2 LP 4-port 1GbE Adapter	9223	22S	5260
PCIe LP POWER ^(R) GXT145 Graphics Accelerator	9223	22S	5269
PCIe LP 8Gb 2-Port Fibre Channel Adapter	9223	22S	5273
PCIe2 8Gb 4-port Fibre Channel Adapter	9223	22S	5729
8 Gigabit PCI Express ^(R) Dual Port Fibre Channel Adapter	9223	22S	5735
4 Port Async EIA-232 PCIe Adapter	9223	22S	5785
EXP24S SFF Gen2-bay Drawer	9223	22S	5887
PCIe2 4-port 1GbE Adapter	9223	22S	5899
Opt Front Door for 1.8m Rack	9223	22S	6068
Opt Front Door for 2.0m Rack	9223	22S	6069
1.8m Rack Acoustic Doors	9223	22S	6248
2.0m Rack Acoustic Doors	9223	22S	6249
1.8m Rack Trim Kit	9223	22S	6263
2.0m Rack Trim Kit	9223	22S	6272
Power Cord 4.3m (14-ft), Drawer to IBM PDU (250V/ 10A)	9223	22S	6458
Power Cord 4.3m (14-ft), Drawer To OEM PDU (125V, 15A)	9223	22S	6460
Power Cord 4.3m (14-ft), Drawer to Wall/OEM PDU (250V/15A) U. S.	9223	22S	6469
Power Cord 1.8m (6-ft), Drawer to Wall (125V/15A)	9223	22S	6470
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU (250V/10A)	9223	22S	6471
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU (250V/16A)	9223	22S	6472
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU (250V/10A)	9223	22S	6473
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/13A)	9223	22S	6474
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/16A)	9223	22S	6475
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/10A)	9223	22S	6476
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/16A)	9223	22S	6477
Power Cord 2.7 M(9-foot), To Wall/OEM PDU, (250v, 16A)	9223	22S	6478
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (125V/15A or 250V/10A)	9223	22S	6488
4.3m (14-Ft) 3PH/32A 380-415V Power Cord	9223	22S	6489

4.3m (14-Ft) 1PH/63A 200-240V Power Cord	9223	22S	6491
4.3m (14-Ft) 1PH/48A 200-240V Power Cord	9223	22S	6492
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/10A)	9223	22S	6493
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/10A)	9223	22S	6494
Power Cord 2.7M (9-foot), To wall/OEM PDU, (250V, 10A)	9223	22S	6496
Power Cable - Drawer to IBM PDU, 200-240v/10A	9223	22S	6577
Optional Rack Security Kit	9223	22S	6580
Power Cord 2.7M (9-foot), To wall/OEM PDU, (125V, 15A)	9223	22S	6651
4.3m (14-Ft) 3PH/16A 380-415V Power Cord	9223	22S	6653
4.3m (14-Ft) 1PH/24A Power Cord	9223	22S	6654
4.3m (14-Ft) 1PH/24A WR Power Cord	9223	22S	6655
4.3m (14-Ft) 1PH/32A Power Cord	9223	22S	6656
4.3m (14-Ft) 1PH/32A Power Cord	9223	22S	6657
4.3m (14-Ft) 1PH/24A Power Cord-Korea	9223	22S	6658
Power Cord 2.7M (9-foot), To wall/OEM PDU, (250V, 15A)	9223	22S	6659
Power Cord 4.3m (14-ft), Drawer to Wall/OEM PDU (125V/15A)	9223	22S	6660
Power Cord 2.8m (9.2-ft), Drawer to IBM PDU, (250V/10A)	9223	22S	6665
4.3m (14-Ft) 3PH/32A 380-415V Power Cord-Australia	9223	22S	6667
Power Cord 4.3M (14-foot), Drawer to OEM PDU, (250V, 15A)	9223	22S	6669
Power Cord 2.7M (9-foot), Drawer to IBM PDU, 250V/10A	9223	22S	6671
Power Cord 2M (6.5-foot), Drawer to IBM PDU, 250V/10A	9223	22S	6672
Power Cord 2.7m (9-ft), Drawer to Wall/OEM PDU, (250V/10A)	9223	22S	6680
Intelligent PDU+, 1 EIA Unit, Universal UTG0247 Connector	9223	22S	7109
Environmental Monitoring Probe	9223	22S	7118
Power Distribution Unit	9223	22S	7188
Power Distribution Unit (US) - 1 EIA Unit, Universal, Fixed Power Cord	9223	22S	7196
Ethernet Cable, 15m, Hardware Management Console to System Unit	9223	22S	7802
Linux Software Preinstall	9223	22S	8143
Linux Software Preinstall (Business Partners)	9223	22S	8144
USB Mouse	9223	22S	8845
Order Routing Indicator- System Plant	9223	22S	9169
Language Group Specify - US English	9223	22S	9300
Specify mode-1 & CEC SAS port for EXP24 #5887/ELIS	9223	22S	9387
New AIX License Core Counter	9223	22S	9440
New IBM i License Core Counter	9223	22S	9441
New Red Hat License Core Counter	9223	22S	9442
New SUSE License Core Counter	9223	22S	9443
Other AIX License Core Counter	9223	22S	9444
Other Linux License Core Counter	9223	22S	9445
3rd Party Linux License Core Counter	9223	22S	9446
VIOS Core Counter	9223	22S	9447
Other License Core Counter	9223	22S	9449
Ubuntu Linux License Core Counter	9223	22S	9450
Month Indicator	9223	22S	9461
Day Indicator	9223	22S	9462
Hour Indicator	9223	22S	9463
Minute Indicator	9223	22S	9464
Qty Indicator	9223	22S	9465
Countable Member Indicator	9223	22S	9466
Language Group Specify - Dutch	9223	22S	9700
Language Group Specify - French	9223	22S	9703
Language Group Specify - German	9223	22S	9704
Language Group Specify - Polish	9223	22S	9705
Language Group Specify - Norwegian	9223	22S	9706
Language Group Specify - Portuguese	9223	22S	9707
Language Group Specify - Spanish	9223	22S	9708
Language Group Specify - Italian	9223	22S	9711
Language Group Specify - Canadian French	9223	22S	9712

Language Group Specify - Japanese	9223	22S	9714
Language Group Specify - Traditional Chinese (Taiwan)	9223	22S	9715
Language Group Specify - Korean	9223	22S	9716
Language Group Specify - Turkish	9223	22S	9718
Language Group Specify - Hungarian	9223	22S	9719
Language Group Specify - Slovakian	9223	22S	9720
Language Group Specify - Russian	9223	22S	9721
Language Group Specify - Simplified Chinese (PRC)	9223	22S	9722
Language Group Specify - Czech	9223	22S	9724
Language Group Specify - Romanian	9223	22S	9725
Language Group Specify - Croatian	9223	22S	9726
Language Group Specify - Slovenian	9223	22S	9727
Language Group Specify - Brazilian Portuguese	9223	22S	9728
Language Group Specify - Thai	9223	22S	9729
QSFP+ 40GbE Base-SR Transceiver	9223	22S	EB27
1m (3.3-ft), IBM Passive QSFP+ to QSFP+ Cable (DAC)	9223	22S	EB2B
3m (9.8-ft), IBM Passive QSFP+ to QSFP+ Cable (DAC)	9223	22S	EB2H
10m (30.3-ft), IBM Passive QSFP+ MTP Optical Cable	9223	22S	EB2J
30m (90.3-ft), IBM Passive QSFP+ MTP Optical Cable	9223	22S	EB2K
AC Power Supply - 1400w for Server (200-240 VAC)	9223	22S	EB2M
Lift tool based on GenieLift GL-8 (standard)	9223	22S	EB3Z
10GbE Optical Transceiver SFP+ SR	9223	22S	EB46
25GbE Optical Transceiver SFP28	9223	22S	EB47
0.5m SFP28/25GbE copper Cable	9223	22S	EB4J
1.0m SFP28/25GbE copper Cable	9223	22S	EB4K
1.5m SFP28/25GbE copper Cable	9223	22S	EB4L
2.0m SFP28/25GbE copper Cable	9223	22S	EB4M
2.0m QSFP28/100GbE copper split Cable to SFP28 4x25GbE	9223	22S	EB4P
Service wedge shelf tool kit for EB3Z	9223	22S	EB4Z
0.5m EDR IB Copper Cable QSFP28	9223	22S	EB50
1.0m EDR IB Copper Cable QSFP28	9223	22S	EB51
2.0M EDR IB Copper Cable QSFP28	9223	22S	EB52
1.5M EDR IB Copper Cable QSFP28	9223	22S	EB54
100GbE Optical Transceiver QSFP28	9223	22S	EB59
3M EDR IB Optical Cable QSFP28	9223	22S	EB5A
5M EDR IB Optical Cable QSFP28	9223	22S	EB5B
10M EDR IB Optical Cable QSFP28	9223	22S	EB5C
15M EDR IB Optical Cable QSFP28	9223	22S	EB5D
20M EDR IB optical Cable QSFP28	9223	22S	EB5E
30M EDR IB optical Cable QSFP28	9223	22S	EB5F
50M EDR IB Optical Cable QSFP28	9223	22S	EB5G
100M EDR IB optical cable QSFP28	9223	22S	EB5H
0.5M 100GbE Copper Cable QSFP28	9223	22S	EB5J
1.0M 100GbE Copper Cable QSFP28	9223	22S	EB5K
1.5M 100GbE Copper Cable QSFP28	9223	22S	EB5L
2.0M 100GbE Copper Cable QSFP28	9223	22S	EB5M
25M EDR IB optical Cable QSFP28	9223	22S	EB5N
3M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5R
5M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5S
10M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5T
15M 100GbE Optical Cable QSFP28 (AOC)	9223	22S	EB5U
20M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5V
30M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5W
50M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5X
100M 100GbE optical Cable QSFP28 (AOC)	9223	22S	EB5Y
IBM i 7.2 Indicator	9223	22S	EB72
IBM i 7.3 Indicator	9223	22S	EB73
IBM i 7.4 Indicator	9223	22S	EB74
Slim Rear Acoustic Door	9223	22S	EC07
Slim Front Acoustic Door	9223	22S	EC08
PCIe3 LP 2-Port 10Gb NIC&ROCE SR/Cu Adapter	9223	22S	EC2R
PCIe3 2-Port 10Gb NIC&ROCE SR/Cu Adapter	9223	22S	EC2S
PCIe3 LP 2-Port 25/10Gb NIC&ROCE SR/Cu Adapter	9223	22S	EC2T
PCIe3 2-Port 25/10Gb NIC&ROCE SR/Cu Adapter	9223	22S	EC2U
PCIe3 LP 2-port 10GbE NIC&ROCE SFP+ Copper Adapter	9223	22S	EC37
PCIe3 2-port 10GbE NIC&ROCE SFP+ Copper Adapter	9223	22S	EC38
PCIe3 LP 2-Port 40GbE NIC RoCE QSFP+ Adapter	9223	22S	EC3A

PCIe3 2-Port 40GbE NIC RoCE QSFP+ Adapter	9223	22S	EC3B
PCIe3 LP 2-port 100Gb EDR IB Adapter x16	9223	22S	EC3E
PCIe3 LP 2-port 100GbE (NIC& RoCE) QSFP28 Adapter x16	9223	22S	EC3L
PCIe3 LP 1-port 100Gb EDR IB Adapter x16	9223	22S	EC3T
PCIe2 LP 4-Port USB 3.0 Adapter	9223	22S	EC45
PCIe2 4-Port USB 3.0 Adapter	9223	22S	EC46
PCIe3 LP 3D Graphics Adapter x16	9223	22S	EC51
PCIe3 x8 LP 3.2 TB NVMe Flash adapter for AIX/Linux	9223	22S	EC5C
PCIe3 x8 LP 6.4 TB NVMe Flash adapter for AIX/Linux	9223	22S	EC5E
PCIe3 x8 LP 1.6 TB NVMe Flash Adapter for AIX/Linux	9223	22S	EC5G
PCIe4 LP 1-port 100Gb EDR IB CAPI adapter	9223	22S	EC62
PCIe4 LP 2-port 100Gb EDR IB CAPI adapter	9223	22S	EC64
PCIe4 LP 2-port 100Gb ROCE EN LP adapter	9223	22S	EC67
SAS X Cable 3m - HD Narrow 6Gb 2-Adapters to Enclosure	9223	22S	ECBJ
SAS X Cable 6m - HD Narrow 6Gb 2-Adapters to Enclosure	9223	22S	ECBK
SAS X Cable 10m - HD Narrow 6Gb 2-Adapters to Enclosure	9223	22S	ECBL
SAS X Cable 15m - HD Narrow 3Gb 2-Adapters to Enclosure	9223	22S	ECBM
5m (16.4-ft), IBM Passive QSFP+ to QSFP+ Cable (DAC)	9223	22S	ECBN
SAS YO Cable 1.5m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBT
SAS YO Cable 3m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBU
SAS YO Cable 6m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBV
SAS YO Cable 10m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBW
SAS YO Cable 15m - HD Narrow 3Gb Adapter to Enclosure	9223	22S	ECBX
SAS AE1 Cable 4m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBY
SAS YE1 Cable 3m - HD Narrow 6Gb Adapter to Enclosure	9223	22S	ECBZ
3M Optical Cable Pair for PCIe3 Expansion Drawer	9223	22S	ECC7
10M Optical Cable Pair for PCIe3 Expansion Drawer	9223	22S	ECC8
System Port Converter Cable for UPS	9223	22S	ECCF
Variable Length, Blue Cat5e Cable	9223	22S	ECCG
Variable Length, Green Cat5e Cable	9223	22S	ECCH
3M Copper CXP Cable Pair for PCIe3 Expansion Drawer	9223	22S	ECCS
3M Active Optical Cable Pair for PCIe3 Expansion Drawer	9223	22S	ECCX
10M Active Optical Cable Pair for PCIe3 Expansion Drawer	9223	22S	ECCY
3.0M SAS X12 Cable (Two Adapter to Enclosure)	9223	22S	ECDJ
4.5M SAS X12 Active Optical Cable (Two Adapter to Enclosure)	9223	22S	ECDK
10M SAS X12 Active Optical Cable (Two Adapter to Enclosure)	9223	22S	ECDL
1.5M SAS Y012 Cable (Adapter to Enclosure)	9223	22S	ECDT
3.0M SAS Y012 Cable (Adapter to Enclosure)	9223	22S	ECDU
4.5M SAS Y012 Active Optical Cable (Adapter to Enclosure)	9223	22S	ECDV
10M SAS Y012 Active Optical Cable (Adapter to Enclosure)	9223	22S	ECDW
0.6M SAS AA12 Cable (Adapter to Adapter)	9223	22S	ECE0
3.0M SAS AA12 Cable	9223	22S	ECE3
4.5M SAS AA12 Active Optical Cable (Adapter to Adapter)	9223	22S	ECE4
4.3m (14-Ft) PDU to wall 3PH/24A 200-240V Delta-wired Power Cord	9223	22S	ECJ5
4.3m (14-Ft) PDU to wall 3PH/48A 200-240V Delta-wired Power Cord	9223	22S	ECJ7
High Function 9xC19 Single-Phase or Three-Phase Wye PDU plus	9223	22S	ECJJ
High Function 9xC19 PDU plus 3-Phase Delta	9223	22S	ECJL

High Function 12xC13 Single-Phase or Three-Phase Wye PDU plus	9223	22S	ECJN
High Function 12xC13 PDU plus 3-Phase Delta	9223	22S	ECJQ
Cloud Private Solution	9223	22S	ECP0
2.0 Meter Slim Rack	9223	22S	ECR0
Rack Front Door High-End appearance	9223	22S	ECRF
Rack Rear Door Black	9223	22S	ECRG
Rack Side Cover	9223	22S	ECRJ
Rack Rear Extension 5-In	9223	22S	ECRK
Rack Front Door for Rack (Black/Flat)	9223	22S	ECRM
Custom Service Specify, Montpellier, France	9223	22S	ECSF
Custom Service Specify, Mexico	9223	22S	ECSM
Custom Service Specify, Poughkeepsie, USA	9223	22S	ECSP
Integrated Solution Packing	9223	22S	ECSS
Optical Wrap Plug	9223	22S	ECW0
Boot Drive / Load Source in EXP12SX Specify (in #ESLL or #ELLL)	9223	22S	EHR1
Boot Drive / Load Source in EXP24SX Specify (in #ESLS or #ELLS)	9223	22S	EHR2
SSD Placement Indicator - #ESLS/#ELLS	9223	22S	EHS2
SAS Port/Cabling for single IOA Backplane	9223	22S	EJ00
PCIe3 Optical Cable Adapter for PCIe3 Expansion Drawer	9223	22S	EJ05
PCIe3 RAID SAS Adapter Quad-port 6Gb x8	9223	22S	EJ0J
PCIe3 12GB Cache RAID SAS Adapter Quad-port 6Gb x8	9223	22S	EJ0L
PCIe3 LP RAID SAS Adapter Quad-Port 6Gb x8	9223	22S	EJ0M
PCIe3 SAS Tape/DVD Adapter Quad-port 6Gb x8	9223	22S	EJ10
PCIe3 LP SAS Tape/DVD Adapter Quad-port 6Gb x8	9223	22S	EJ11
PCIe3 12GB Cache RAID PLUS SAS Adapter Quad-port 6Gb x8	9223	22S	EJ14
Base Storage Backplane 8 SFF-3 Bays	9223	22S	EJ1F
Expanded function Storage Backplane 8 SFF-3 Bays/ Single IOA with write Cache	9223	22S	EJ1G
Split #EJ1F to 4+4 SFF-3 Bays: Add 2nd SAS Controller	9223	22S	EJ1H
PCIe1 LP SAS Tape/DVD Dual-port 3Gb x8 Adapter	9223	22S	EJ1N
PCIe1 SAS Tape/DVD Dual-port 3Gb x8 Adapter	9223	22S	EJ1P
PCIe x16 to CXP Optical or CU converter Adapter for PCIe3 Expansion Drawer	9223	22S	EJ1R
PCIe3 Crypto Coprocessor BSC-Gen3 4767	9223	22S	EJ33
Specify Mode-1 & (1)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJR1
Specify Mode-1 & (2)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJR2
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B & (2) X for EXP24S (#5887/EL1S)	9223	22S	EJR3
Specify Mode-2 & (4)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJR4
Specify Mode-4 & (4)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJR5
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B & (2) YO for EXP24S (#5887/EL1S)	9223	22S	EJR6
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B & (2) YO for EXP24S (#5887/EL1S)	9223	22S	EJR7
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B & (1) YO for EXP24S (#5887/EL1S)	9223	22S	EJRA
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B & (1) X for EXP24S (#5887/EL1S)	9223	22S	EJRB
Specify Mode-4 & (1)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJRC
Specify Mode-4 & (2)EJ0J/EJ0M/EL3B for EXP24S (#5887/EL1S)	9223	22S	EJRD
Specify Mode-4 & (3)EJ0J/EJ0M/EL3B for EXP24S (#5888/EL1S)	9223	22S	EJRE
Specify Mode-1 & (2)EJ14 for EXP24S (#5887/EL1S)	9223	22S	EJRF
Specify Mode-2 & (2)EJ14 & (2) X for EXP24S (#5887/EL1S)	9223	22S	EJRG
Specify Mode-2 & (2)EJ14 & (1) X for EXP24S (#5887/EL1S)	9223	22S	EJRH
Specify Mode-2 & (4)EJ14 for EXP24S (#5887/EL1S)	9223	22S	EJRJ
Non-paired Indicator EJ14 PCIe SAS RAID+ Adapter	9223	22S	EJRL
Specify Mode-1 & (2)EJ0L for EXP24S (#5887/EL1S)	9223	22S	EJRP
Specify mode-2 & (4) EJ0L for EXP24S #5887/EL1S	9223	22S	EJRR

Specify Mode-2 & (2)EJ0L & (2) X for EXP24S (#5887/EL1S)	9223	22S	EJRS
Specify Mode-2 & (2)EJ0L & (1) X for EXP24S (#5887/EL1S)	9223	22S	EJRT
Non-paired Indicator EJ0L PCIe SAS RAID Adapter	9223	22S	EJRU
Specify Mode-1 & CEC SAS port Controller EJ1G/EL67 & (1) 6G Y0 for EXP24S (#5887/EL1S)	9223	22S	EJSU
Front IBM Bezel for 8-Bay BackPlane	9223	22S	EJU6
Front OEM Bezel for 8-Bay BackPlane	9223	22S	EJU7
Specify Mode-1 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJV1
Specify Mode-1 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJV2
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJV3
Specify Mode-2 & (4)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJV4
Specify Mode-4 & (4)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJV5
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJV6
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJV7
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJVA
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJVB
Specify Mode-4 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJVC
Specify Mode-4 & (2)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJVD
Specify Mode-4 & (3)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP12SX #ESLL/ELLL	9223	22S	EJVE
Specify Mode-1 & (2)EJ14 & (2)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJVF
Specify Mode-1 & (2)EJ0L & (2)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJVP
Specify Mode-1 & CEC SAS port Controller EJ1G/EL67 & (1)Y012 for EXP12SX #ESLL/ELLL	9223	22S	EJVV
Specify Mode-1 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJW1
Specify Mode-1 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJW2
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJW3
Specify Mode-2 & (4)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJW4
Specify Mode-4 & (4)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJW5
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJW6
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (2)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJW7
Specify Mode-2 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJWA
Specify Mode-2 & (2)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWB
Specify Mode-4 & (1)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWC
Specify Mode-4 & (2)EJ0J/EJ0M/EL3B/EL59 & (1)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWD
Specify Mode-4 & (3)EJ0J/EJ0M/EL3B/EL59 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWE
Specify Mode-1 & (2)EJ14 & (2)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJWF
Specify Mode-2 & (2)EJ14 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWG
Specify Mode-2 & (2)EJ14 & (1)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWH
Specify Mode-2 & (4)EJ14 & (2)X12 for EXP24SX #ESLS/ELLS	9223	22S	EJWJ
Specify Mode-1 & (2)EJ0L & (2)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJWP
Specify Mode-2 & (4)EJ0L & (2)X12 for EXP24SX			

#ESLS/ELLS	9223	22S	EJWR
Specify Mode-2 & (2)EJ0L & (2)X12 for EXP24SX			
#ESLS/ELLS	9223	22S	EJWS
Specify Mode-2 & (2)EJ0L& (1)X12 for EXP24SX			
#ESLS/ELLS	9223	22S	EJWT
Specify Mode-1 & CEC SAS port Controller EJ1G/ EL67 & (1)Y012 for EXP24SX #ESLS/ELLS	9223	22S	EJWU
PDU Access Cord 0.38m	9223	22S	ELC0
Power Cable - Drawer to IBM PDU (250V/10A)	9223	22S	ELC5
16 GB DDR4 Memory	9223	22S	EM6J
32 GB DDR4 Memory	9223	22S	EM6K
PCIe Gen3 I/O Expansion Drawer	9223	22S	EMX0
AC Power Supply Conduit for PCIe3 Expansion Drawer	9223	22S	EMXA
PCIe3 6-slot Fanout Module for PCIe3 Expansion Drawer	9223	22S	EMXF
PCIe3 6-slot Fanout Module for PCIe3 Expansion Drawer	9223	22S	EMXG
PCIe3 6-slot Fanout Module for PCIe3 Expansion Drawer	9223	22S	EMXH
1m (3.3-ft), 10Gb E'Net Cable SFP+ Act Twinax Copper	9223	22S	EN01
3m (9.8-ft), 10Gb E'Net Cable SFP+ Act Twinax Copper	9223	22S	EN02
5m (16.4-ft), 10Gb E'Net Cable SFP+ Act Twinax Copper	9223	22S	EN03
PCIe3 16Gb 2-port Fibre Channel Adapter	9223	22S	EN0A
PCIe3 LP 16Gb 2-port Fibre Channel Adapter	9223	22S	EN0B
PCIe2 LP 8Gb 2-Port Fibre Channel Adapter	9223	22S	EN0F
PCIe2 8Gb 2-Port Fibre Channel Adapter	9223	22S	EN0G
PCIe3 4-port (10Gb FCoE & 1GbE) SR&RJ45	9223	22S	EN0H
PCIe3 LP 4-port (10Gb FCoE & 1GbE) SR&RJ45	9223	22S	EN0J
PCIe3 4-port (10Gb FCoE & 1GbE) SFP+Copper&RJ45	9223	22S	EN0K
PCIe3 LP 4-port(10Gb FCoE & 1GbE) SFP+Copper&RJ45	9223	22S	EN0L
PCIe2 4-Port (10Gb+1GbE) SR+RJ45 Adapter	9223	22S	EN0S
PCIe2 LP 4-Port (10Gb+1GbE) SR+RJ45 Adapter	9223	22S	EN0T
PCIe2 4-port (10Gb+1GbE) Copper SFP+RJ45 Adapter	9223	22S	EN0U
PCIe2 LP 4-port (10Gb+1GbE) Copper SFP+RJ45 Adapter	9223	22S	EN0V
PCIe2 2-port 10/1GbE BaseT RJ45 Adapter	9223	22S	EN0W
PCIe2 LP 2-port 10/1GbE BaseT RJ45 Adapter	9223	22S	EN0X
PCIe2 LP 8Gb 4-port Fibre Channel Adapter	9223	22S	EN0Y
PCIe2 8Gb 4-port Fibre Channel Adapter	9223	22S	EN12
PCIe3 4-port 10GbE SR Adapter	9223	22S	EN15
PCIe3 32Gb 2-port Fibre Channel Adapter	9223	22S	EN1A
PCIe3 LP 32Gb 2-port Fibre Channel Adapter	9223	22S	EN1B
PCIe3 16Gb 4-port Fibre Channel Adapter	9223	22S	EN1C
PCIe3 LP 16Gb 4-port Fibre Channel Adapter	9223	22S	EN1D
Horizontal PDU Mounting Hardware	9223	22S	EPTH
High Function 9xC19 PDU: Switched, Monitoring	9223	22S	EPTJ
High Function 9xC19 PDU 3-Phase: Switched, Monitoring	9223	22S	EPTL
High Function 12xC13 PDU: Switched, Monitoring	9223	22S	EPTN
High Function 12xC13 PDU 3-Phase: Switched, Monitoring	9223	22S	EPTQ
Quantity 150 of #ES62 3.86-4.0 TB 7200 rpm 4k LFF-1 Disk	9223	22S	EQ62
Quantity 150 of #ES64 7.72-8.0 TB 7200 rpm 4k LFF-1 Disk	9223	22S	EQ64
Quantity 150 of #ES78 387GB SFF-2 SSD 5xx	9223	22S	EQ78
Quantity 150 of #ES7E 775GB SFF-2 SSD 5xx	9223	22S	EQ7E
Quantity 150 of #ES80 1.9TB SFF-2 SSD 4k	9223	22S	EQ80
Quantity 150 of #ES85 387GB SFF-2 SSD 4k	9223	22S	EQ85
Quantity 150 of #ES8C 775GB SFF-2 SSD 4k	9223	22S	EQ8C
Quantity 150 of #ES8F 1.55TB SFF-2 SSD 4k	9223	22S	EQ8F
Quantity 150 of #ES8Y 931GB SFF-2 SSD 4k	9223	22S	EQ8Y
Quantity 150 of ES96 1.86TB SFF-2 SSD 4k	9223	22S	EQ96
Quantity 150 of #ESE7 3.72TB SFF-2 SSD 4k	9223	22S	EQE7
Quantity 150 of #ESEV (600GB 10k SFF-2)	9223	22S	EQEV
Quantity 150 of #ESEZ (300GB SFF-2)	9223	22S	EQEZ
Quantity 150 of #ESF3 (1.2TB 10k SFF-2)	9223	22S	EQF3
Quantity 150 of #ESFP (600GB SFF-2)	9223	22S	EQFP
Quantity 150 of #ESFT (1.8TB 10k SFF-2)	9223	22S	EQFT

Quantity 150 of #ESG5 (387GB SAS 5xx)	9223	22S	EQG5
Quantity 150 of #ESGB (387GB SAS 4k)	9223	22S	EQGB
Quantity 150 of #ESGF (775GB SAS 5xx)	9223	22S	EQGF
Quantity 150 of #ESGK (775GB SAS 4k)	9223	22S	EQGK
Quantity 150 of #ESGP (1.55TB SAS 4k)	9223	22S	EQGP
Quantity 150 of ES94 387GB SAS 4k	9223	22S	ER94
Bulk Packaging Request ID	9223	22S	ERB0
Bulk Packaging ID #1	9223	22S	ERB1
Bulk Packaging ID #2	9223	22S	ERB2
Bulk Packaging ID #3	9223	22S	ERB3
Bulk Packaging ID #4	9223	22S	ERB4
Bulk Packaging ID #5	9223	22S	ERB5
Bulk Packaging ID #6	9223	22S	ERB6
Bulk Packaging ID #7	9223	22S	ERB7
Bulk Packaging ID #8	9223	22S	ERB8
Bulk Packaging ID #9	9223	22S	ERB9
Bulk Packaging ID #10	9223	22S	ERBA
Bulk Packaging ID #11	9223	22S	ERBB
Bulk Packaging ID #12	9223	22S	ERBC
Bulk Packaging ID #13	9223	22S	ERBD
Bulk Packaging ID #14	9223	22S	ERBE
Bulk Packaging ID #15	9223	22S	ERBF
Bulk Packaging ID #16	9223	22S	ERBG
Bulk Packaging ID #17	9223	22S	ERBH
Bulk Packaging ID #18	9223	22S	ERBJ
Bulk Packaging ID #19	9223	22S	ERBK
Bulk Packaging ID #20	9223	22S	ERBL
No Bulk Packaging Specify	9223	22S	ERBZ
RFID Tags for Servers, Compute Nodes, Chassis, Racks, and HMCs	9223	22S	ERF1
Rear rack extension	9223	22S	ERG0
Quantity 150 of ESGV 387GB SSD 4k	9223	22S	ERGV
Quantity 150 of ESGZ 775GB SSD 4k	9223	22S	ERGZ
Quantity 150 of #ESHJ 931 GB SSD 4k SFF-2	9223	22S	ERHJ
Quantity 150 of #ESHL 1.86 TB SSD 4k SFF-2	9223	22S	ERHL
Quantity 150 of #ESHN 7.45 TB SSD 4k SFF-2	9223	22S	ERHN
Quantity 150 of ESJ0 931GB SAS 4k	9223	22S	ERJ0
Quantity 150 of ESJ2 1.86TB SAS 4k	9223	22S	ERJ2
Quantity 150 of ESJ4 3.72TB SAS 4k	9223	22S	ERJ4
Quantity 150 of ESJ6 7.45TB SAS 4k	9223	22S	ERJ6
Quantity 150 of #ESM8 3.72 TB SSD 4k SFF-2	9223	22S	ERM8
Quantity 150 of ESNA 775GB SSD 4k	9223	22S	ERNA
Quantity 150 of ESNE 1.55TB SSD 4k	9223	22S	ERNE
3.86-4.0 TB 7200 RPM 4K SAS LFF-1 Nearline Disk Drive (AIX/Linux)	9223	22S	ES62
7.72-8.0 TB 7200 RPM 4K SAS LFF-1 Nearline Disk Drive (AIX/Linux)	9223	22S	ES64
387GB SFF-2 SSD 5xx eMLC4 for AIX/Linux	9223	22S	ES78
775GB SFF-2 SSD 5xx eMLC4 for AIX/Linux	9223	22S	ES7E
387GB SFF-3 SSD 5xx eMLC4 for AIX/Linux	9223	22S	ES7K
775GB SFF-3 SSD 5xx eMLC4 for AIX/Linux	9223	22S	ES7P
1.9TB Read Intensive SAS 4k SFF-2 SSD for AIX/ Linux	9223	22S	ES80
931GB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ES83
387GB SFF-2 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES85
775GB SFF-2 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES8C
1.55TB SFF-2 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES8F
1.9TB Read Intensive SAS 4k SFF-3 SSD for AIX/ Linux	9223	22S	ES8J
387GB SFF-3 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES8N
775GB SFF-3 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES8Q
1.55TB SFF-3 SSD 4k eMLC4 for AIX/Linux	9223	22S	ES8V
931GB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ES8Y
387GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ES90
1.86TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ES92
387GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ES94
1.86TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ES96
387GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESB0
387GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESB2
775GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESB4
775GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESB6
387GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESB8
387GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESBA
775GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESBE

775GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESBG
1.55TB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESBJ
1.55TB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESBL
S&H - No Charge	9223	22S	ESC0
S&H-a	9223	22S	ESC5
600GB 10K RPM SAS SFF-3 Disk Drive (AIX/Linux)	9223	22S	ESD5
300GB 15K RPM SAS SFF-3 Disk Drive (AIX/Linux)	9223	22S	ESDB
3.72TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESE1
3.72TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESE7
600GB 10K RPM SAS SFF-2 Disk Drive 4K Block - 4096	9223	22S	ESEV
300GB 15K RPM SAS SFF-2 4K Block - 4096 Disk Drive	9223	22S	ESEZ
1.2TB 10K RPM SAS SFF-2 Disk Drive 4K Block - 4096	9223	22S	ESF3
600GB 10K RPM SAS SFF-3 Disk Drive 4K Block - 4096	9223	22S	ESF5
1.2TB 10K RPM SAS SFF-3 Disk Drive 4K Block - 4096	9223	22S	ESF9
300GB 15K RPM SAS SFF-3 4K Block - 4096 Disk Drive	9223	22S	ESFB
600GB 15K RPM SAS SFF-3 4K Block - 4096 Disk Drive	9223	22S	ESFF
600GB 15K RPM SAS SFF-2 4K Block - 4096 Disk Drive	9223	22S	ESFP
1.8TB 10K RPM SAS SFF-2 Disk Drive 4K Block - 4096	9223	22S	ESFT
1.8TB 10K RPM SAS SFF-3 Disk Drive 4K Block - 4096	9223	22S	ESFV
387GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESG5
387GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESG9
387GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESGB
387GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESGD
775GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESGF
775GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESGH
775GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESGK
775GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESGM
1.55TB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESGP
1.55TB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESGR
387GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESGT
387GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESGV
775GB Enterprise SAS 5xx SFF-3 SSD for AIX/Linux	9223	22S	ESGX
775GB Enterprise SAS 5xx SFF-2 SSD for AIX/Linux	9223	22S	ESGZ
SAP HANA Identifier for 9223-22H/22S	9223	22S	ESH1
931 GB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESHJ
1.86 TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESHL
7.45 TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESHN
931 GB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESHS
1.86 TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESHU
7.45 TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESHW
931GB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJ0
1.86TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJ2
3.72TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJ4
7.45TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESJ6
931GB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJ8
1.86TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJA
3.72TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJC
7.45TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESJE
Specify AC Power Supply for EXP12SX/EXP24SX Storage Enclosure	9223	22S	ESLA
EXP12SX SAS Storage Enclosure	9223	22S	ESLL
EXP24SX SAS Storage Enclosure	9223	22S	ESLS
3.72 TB Mainstream SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESM8
3.72 TB Mainstream SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESMQ
775GB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESNA
775GB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESNC
1.55TB Enterprise SAS 4k SFF-2 SSD for AIX/Linux	9223	22S	ESNE
1.55TB Enterprise SAS 4k SFF-3 SSD for AIX/Linux	9223	22S	ESNG
300GB 15K RPM SAS SFF-3 4k Block Cached Disk Drive (AIX/Linux)	9223	22S	ESNK
300GB 15K RPM SAS SFF-2 4k Block Cached Disk Drive (AIX/Linux)	9223	22S	ESNM
600GB 15K RPM SAS SFF-3 4k Block Cached Disk Drive (AIX/Linux)	9223	22S	ESNP

600GB 15K RPM SAS SFF-2 4k Block Cached Disk Drive (AIX/Linux)	9223	22S	ESNR
Quantity 150 of #ESNM (300GB 15k SFF-2)	9223	22S	ESPM
Quantity 150 of #ESNR (600GB 15k SFF-2)	9223	22S	ESPR
Quantity 150 of ESB2 387GB SAS 4k	9223	22S	ESQ2
Quantity 150 of ESB6 775GB SAS 4k	9223	22S	ESQ6
Quantity 150 of ESBA 387GB SAS 4k	9223	22S	ESQA
Quantity 150 of ESBG 775GB SAS 4k	9223	22S	ESQG
Quantity 150 of ESBL 1.55TB SAS 4k	9223	22S	ESQL
1TB Removable Disk Drive Cartridge	9223	22S	EU01
Not available in US, EMEA, and Japan			
RDX USB External Docking Station for Removable Disk Cartridge	9223	22S	EU04
RDX 320 GB Removable Disk Drive	9223	22S	EU08
Operator Panel LCD Display	9223	22S	EU0B
1.5TB Removable Disk Drive Cartridge	9223	22S	EU15
Cable Ties & Labels	9223	22S	EU19
Order Placed Indicator	9223	22S	EU29
2TB Removable Disk Drive Cartridge (RDX)	9223	22S	EU2T
RDX USB External Docking Station	9223	22S	EUA4
Standalone USB DVD drive w/cable	9223	22S	EUA5
Core Use HW Feature	9223	22S	EUC6
Core Use HW Feature 10X	9223	22S	EUC7
BP Post-Sale Services: 1 Day	9223	22S	SVBP
IBM Systems Lab Services Post-Sale Services: 1 Day	9223	22S	SVCS
Other IBM Post-Sale Services: 1 Day	9223	22S	SVNN

Publications

Publications:

Power Systems hardware documentation provides clients with the following topical information:

- Licenses, notices, safety, and warranty information
- Planning for the system
- Installing and configuring the system
- Troubleshooting, service, and support
- Installing, configuring, and managing consoles, terminals, and interfaces
- Installing operating systems
- Creating a virtual computing environment
- Enclosures and expansion units
- Glossary

You can access the product documentation at [IBM Knowledge Center](#).

Product documentation is also available on DVD (SK5T-7087).

The following information is shipped with the 9223-22S:

- Power Hardware Information DVD SK5T-7087
- Installing the 9223-22S
- Important Notices
- Warranty Information
- License Agreement for Machine Code

Hardware documentation such as installation instructions, user's information, and service information is available to download or view at the [IBM Support](#) website.

You can access IBM i documentation at the [IBM i](#) website.

You can access AIX documentation at the [AIX](#) website.

You can access documentation about Linux on IBM systems at the [Linux information for IBM systems](#) website.

The IBM Systems Information Center provides you with a single information center where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access. See the IBM Systems Information Center at [IBM Knowledge Center](#).

IBM Knowledge Center provides you with a single point of reference where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access by going to [IBM Knowledge Center](#) for all your product information needs.

To access the IBM Publications Center Portal, go to the [IBM Publications Center](#) website.

The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. A large number of publications are available online in various file formats, which can currently be downloaded.

National language support

Not applicable

Services

IBM Systems Lab Services

IBM Systems Lab Services offers infrastructure services to help you build the foundation for on-premise IT or hybrid cloud with SAP HANA. From servers, storage systems and software, Lab Services helps you deploy the building blocks of your next-generation IT infrastructure for SAP HANA. Our IBM Lab Services consultants perform SAP HANA infrastructure and migration services for clients on site, offering deep technical expertise, trusted tools and successful methodologies. Our services are designed to help clients solve business challenges, gain new skills and apply best practices as they deploy, migrate or upgrade their SAP HANA systems. Our implementation services include advising clients on planning data center, infrastructure, storage, networking and database requirements, implementing PowerVM, Linux on Power (SUSE or Red Hat) and an SAP HANA instance/s using a Tailored Datacenter Integration (TDI) methodology before performing verification tests of file system performance and of the SAP HANA landscape required for SAP environment certification. Our SAP HANA migration services will help you understand the practical aspects of planning and executing a migration from any database or an existing SAP HANA on x86 deployment to SAP HANA on Power. A workshop with an experienced IBM Lab Services consultant will help you plan the migration, selecting the appropriate SAP migration tools and methodologies. For details on available SAP HANA services, clients should contact their IBM representative, go to the [IBM Systems Lab Services](#) website or contact us at ibmsls@us.ibm.com^(R).

Global Technology Services

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an on-demand business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or go to the [IBM Global Technology Services](#) website.

For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or go to the [Resiliency Services](#) website.

Details on education offerings related to specific products can be found on the [IBM Skills Gateway](#) website.

Technical information

Specified operating environment

Physical specifications

- Width: 482 mm (18.97 in.)
- Depth: 766.5 mm (30.2 in.)
- Height: 86.7 mm (3.4 in.)
- Weight: 30.4 kg (67 lb)

To assure installability and serviceability in non-IBM industry-standard racks, review the installation planning information for any product-specific installation requirements.

Operating environment

- Temperature: (nonoperating) 5 to 45 degrees Celsius (41 to 113 Fahrenheit); recommended temperature (operating) 18 to 27 degrees Celsius (64 to 80 Fahrenheit); allowable operating temperature 5 to 40 degrees Celsius (41 to 104 Fahrenheit)
- Relative humidity: 8% - 85% (allowable operating humidity range); recommended 5.5 degrees Celsius (42 Fahrenheit) dew point to 60% RH and 15 degrees Celsius (59 Fahrenheit) dew point
- Maximum dew point: 24 degrees C (75 Fahrenheit) (allowable operating)
- Operating voltage: 1400 W PSU: 200 - 240 V AC
- Operating frequency: 47/63 Hz
- Maximum power consumption: 1880 watts (maximum)
- Power factor: 0.98
- Thermal output: 6,416 Btu/hour (maximum)
- Power-source loading
 - 1.94 kVa (maximum configuration)
 - Maximum altitude: 3,050 m (10,000 ft)

Note: The maximum measured value is the worst case power consumption expected from a fully populated server under an intensive workload. The maximum measured value also accounts for component tolerance and non-ideal operating conditions. Power consumption and heat load vary greatly by server configuration and utilization. The [IBM Systems Energy Estimator](#) should be used to obtain a heat output estimate based on a specific configuration.

Noise levels and declared A-weighted sound power level

- Rack-mount system: 6.5 bels operating; 5.3 bels idling

See the *Installation Planning Guide* in [IBM Knowledge Center](#) for additional detail.

For example, the actual power noise level is impacted by multiple factors, including:

- Enablement of the Turbo mode increases fan speed, which increases power noise levels.
- Usage of the Turbo mode further increases fan speed, which further increases power noise levels.
- Using higher wattage PCIe adapters increases fan speed, which increases power noise levels.
- Placing multiple servers in a rack increases the total power noise level.
- Placing servers in racks with acoustic doors reduces the power noise levels.

EMC conformance classification

This equipment is subject to FCC rules and shall comply with the appropriate FCC rules before final delivery to the buyer or centers of distribution.

- US: FCC Class A
- Europe: CISPR 22 Class A
- Japan: VCCI-A
- Korea: Korean Requirement Class A
- China: People's Republic of China commodity inspection law Class A

Homologation -- Telecom environmental testing (Safety and EMC):

Homologation approval for specific countries has been initiated with the IBM Homologation and Type Approval (HT&A) organization in LaGaude, France. This Power Systems model and applicable features meet the environmental testing requirements of the country telecom and have been designed and tested in compliance with the Full Quality Assurance Approval (FQAA) process as delivered by the British Approval Board for Telecom (BABT), the UK Telecom regulatory authority.

This product is not certified for connection by any means whatsoever to interfaces of public telecommunications networks. Certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

Product safety/Country testing/Certification

- UL 60950-1:2007 Underwriters Laboratory, Safety Information
- CSA C22.2 No. 60950-1-07, Canadian Standards Association
- EN60950 European Norm
- IEC 60950, Edition 1, International Electrotechnical Commission, Safety Information
- Nordic deviations to IEC 60950-1 1st Edition

General requirements:

The product is in compliance with IBM Corporate Bulletin C-B 0-2594-000 Statement of Conformity of IBM Product to External Standard (Suppliers Declaration).

Hardware requirements

Power H922 system configuration

The minimum Power H922 initial order must include a processor module, two 16 GB DIMMs, two power supplies and line cords, an operating system indicator, a cover set indicator, and a Language Group Specify. Also, it must include one of the storage options and the network options below:

Storage options:

- For boot from NVMe: One NVMe drive slot and one NVMe drive or one PCIe NVMe add in adapter .

- For boot from direct attach storage SFF-3 / SFF-2 HDD/SSD: One storage backplane and one SFF-3 / SFF-2 HDD or SSD.
- For boot from SAN: Internal HDD or SSD and RAID card are not required if feature 0837 (Boot from SAN) is selected. A Fibre Channel adapter must be ordered if feature 0837 is selected.

Network options:

- One PCIe2 4-port 1 Gb Ethernet adapter
- One of the supported 10 Gb Ethernet adapters

Linux is the primary operating system. The minimum defined initial order configuration is as follows:

Feature number	Description	Quantity	Notes
EU0B	Operator Panel LCD Display	1	Optional
Processors			
EP76	4-core typical 2.8 to 3.8 GHz (max) POWER9 Processor	1	
or			
EP77	8-core typical 3.4 to 3.9 GHz (max) POWER9 Processor	1	
or			
EP78	10-core typical 2.9 to 3.8 GHz (max) POWER9 Processor	1	
or			
EP79	11-core Typical 2.8 to 3.8 Ghz (max) POWER9 Processor	1	
Processor activations			
EP7C	One Processor Core Activation for #EP76	4	
or			
EP7D	One Processor Core Activation for #EP77	8	
or			
EP7E	One Processor Core Activation for #EP78	10	
or			
EP7F	One Processor Core Activation for #EP79	11	
Memory DIMMs			
EM62	16 GB DDR4 Memory	2	
or			
EM63	32 GB DDR4 Memory	2	
or			
EM64	64 GB DDR4 Memory	2	
or			

Feature number	Description	Quantity	Notes
EM65	128 GB DDR4 Memory	2	
Storage Backplane			
EJ1V	Storage Backplane with 2 PCIe Gen4 capable NVMe U.2 drive slots	1	See Note 2 and Note 4
or			
EJ1W	Storage Backplane with 4 PCIe Gen4 capable NVMe U.2 drive slots	1	See Note 2 and Note 4
Disk Drive			
ESDB	300 GB 15K RPM SAS SFF-3 Disk Drive (AIX/Linux)	1	
LAN Adapter			
5260	PCIe2 LP 4-port 1 GbE Adapter	1	See Note 3
Power supplies/ Power cord			
EB2M	AC Power Supply - 1400 W for Server (200 - 240 V AC)	2	EB2M -(default)
6458	Power Cord 4.3 m (14 ft), Drawer to IBM PDU (250V/10A)	2	6458 - (default)
9300/97xx	Language Group Specify		9300 - (default)
Front Bezel			
EJUN	Front IBM Bezel for 4 NVMe-Bay BackPlane	1	
or			
EJUP	Front OEM Bezel for 4 NVMe-Bays BackPlane	1	
Operating System			
2147	Primary Operating System Indicator - Linux	1	

1. The racking approach for the initial order must be either a 7014-T00, 7014-T42, 7965-S42, or 7953-94Y. If an additional rack is required for I/O expansion drawers as an MES to an existing system, either a feature 0551, 0553, or ER05 rack must be ordered.
2. Must order, at a minimum, one #ES1E/#ES1G/#EC5V/#EC5X (NVMe U.2 drive) with backplane #EJ1V, or #EJ1W. Maximum of two #ES1E/#ES1G/#EC5V/#EC5X per one #EJ1V. Maximum of four #ES1E/#ES1G/#EC5V/#EC5X per one #EJ1W. Mixing of #ES1E, #ES1G, #EC5V, or #EC5X is allowed on a backplane.
3. Adapter feature 5260 is the default 1 Gb Ethernet adapter. Options of a 10 Gb Ethernet adapter include one of either #EC2R, #EC2T, #EN0J, #EN0L, #EN0T, #EN0X, or EN0V.
4. Storage backplane features #EJ1F/#EJ1G/#EJ1H are also available (selected Front Bezel are required).

Hardware Management Console (HMC) machine code

An HMC is required to manage the Power H922 server implementing partitioning. Multiple POWER7^(R), POWER8^(R), and POWER9 processor-based servers can be supported by a single HMC.

Planned HMC hardware and software support:

- X86 based - 7042-CR7, 7042-CR8, 7042-CR9
 - vHMC x86
- POWER8 based Open Power: 7063-CR1
 - vHMC PowerVM based LPAR

If you are attaching an HMC to a new server or adding function to an existing server that requires a firmware update, the HMC machine code may need to be updated because HMC code must always be equal to or higher than the managed server's firmware. Access to firmware and machine code updates is conditioned on entitlement and license validation in accordance with IBM policy and practice. IBM may verify entitlement through customer number, serial number, electronic restrictions, or any other means or methods employed by IBM at its discretion.

To determine the HMC machine code level required for the firmware level on any server, go to the following web page to access the Fix Level Recommendation Tool (FLRT) on or after the planned availability date for this product. FLRT will identify the correct HMC machine code for the selected system firmware level; see the [Fix Level Recommendation Tool](#) website.

If a single HMC is attached to multiple servers, the HMC machine code level must be updated to be at or higher than the server with the most recent firmware level. All prior levels of server firmware are supported with the latest HMC machine code level.

The HMC code latest level contains the following:

- Support for managing Power H922, Power S924, and Power S914 systems.
- Support for the new HMC model 7063-CR1.
- Support for PowerVM functions such as the new HMC GUI interface for VIOS management.
- GUI for HMC's Performance and Capacity Monitoring function.
- An HMC command to initiate a remote restart operation. This removes the requirement of VMControl for the PowerVM Remote Restart function.
- For PowerVM GUI functions, VIOS is recommended.

For clients installing systems higher than the EIA 29 position (location of the rail that supports the rack-mounted server) in any IBM or non-IBM rack, acquire approved tools outlined in the server specifications section at [IBM Knowledge Center](#). In situations where IBM service is required and the recommended tools are not available, there could be delays in repair actions.

Software requirements

Linux as the Primary Operating System:

Linux is required as the primary operating system with a minimum of 75% of total cores activated.

If installing the Linux operating systems LPAR in production SAP implementations:

- SUSE Linux Enterprise Server for SAP with SUSE Linux Enterprise Server 15 Service Pack 1, or later
- Red Hat Enterprise Linux for SAP with Red Hat Enterprise Linux 8 for Power LE version 8.1, or later
- SUSE Linux Enterprise Server for SAP with SUSE Linux Enterprise Server 12, Service Pack 5, or later

If installing the Linux operating system LPAR in nonproduction SAP implementations:

- Red Hat Enterprise Linux 8 for Power LE, version 8.1, or later
- SUSE Linux Enterprise Server 15 Service Pack 1, or later
- SUSE Linux Enterprise Server 12 Service Pack 5, or later

AIX and IBM i as the Secondary Operating Systems:

IBM AIX and IBM i can be chosen as secondary operating systems, with a maximum of 25% of total cores activated across both.

If installing the AIX operating system LPAR with any I/O configuration (one of these):

- AIX Version 7.2 with the 7200-05 Technology Level, or later
- AIX Version 7.2 with the 7200-04 Technology Level and Service Pack 7200-04-02-2028, or later
- AIX Version 7.1 with the 7100-05 Technology Level and Service Pack 7100-05-06-2028, or later
- AIX Version 7.2 with the 7200-03 Technology Level and Service Pack 7 (planned availability February 19, 2021)

If installing the AIX operating system Virtual I/O only LPAR (one of these):

- AIX Version 7.2 with the 7200-05 Technology Level, or later
- AIX Version 7.2 with the 7200-04 Technology Level, or later
- AIX Version 7.2 with the 7200-03 Technology Level, or later
- AIX Version 7.1 with the 7100-05 Technology Level and Service Pack 7100-05-02-1832, or later

If installing VIOS:

- VIOS 3.1.2.10, or later
- VIOS 3.1.1.25, or later

If installing the IBM i operating system LPAR, IBM i requires VIOS, and the supported levels are:

- IBM i 7.4 TR3, or later
- IBM i 7.3 TR9, or later
- IBM i 7.2 with 7.2 Licensed Machine Code - RS 720-Q, or later

For the latest prerequisites, visit the [Power Systems Prerequisites](#) tool.

Limitations

- Integrated system port is not supported under AIX or Linux when the HMC ports are connected to an HMC. Either the HMC ports or the integrated system ports can be used, but not both. The FSP2 USB 2.0 port is used for communication to a UPS.
- The integrated system port is supported for modem and TTY terminal connections by AIX or Linux. Any other application using serial ports requires a serial port adapter to be installed in a PCI slot. The integrated system port does not support HACMP configurations.

Planning information

Cable orders

No additional cables are required.

Security, auditability, and control

This product uses the security and auditability features of host hardware and application software.

The client is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

IBM Systems Lab Services

IBM Systems Lab Services offers infrastructure services to help you build the foundation for on-premise IT or hybrid cloud with SAP HANA. From servers, storage systems and software, Lab Services helps you deploy the building blocks of your next-generation IT infrastructure for SAP HANA. Our IBM Lab Services consultants perform SAP HANA infrastructure and migration services for clients on site, offering deep technical expertise, trusted tools and successful methodologies. Our services are designed to help clients solve business challenges, gain new skills and apply best practices as they deploy, migrate or upgrade their SAP HANA systems. Our implementation services include advising clients on planning data center, infrastructure, storage, networking and database requirements, implementing PowerVM, Linux on Power (SUSE or Red Hat) and an SAP HANA instance/s using a Tailored Datacenter Integration (TDI) methodology before performing verification tests of file system performance and of the SAP HANA landscape required for SAP environment certification. Our SAP HANA migration services will help you understand the practical aspects of planning and executing a migration from any database or an existing SAP HANA on x86 deployment to SAP HANA on Power. A workshop with an experienced IBM Lab Services consultant will help you plan the migration, selecting the appropriate SAP migration tools and methodologies. For details on available SAP HANA services, clients should contact their IBM representative, go to the [IBM Systems Lab Services](#) website or contact us at ibmsls@us.ibm.com.

Global Technology Services

Contact your IBM representative for the list of selected services available in your country, either as standard or customized offerings, for the efficient installation, implementation, and/or integration of this product.

Terms and conditions

Volume orders

Contact your IBM representative.

Products - terms and conditions

Warranty period

Warranty and additional coverage options:	Coverage summary ⁽¹⁾ :
Warranty Period:	3 years
Service Level:	IBM CRU & On-Site, 9x5 Next Business Day
Service Upgrade Options :	
Warranty Service Upgrade	IBM On-Site Repair, 9x5 Same Day ⁽²⁾ and 24x7 Same Day options
Maintenance Services (Post-Warranty):	IBM On-Site Repair, Next Business Day and Same Day options
IBM Hardware Maintenance Services - committed maintenance ⁽³⁾ :	Y

- ⁽¹⁾ See complete coverage details below.
- ⁽²⁾ Offered in US and EMEA only.
- ⁽³⁾ Not offered in the US.

To obtain copies of the IBM Statement of Limited Warranty, contact your reseller or IBM.

An IBM part or feature installed during the initial installation of an IBM machine is subject to the full warranty period specified by IBM. An IBM part or feature that replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature are the same as those for the machine in which it is installed.

Any IBM Mainstream devices (previously called *read intensive device*) identified in this document have a maximum number of write cycles. IBM Mainstream device failures will be replaced during standard warranty and maintenance period for devices that have not reached the maximum number of write cycles. Devices that reach this limit may fail to operate according to specifications and must be replaced at the client's expense. Individual service life may vary and can be monitored using an operating system command.

The IBM warranty covers feature number EB4Z. For warranty terms associated with feature number EB3Z and the Lift tool based on GenieLift GL-8, see the separate warranty terms provided by Genie found in the Genie Operator's Manual at the [Genie](#) website.

For clients installing systems higher than the EIA 29 position (location of the rail that supports the rack-mounted server) in any IBM or non-IBM rack, acquire approved tools outlined in the server specifications section at [IBM Knowledge Center](#). In situations where IBM service is required and the recommended tools are not available, there could be delays in repair actions.

Warranty service

If required, IBM provides repair or exchange service depending on the types of warranty service specified for the machine. IBM will attempt to resolve your problem over the telephone, or electronically through an IBM website. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines on-site service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts. If applicable to your product, parts considered Customer Replaceable Units (CRUs) will be provided as part of the machine's standard warranty service.

Service levels are response-time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country-specific and location-specific information.

CRU Service

IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your machine and are available from IBM upon your request. CRUs are designated as being either a Tier 1 (mandatory) or a Tier 2 (optional) CRU.

Tier 1 (mandatory) CRU

Installation of Tier 1 CRUs, as specified in this announcement, is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.

The following parts have been designated as Tier 1 CRUs:

- DASD SFF Drive
- DASD SSD Drive
- RDX Drive
- Enclosure
- Power Cable
- NVMe U.2
- SAS Card
- Op Panel -- Base
- Op Panel -- LCD
- Memory DIMM
- All PCI Adapters
- FAN
- Upper Fan cable
- TPM Card
- Power Supplies
- Service Processor Card/FSP
- TOD Battery
- Air Baffle
- Bezel
- SAS Cable
- Front Heatsink
- Service Cover
- DASD Backplane Power Cable
- DASD Backplane Signal Cable

Tier 2 (optional) CRU

You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge.

Based upon availability, CRUs will be shipped for next-business-day (NBD) delivery. IBM specifies, in the materials shipped with a replacement CRU, whether a defective CRU must be returned to IBM. When return is required, return instructions and a container are shipped with the replacement CRU. You may be charged for the replacement CRU if IBM does not receive the defective CRU within 15 days of your receipt of the replacement.

CRU and On-site Service

At IBM's discretion, you will receive specified CRU service, or IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well-lit, and suitable for the purpose.

Service level is:

- 9 hours per day, Monday through Friday, excluding holidays, next-business-day response. Calls must be received by 3:00 PM local time in order to qualify for next-business-day response.

Warranty service

IBM is now shipping machines with selected non-IBM parts that contain an IBM field replaceable unit (FRU) part number label. These parts are to be serviced during the IBM machine warranty period. IBM is covering the service on these selected non-IBM parts as an accommodation to their customers, and normal warranty service procedures for the IBM machine apply.

International Warranty Service

International Warranty Service allows you to relocate any machine that is eligible for International Warranty Service and receive continued warranty service in any country where the IBM machine is serviced. If you move your machine to a different country, you are required to report the machine information to your Business Partner or IBM representative.

The warranty service type and the service level provided in the servicing country may be different from that provided in the country in which the machine was purchased. Warranty service will be provided with the prevailing warranty service type and service level available for the eligible machine type in the servicing country, and the warranty period observed will be that of the country in which the machine was purchased.

The following types of information can be found on the [International Warranty Service](#) website

- Machine warranty entitlement and eligibility
- Directory of contacts by country with technical support contact information
- Announcement Letters

Warranty service upgrades

During the warranty period, warranty service upgrades provide an enhanced level of On-site Service for an additional charge. Service levels are response-time objectives and are not guaranteed. See the Warranty services section for additional details.

IBM will attempt to resolve your problem over the telephone or electronically by access to an IBM website. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines on-site service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts.

Maintenance service options

CRU and On-site Service

At IBM's discretion, you will receive CRU service or IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well-lit, and suitable for the purpose. The following on-site response-time objectives are available as warranty service upgrades for your machine. Available offerings are:

- IBM On-Site Repair, Same-Day On-Site Response Target, Monday-Friday 08:00-17:00 (excluding public holidays), Last Call Registration: 12:00
- IBM On-Site Repair, Same-Day On-Site Response Target, Monday-Sunday 00:00-24:00, 365 days a year

Customer Replaceable Units (CRUs) may be provided as part of the machine's standard warranty CRU Service except that you may install a CRU yourself or request IBM installation, at no additional charge, under the CRU and On-site Service level specified above. For additional information on the CRU Service, see the warranty information.

Maintenance services

If required, IBM provides repair or exchange service depending on the types of maintenance service specified for the machine. IBM will attempt to resolve your problem over the telephone or electronically, through an IBM website. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines on-site service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts. Service levels are response-time objectives and are not guaranteed. The specified level of maintenance service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country-specific and location-specific information.

The following service selections are available as maintenance options, at additional cost, for your machine type.

- IBM On-Site Repair, Next-Business-Day Response Target, Monday-Friday. Calls must be received by 3:00 PM local time in order to qualify for next-business-day response.
- IBM On-Site Repair, Same-Day On-Site Response Target, Monday-Friday 08:00-17:00 (excluding public holidays), Last Call Registration: 12:00.
- IBM On-Site Repair, Same-Day On-Site Response Target, Monday-Sunday 00:00-24:00, 365 days a year.

IBM Hardware Maintenance Services -- committed maintenance⁽¹⁾

Organizations can lose as much as USD100 million per year to downtime related to information and communications technology. IBM Hardware Maintenance Services -- committed maintenance can deliver different types of hardware service for IBM equipment from the moment you call for support worldwide (based on the countries in which IBM has a presence) and around the clock. Through clear response targets and standardized service-delivery metrics, we can help you optimize your IT infrastructure and can help reduce the threat of hardware-related outages.

For more information, visit: [IBM Hardware Maintenance Services - committed maintenance Data Sheet \(D\) - USEN](#)

⁽¹⁾ Currently not available in the US

On-site Service

IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well-lit, and suitable for the purpose.

Customer Replaceable Unit (CRU) Service

If your problem can be resolved with a CRU (for example, keyboard, mouse, speaker, memory, or hard disk drive), and depending upon the maintenance service offerings in your geography, IBM will ship the replacement CRU to you for you to install. CRU information and replacement instructions are shipped with your machine and are available from IBM upon your request.

CRUs will be shipped based upon availability. IBM specifies, in the materials shipped with a replacement CRU, whether a defective CRU must be returned to IBM. When return is required, 1) return instructions and a container are shipped with the replacement CRU, and 2) you may be charged for the replacement CRU if IBM does not receive the defective CRU within 15 days of your receipt of the replacement.

CRUs are designated as being either a Tier 1 (mandatory) or a Tier 2 (optional) CRU.

Tier 1 (mandatory) CRUs: Installation of Tier 1 CRUs, as specified in this announcement, is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.

For machines with On-site Same-day Response Service, IBM will replace a Tier 1 CRU part at your request, at no additional charge.

The following parts have been designated as Tier 1 CRUs:

- DASD SFF Drive
- DASD SSD Drive
- NVMe U.2
- SAS Card
- Op Panel -- Base
- Op Panel -- LCD
- Memory DIMM
- All PCI Adapters
- FAN
- TPM Card
- Power Supplies
- Service Processor Card/FSP
- TOD Battery
- Air Baffles
- Bezel
- SAS Cable Front
- Heatsink
- Service Cover
- DASD Backplane Power Cable
- DASD Backplane Signal Cable

Tier 2 (optional) CRUs: You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge.

Feature codes or models for which there is a maintenance charge:

9223-22S

Additional reference for Europe

The following European documents can be found on the [IBM Maintenance and Technical Support Services](#) website.

- European Announcement Letter ZS03-0150 for IBM Customer Agreement (ICA)
- European Announcement Letter ZS04-0135 for Enterprise Agreement Contract
- European Announcement Letter ZS98-0118 for ServiceSuite Contract

Non-IBM parts service

Under certain conditions, IBM provides services for selected non-IBM parts at no additional charge for machines that are covered under warranty service upgrades or maintenance services.

This service includes hardware problem determination (PD) on the non-IBM parts (for example, adapter cards, PCMCIA cards, disk drives, memory) installed within IBM machines and provides the labor to replace the failing parts at no additional charge.

If IBM has a Technical Service Agreement with the manufacturer of the failing part, or if the failing part is an accommodations part (a part with an IBM FRU label), IBM may also source and replace the failing part at no additional charge. For all other non-IBM parts, customers are responsible for sourcing the parts. Installation labor is provided at no additional charge, if the machine is covered under a warranty service upgrade or a maintenance service.

Usage plan machine

No

IBM hourly service rate classification

Three

When a type of service involves the exchange of a machine part, the replacement may not be new, but will be in good working order.

Maintenance service offerings

This machine is eligible under terms and conditions of IBM ServiceElite, the IBM Enterprise Service Agreement (ESA), or the IBM Maintenance Agreement. Consult your IBM representative for details.

General terms and conditions

Field-installable features

Yes

Model conversions

No

Machine installation

Client setup. Clients are responsible for installation according to the instructions IBM provides with the machine.

Graduated program license charges apply

Yes

The applicable processor group is: Small

Licensed Machine Code

IBM Machine Code is licensed for use by a customer on the IBM machine for which it was provided by IBM under the terms and conditions of the IBM License Agreement for Machine Code, to enable the machine to function in accordance with its specifications, and only for the capacity authorized by IBM and acquired by the customer. You can obtain the agreement by contacting your IBM representative. It can also be found on the [License Agreement for Machine Code and Licensed Internal Code](#) website.

Machine using LMC Type Model 9223-22S

Access to Machine Code updates is conditioned on entitlement and license validation in accordance with IBM policy and practice. IBM may verify entitlement through customer number, serial number, electronic restrictions, or any other means or methods employed by IBM in its discretion.

If the machine does not function as warranted and your problem can be resolved through your application of downloadable Machine Code, you are responsible for downloading and installing these designated Machine Code changes as IBM specifies.

If you would prefer, you may request IBM to install downloadable Machine Code changes; however, you may be charged for that service.

Prices

For all local charges, contact your IBM representative.

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Financing solutions from IBM Global Financing can help you stretch your budget and affordably acquire the new product. But beyond the initial acquisition, our end-to-end approach to IT management can also help keep your technologies current, reduce costs, minimize risk, and preserve your ability to make flexible equipment decisions throughout the entire technology lifecycle.

Announcement countries

All European, Middle Eastern, and African countries, except Islamic Republic of Iran, Sudan, and Syrian Arab Republic.

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