

Lenovo System x3500 M5

Lenovo Press Product Guide

The Lenovo System x3500 M5 server provides outstanding performance for your business-critical applications. Its energy-efficient design supports more cores, memory, and data capacity in a scalable Tower or 5U Rack package that is easy to service and manage. With more computing power per watt and the latest Intel Xeon E5-2600 v3 processors, you can reduce costs while maintaining speed and availability.

Suggested use: business-critical workloads, cloud computing, virtualization, virtual desktop, big data, analytics, SAP applications, database management, point of sale

Figure 1 shows the System x3500 M5.



Figure 1. The Lenovo System x3500 M5

Did you know?

The x3500 M5 offers a flexible, scalable design and simple upgrade path to 32 HDDs, with up to seven PCIe 3.0 slots and up to 1.5 TB of memory. The onboard Ethernet solution provides four standard integrated Gigabit Ethernet ports without occupying PCIe slots. Comprehensive systems management tools with the next-generation Integrated Management Module II make it easy to deploy, integrate, service, and manage.

Key features

A high-performance dual-socket tower server, the Lenovo System x3500 M5 can deliver the scalability, reliable performance, and optimized efficiency for your business-critical applications. Start with the basics and upgrade as your business changes without jeopardizing existing investments. Virtualizing the PC infrastructure into one server can provide access to a powerful server with abundant storage space, while significantly reducing IT costs.

Scalability and performance

The x3500 M5 offers the following features to boost performance, improve scalability, and reduce costs:

- Improves productivity by offering superior system performance with up to two processors (each with up to 18 cores), up to 45 MB of L3 cache, and up to 9.6 GT/s QPI interconnect links.
- Supports up to two processors, 36 cores, and 72 threads maximize the concurrent execution of multi-threaded applications.
- Intelligent and adaptive system performance with energy efficient Intel Turbo Boost Technology allows CPU cores to run at maximum speeds during peak workloads by temporarily going beyond processor thermal design power (TDP).
- Intel Hyper-Threading Technology boosts performance for multithreaded applications by enabling simultaneous multithreading within each processor core, up to two threads per core.
- Intel Virtualization Technology integrates hardware-level virtualization hooks that allow operating system vendors to better use the hardware for virtualization workloads.
- Intel Advanced Vector Extensions 2.0 (AVX 2.0) enable acceleration of enterprise-class workloads, including databases, and enterprise resource planning.
- Up to 2133 MHz memory speeds with two DIMMs per channel that are running at 2133 MHz to help maximize system performance.
- Up to 1.5 TB of memory capacity with 64 GB load-reduced DIMMs, or LRDIMMs (support for 64 GB LRDIMMs is planned for a later date).
- The 12 Gbps SAS internal storage connectivity doubles the data transfer rate compared to 6 Gb SAS solutions to maximize performance of storage I/O-intensive applications.
- Up to 32 drive bays with internal backup and optical drive at the same time provide a flexible and scalable all-in-one platform to meet increasing demands.
- Flexible and scalable internal storage configurations provide for up to 72 TB of storage capacity.
- The use of solid-state drives (SSDs) instead of or along with traditional spinning hard disk drives (HDDs) can significantly improve I/O performance. An SSD can support up to 100 times more I/O operations per second (IOPS) than a typical HDD.
- The server has four integrated Gigabit Ethernet ports.
- The server offers up to seven PCI Express (PCIe) 3.0 I/O expansion slots.
- With Intel Integrated I/O Technology, the PCI Express 3.0 controller is integrated into the Intel Xeon processor E5 family. This integration helps to dramatically reduce I/O latency and increase overall system performance.
- Support for up to two NVIDIA Quadro graphics processing units (GPUs) to maximize computing power.

Availability and serviceability

The x3500 M5 provides the following features to simplify serviceability and increase system uptime:

- The server offers Chipkill, memory mirroring, and memory rank sparing for redundancy in the event of a non-correctable memory failure.
- Tool-less cover removal provides easy access to upgrades and serviceable parts, such as CPU, memory, and adapter cards.
- Offers hot-swap drives that support RAID redundancy for data protection and greater system uptime.
- Supports the ability to have redundant hot-swap power supplies and redundant hot-swap fans to provide availability for business-critical applications.
- The optional light path diagnostics panel and individual light path LEDs quickly lead the technician to failed (or failing) components. This feature simplifies servicing, speeds up problem resolution, and helps improve system availability.
- Predictive Failure Analysis (PFA) detects when system components (processors, VRMs, memory, disks, fans, and power supplies) operate outside of standard thresholds and generates proactive alerts in advance of possible failure, which increases uptime.
- SSDs offer significantly better reliability than traditional mechanical HDDs for greater uptime.
- Built-in Integrated Management Module II (IMM2.1) continuously monitors system parameters, triggers alerts, and performs recovery actions if there is a failure to minimize downtime.
- Built-in diagnostics by using Dynamic Systems Analysis (DSA) Preboot speeds up troubleshooting tasks to reduce service time.
- Three-year customer replaceable unit and onsite limited warranty; next business day 9x5. Optional service upgrades available.

Manageability and security

The following powerful systems management features simplify local and remote management of the x3500 M5:

- The server includes an IMM2.1 to monitor server availability and perform remote management.
- Integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates and simplifies error handling.
- Two integrated Trusted Platform Modules (TPMs) enable advanced cryptographic functionality, such as digital signatures and remote attestation.
- System x Trusted Platform Assurance, an exclusive set of System x security features and practices, establishes a foolproof security foundation for workloads by delivering firmware that is securely built, tested, digitally signed, and verified before running.
- The server offers enterprise-class data protection with optional self-encrypting drives and simple, centralized key management through IBM Security Key Lifecycle Management.
- Industry-standard AES NI support offers faster, stronger encryption.
- IBM Systems Director offers comprehensive systems management tools that help to increase uptime, reduce costs, and improve productivity through advanced server management capabilities.
- Intel Execute Disable Bit functionality can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.

- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, which allows an application to run in its own isolated space that is protected from all other software running on a system.

Energy efficiency

The x3500 M5 offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to the green environment:

- Energy-efficient planar components help lower operational costs.
- High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed to reduce power draw.
- The Intel Xeon processor E5-2600 v3 product families offer significantly better performance over the previous generation while fitting into the same thermal design power (TDP) limits.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed to reduce power draw.
- Low-voltage Intel Xeon processors draw less energy to satisfy demands of power and thermally constrained data centers and telecommunication environments.
- Low-voltage 1.2 V DDR4 memory DIMMs use up to 20% less energy compared to 1.35 V DDR3 DIMMs.
- SSDs use as much as 80% less power than traditional spinning 2.5-inch HDDs.
- The server uses hexagonal ventilation holes, which is a part of IBM Calibrated Vectors Cooling™ technology. Hexagonal holes can be grouped more densely than round holes, which provides more efficient airflow through the system.
- IBM Systems Director Active Energy Manager™ provides advanced data center power notification and management to help achieve lower heat output and reduced cooling needs.

Locations of key components and connectors

The following figure shows the front of the server.

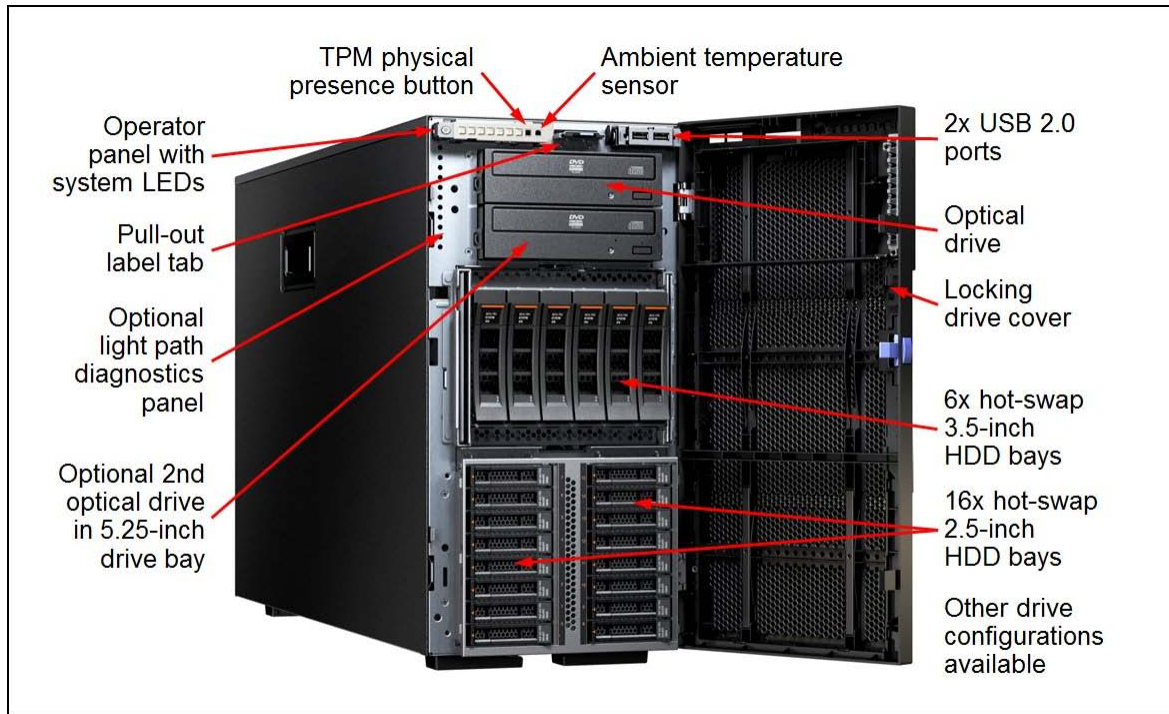


Figure 2. Front view of the System x3500 M5

The following figure shows the rear of the server.

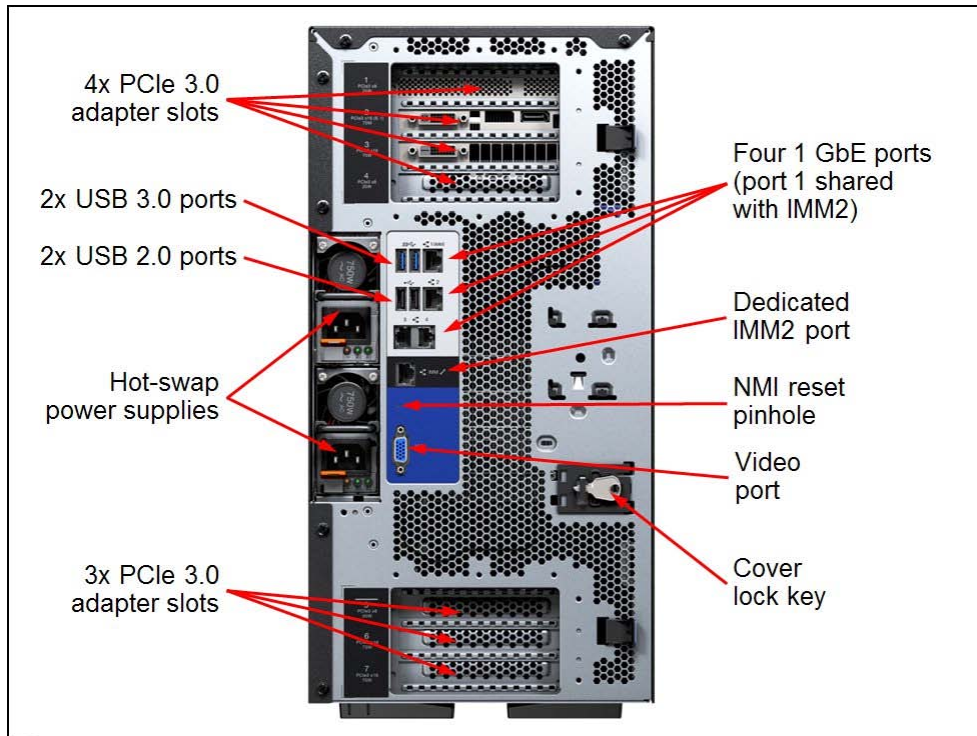


Figure 3. Rear view of the System x3500 M5

The following figure shows the locations of key components inside the server.

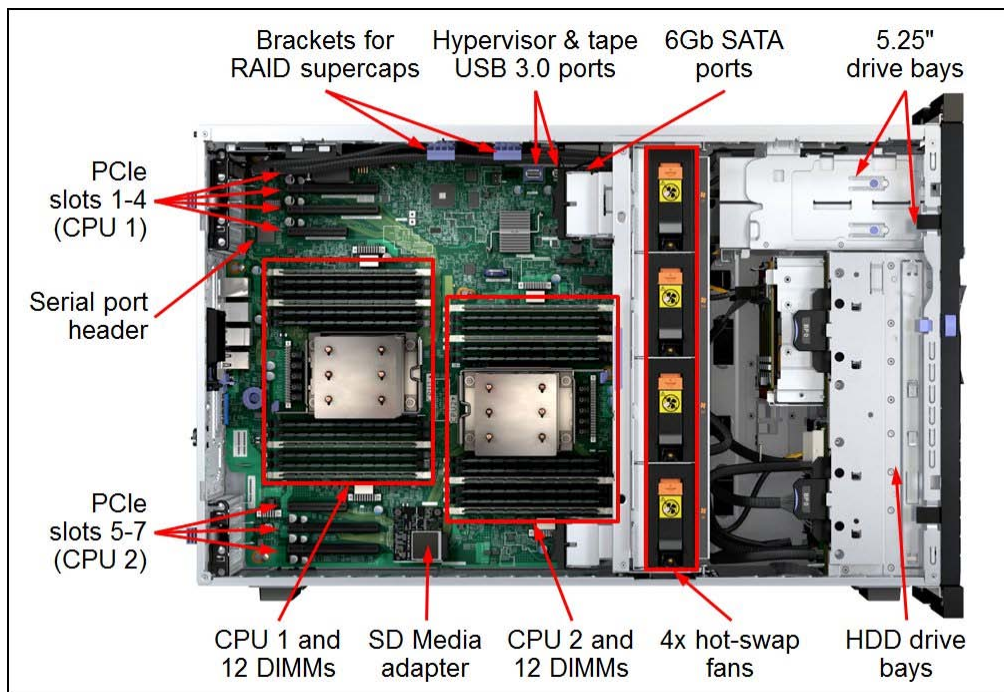


Figure 4. Inside view of the System x3500 M5

Standard specifications

The following table lists the standard specifications.

Table 1. Standard specifications (part 1)

Components	Specification
Form factor	Tower or 5U Rack.
Processor	Up to two Intel Xeon processor E5-2600 v3 product family CPUs with 18 cores (2.8 GHz core speeds); or 14 cores (2.6 GHz), 12 cores (up to 2.6 GHz), 10 cores (2.3 GHz), 8 cores (up to 2.6 GHz), 6 cores (up to 2.4 GHz). Two QPI links up to 9.6 GT/s each. Up to 2133 MHz memory speed. Up to 45 MB L3 cache.
Chipset	Intel C612.
Memory	Up to 24 DIMM sockets (12 DIMMs per processor). RDIMMs and LRDIMMs are supported. Memory types cannot be intermixed. Memory speed up to 2133 MHz.
Memory maximums	With RDIMMs: Up to 384 GB with 24x 16 GB RDIMMs and two processors With LRDIMMs: Up to 1.5 TB with 24x 64 GB LRDIMMs and two processors
Memory protection	ECC, Chipkill (for x4-based memory DIMMs), memory mirroring, and memory rank sparing
Disk drive bays	<ul style="list-style-type: none"> Up to 32x 2.5-inch hot-swap SAS/SATA HDDs Up to 12x 3.5-inch hot-swap SAS/SATA HDDs or SSDs Up to 6x 3.5-inch simple-swap SATA HDDs Two 5.25-inch drive bays for optical drives
Maximum internal storage	<ul style="list-style-type: none"> 72 TB with 12x 6TB 3.5-inch NL SAS or NL SATA hot-swap HDDs 51.2 TB with 32x 1.6TB 2.5-inch SAS hot-swap SSDs 38.4 TB with 32x 1.2TB 2.5-inch SAS hot-swap HDDs 36 TB with 6x 6TB 3.5-inch NL SAS or NL SATA simple-swap HDDs Intermix of SAS and SATA is supported.
Storage controller	<ul style="list-style-type: none"> Onboard 6 Gb SATA: no RAID support 12 Gb SAS/SATA RAID: RAID 0, 1, 10 with M1215 or M5210. Optional upgrade to RAID 5, 50 is available for M1215. Optional upgrade to RAID 5, 50 is available for M5210 (zero-cache; 1 GB non-backed cache; 1 GB, 2 GB or 4 GB flash-backed cache). Optional upgrade to RAID 6, 60 is available for M5210 with memory cache upgrades. 12 Gb SAS/SATA non-RAID: N2215 HBA
Optical drive bays	Two half-height 5.25-inch bays for optical or tape drives. Supports DVD-ROM or Multiburner.
Tape drive bays	Two half-height 5.25-inch bays for optical or tape drives. Support for one RDX internal USB tape drive.
Network interfaces	Four integrated Gigabit Ethernet 1000BASE-T ports (RJ-45) based on Broadcom BCM5719 controller

Table 1. Standard specifications (part 2)

Components	Specification
PCI Expansion slots	<p>Up to eight slots with two processors and five slots when one CPU is installed. All slots are PCIe 3.0 slots:</p> <ul style="list-style-type: none"> Slot 1: PCIe 3.0 x8 (x8 wired); full-height, half-length Slot 2: PCIe 3.0 x16 (x8 wired); full-height, full-length Slot 3: PCIe 3.0 x16 (x16 wired); full-height, full-length Slot 4: PCIe 3.0 x8 (x8 wired); full-height, full-length Slot 5: PCIe 3.0 x8 (x8 wired); full-height, half-length (requires second processor) Slot 6: PCIe 3.0 x16 (x16 wired); full-height, full-length (requires second processor) Slot 7: PCIe 3.0 x16 (x16 wired) full-height, full-length (requires second processor) <p>Slots 3 and 6 support double-wide GPUs</p>
Ports	<ul style="list-style-type: none"> Front: Two USB 2.0 ports Rear: Four USB ports (two USB 2.0, two USB 3.0), one DB-15 video, one RJ-45 systems management, four RJ-45 GbE network ports, optional serial port. Internal: Two internal USB 3.0 ports (for embedded hypervisor and internal tape drive). Optional SD Media Adapter.
Cooling	Calibrated Vectored Cooling with up to four hot-swap fans (two fans shipped standard on single processor models and four fans shipped on dual processor models). For single-processor models, optional Redundant Cooling Kit provides two extra fans for N+1 redundancy.
Power supply	Up to two redundant hot-swap 550 W, 750 W or 900 W High Efficiency Platinum AC power supplies, or 750 W High Efficiency Titanium AC power supplies.
Hot-swap parts	Hard drives, power supplies, and fans
Systems management	UEFI, IMM2.1 that is based on Renesas SH7758, Predictive Failure Analysis, light path diagnostics panel on the front of the server with optional upgrade kit, Automatic Server Restart, ToolsCenter, Systems Director and Active Energy Manager. Optional IMM Advanced Upgrade software feature for remote presence.
Security features	Power-on password, administrator's password, two TPMs: On the IMM2.1 (TPM 1.2) and on the host (TPM 1.2/2.0). Lockable front bezel.
Video	Matrox G200eR2 with 16 MB memory integrated into the IMM2.1. Maximum resolution is 1600x1200 at 75 Hz with 16 M colors.
Operating systems supported	Microsoft Windows Server 2012 R2, 2012 and 2008 R2, Red Hat Enterprise Linux 6 and 7, SUSE Linux Enterprise Server 11, VMware vSphere (ESXi) 5.1 and 5.5.
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty with 9x5/NBD.
Service and support	Optional service upgrades are available through Lenovo: 4-hour or 2-hour response time, 8-hour fix time, 1-year or 2-year warranty extension, remote technical support for Lenovo hardware and selected Lenovo and third-party (Microsoft, Linux, VMware) software.
Dimensions	Tower: Width: 218 mm (8.6 in), depth: 720 mm (28.3 in), height: 440 mm (17.25 in). With rack conversion kit: Width: 423 mm (16.6 in), depth: 706 mm (27.8 in), height: 218 mm (8.6 in)
Weight	Tower: 45.5 kg (100.3 lb) fully configured, 30.8 kg (67.9 lb) minimum configuration With rack conversion kit: 44.2 kg (97.4 lb) fully configured, 29.5 kg (65 lb) minimum configuration

The x3500 M5 servers are shipped with the following items:

- Statement of Limited Warranty
- Important Notices
- Registration flyer
- Documentation CD that contains the *Installation and User's Guide*
- One 2.8 m C13 line cord (country-specific)

Notes:

- Rack models include a rail kit but do not include a cable management arm. Order the CMA separately by using part number 00KC334.
- EMEA models do not contain line cord. It must be purchased separately.

Standard models

The following table lists the standard models.

Table 2. Standard models

MTM*	Intel Xeon processors† (two maximum)	Memory	RAID	Drive bays (std / max)	Drives	Slots (std / max)	GbE	Optical	Power supply (std / max)
Tower models									
5464-A2x	1x E5-2603 v3 6C 1.6GHz 15MB 1600MHz 85W	1x 8 GB	M1215	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-B2x	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M1215	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-C2x	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 16 GB	M1215	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-C4x	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 16 GB	M1215	6x 3.5-inch HS / 12	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-D2x	1x E5-2630 v3 8C 2.4GHz 20MB 1866MHz 85W	1x 16 GB	M1215	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-G2x	1x E5-2650 v3 10C 2.3GHz 25MB 2133MHz 105W	1x 16 GB	M5210 1GB Flash	8x 2.-inch HS / 32	Open	4 / 7	4	DVD	1x 750 W HS / 2
5464-H2x	1x E5-2670 v3 12C 2.3GHz 30MB 2133MHz 120W	1x 16 GB	M5210 2GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 900 W HS / 2
5464-J2x	1x E5-2680 v3 12C 2.5GHz 30MB 2133MHz 120W	1x 16 GB	M5210 2GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 900 W HS / 2
Rack models									
5464-C3x	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 16 GB	M1215	6x 3.5-inch HS / 12	Open	4 / 7	4	DVD	1x 550 W HS / 2
5464-G3x	1x E5-2650 v3 10C 2.3GHz 25MB 2133MHz 105W	1x 16 GB	M5210 1GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	4	DVD	1x 750 W HS / 2

* x in the Machine Type Model (MTM) represents a country-specific letter (for example, the EMEA MTM is 7983-A5G, and the US MTM is 7383-A5U). Ask a Lenovo representative for specific information.

† Processor detail: Processor quantity and model, cores, core speed, L3 cache, memory speed, TDP.

Refer to the Specifications section for information about standard features of the server.

Express models

The following table lists the express models.

Table 3. Express models (Part 1)

MTM** Form factor	Intel Xeon processors† (two maximum)	Memory	RAID	Drive bays (std / max)	Drives	Slots (std / max)	Optical	Power supply (2 max)
United States and Canada								
5464-EAU Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M1215	6x 3.5-inch HS / 12	Open	4 / 7	Multi- burner	1x 550W
5464-EBU Tower	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 16 GB	M5120	6x 3.5-inch HS / 12	Open	4 / 7	Multi- burner	1x 750W
5464-ECU Tower	1x E5-2640 v3 8C 2.6GHz 20MB 1866MHz 90W	1x 16 GB	M5120	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	1x 750W
5464-EDU Tower	2x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	2x 16 GB	M5120 2GB Flash	6x 3.5-inch HS / 12	Open	4 / 7	Multi- burner	2x 550W
5464-EEU Tower	2x E5-2640 v3 8C 2.6GHz 20MB 1866MHz 90W	2x 16 GB	M5120 2GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	2x 750W
Europe, Middle East & Africa (EMEA)								
5464-E1G Tower	1x E5-2603 v3 6C 1.6GHz 15MB 1600MHz 85W		M1215 + RAID 5/50	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	1x 550W
5464-E2G Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M1215 + RAID 5/50	6x 3.5-inch HS / 12	Open	4 / 7	Multi- burner	1x 550W
5464-E3G Tower	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 8 GB	M5120 1GB No backup	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	2x 550W
5464-E4G Tower	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 8 GB	M5120 1GB Flash	8x 2.5-inch HS / 32	3x 300GB 10K SAS	4 / 7	Multi- burner	2x 750W
5464-E5G Tower	1x E5-2640 v3 8C 2.6GHz 20MB 1866MHz 90W	1x 16 GB	M5120 2GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	2x 750W
Latin America & Brazil								
5464-EFx Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M5120 1GB Flash+Cap	8x 2.5-inch HS / 32	Open	4 / 7	DVD	1x 550W
5464-EGx Tower	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	1x 16 GB	M5120 1GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	DVD	1x 550W
5464-EHx Tower	1x E5-2650 v3 10C 2.3GHz 25MB 2133MHz 105W	1x 16 GB	M5120 1GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	DVD	1x 750W
Japan								
5464-E6J Tower	1x E5-2603 v3 6C 1.6GHz 15MB 1600MHz 85W	1x 8 GB	M5120 1GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	DVD	1x 550W
5464-E7J Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M5120 1GB Flash	8x 2.5-inch HS / 32	Open	4 / 7	DVD	1x 550W

Table 3. Express models (Part 2)

MTM** Form factor	Intel Xeon processors† (two maximum)	Memory	RAID	Drive bays (std / max)	Drives	Slots (std / max)	Optical	Power supply (2 max)
Australia & New Zealand								
5464-EIM Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M1215 + RAID 5/50	6x 3.5-inch HS / 12	Open	4 / 7	Multi- burner	1x 550W
5464-EJM Tower	1x E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	1x 8 GB	M1215 + RAID 5/50	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	1x 550W
5464-EKM Tower	1x E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	2x 8 GB	M5120 1GB Flash+Cap	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	1x 550W
5464-ELM Tower	1x E5-2640 v3 8C 2.6GHz 20MB 1866MHz 90W	2x 8 GB	M5120 1GB Flash+Cap	8x 2.5-inch HS / 32	Open	4 / 7	Multi- burner	1x 750W

** MTM = Machine Type Model

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, TDP.

Processor options

The x3500 M5 supports the processor options that are listed in the following table. The server supports up to two processors. This table shows which server models feature each processor as standard. If there is no corresponding *where-used* model for a particular processor, this processor is available through CTO only.

Table 4. Processor options

Part number	Feature codes*	Description	Standard models where used
81Y7113	A5C8 / A5MP	Intel Xeon E5-2603 v3 6C 1.6GHz 15MB 1600MHz 85W	A2x
81Y7114	A5C9 / A5MQ	Intel Xeon E5-2609 v3 6C 1.9GHz 15MB 1600MHz 85W	B2x
81Y7115	A5CA / A5MR	Intel Xeon E5-2620 v3 6C 2.4GHz 15MB 1866MHz 85W	C2x, C3x, C4x
81Y7116	A5CB / A5MS	Intel Xeon E5-2630 v3 8C 2.4GHz 20MB 1866MHz 85W	D2x
00KG052	ARZK / ARZL	Intel Xeon E5-2630L v3 8C 1.8GHz 20MB 1866MHz 55W	-
81Y7117	A5CC / A5MT	Intel Xeon E5-2640 v3 8C 2.6GHz 20MB 1866MHz 90W	-
81Y7118	A5CD / A5MU	Intel Xeon E5-2650 v3 10C 2.3GHz 25MB 2133MHz 105W	G2x, G3x
81Y7119	A5CE / A5MV	Intel Xeon E5-2670 v3 12C 2.3GHz 30MB 2133MHz 120W	H2x
81Y7120	A5CF / A5MW	Intel Xeon E5-2680 v3 12C 2.5GHz 30MB 2133MHz 120W	J2x
00KG038	ARYU / ARYX	Intel Xeon E5-2690 v3 12C 2.6GHz 30MB 2133MHz 135W	-
00KG039	ARYV / ARYY	Intel Xeon E5-2697 v3 14C 2.6GHz 35MB 2133MHz 145W	-
00KG040	ARYW / ARYZ	Intel Xeon E5-2699 v3 18C 2.8GHz 45MB 2133MHz 145W	-

* The first feature code is for the first processor; the second feature code is for the second processor.

Memory options

The System x3500 M5 supports TruDDR4 memory. TruDDR Memory uses the highest quality components that are sourced from Tier 1 DRAM suppliers and only memory that meets our strict requirements is selected. It is compatibility tested and tuned on every System x server to maximize performance and reliability. TruDDR4 Memory has a unique signature programmed into the DIMM that enables System x servers to verify whether the installed memory is qualified or supported. Because TruDDR4 Memory is authenticated, certain extended memory performance features can be enabled to extend performance over industry standards. From a service and support standpoint, System x memory automatically assumes the system's warranty, and service and support provided worldwide.

The following table lists the available memory options for the x3500 M5 server.

Table 5. Memory options

Part number	Feature code	Description	Maximum supported	Standard models where used
RDIMMs - 2133 MHz				
46W0784	A5B6	4GB TruDDR4 Memory (1Rx8, 1.2V) PC4-17000 CL15 2133MHz LP RDIMM	24 (12 per CPU)	-
46W0788	A5B5	8GB TruDDR4 Memory (1Rx4, 1.2V) PC4-17000 CL15 2133MHz LP RDIMM	24 (12 per CPU)	A2x, B2x
46W0792	A5B8	8GB TruDDR4 Memory (2Rx8, 1.2V) PC4-17000 CL15 2133MHz LP RDIMM	24 (12 per CPU)	
46W0796	A5B7	16GB TruDDR4 Memory (2Rx4, 1.2V) PC4-17000 CL15 2133MHz LP RDIMM	24 (12 per CPU)	All other models
LRDIMMs - 2133 MHz				
46W0800	A5B9	32GB TruDDR4 Memory (4Rx4, 1.2V) PC417000 CL15 2133MHz LP LRDIMM	24 (12 per CPU)	-
95Y4812*	A5UK	64GB TruDDR4 Memory (4Rx4, 1.2V) PC4-17000 CL15 2133MHz LP LRDIMM	24 (12 per CPU)	-

* Support for 64 GB LRDIMMs is planned for a later date.

The server supports up to 12 DIMMs when one processor is installed and up to 24 DIMMs when two processors are installed. Each processor has four memory channels; there are three DIMMs per channel.

The following rules apply when the memory configuration is selected:

- The server supports RDIMMs and LRDIMMs.
- Mixing types of memory (RDIMMs and LRDIMMs) is not supported.
- The maximum quantity of DIMMs that can be installed in the server depends on the number of processors.
- All DIMMs in the server operate at the same speed, which is determined as the lowest value of the following factors:
 - Memory speed that is supported by the specific processor.
 - Lowest of maximum operating speeds for selected memory configuration that depends on quantity of DIMMs per channel, as shown under "Maximum operating speed" section in the following table.

The following memory protection technologies are supported:

- ECC
- Chipkill (for x4-based memory DIMMs)
- Memory mirroring
- Memory rank sparing

Chipkill works only in independent channel mode (the default is operational mode) and supports only x4-based memory DIMMs.

If memory mirroring is used, DIMMs must be installed in pairs (a minimum of one pair per each processor). Both DIMMs in a pair must be identical in type and size.

If memory rank sparing is used, a minimum of one quad-rank LRDIMM or two single-rank or dual-rank RDIMMs must be installed per populated channel (the DIMMs do not need to be identical). In rank sparing mode, one rank of a DIMM in each populated channel is reserved as spare memory. The size of a rank varies, depending on the DIMMs installed.

Chipkill, memory mirroring, and memory rank sparing modes are mutually exclusive. Only one operational memory mode can be enabled on a server, and it is a system-wide setting.

The following table shows the characteristics of the supported DIMMs. Tables cells that are highlighted with a gray background indicate when the number of DIMMs per channel still allows the DIMMs to operate at a rated speed.

Table 6. Maximum memory speeds

DIMM specification	RDIMM			LRDIMM
	Single rank	Dual rank		Quad rank
Part numbers	46W0784 (4 GB) 46W0788 (8 GB)	46W0792 (8 GB)	46W0796 (16 GB)	46W0800 (32 GB) 95Y4812 (64 GB)*
Rated speed	2133 MHz	2133 MHz	2133 MHz	2133 MHz
Rated voltage	1.2 V	1.2 V	1.2 V	1.2 V
Maximum quantity supported**	24	24	24	24
Maximum DIMM capacity	8 GB	8 GB	16 GB	64 GB
Maximum memory capacity	192 GB	192 GB	384 GB	1.5 TB
Maximum memory at rated speed	64 GB	64 GB	256 GB	512 GB
Maximum operating speed				
1 DIMM per channel	2133 MHz	2133 MHz	2133 MHz	2133 MHz
2 DIMMs per channel	2133 MHz	2133 MHz	2133 MHz	2133 MHz
3 DIMMs per channel	1600 MHz	1600 MHz	1600 MHz	1866 MHz

* Support for 64 GB LRDIMMs is planned for a later date.

** The maximum quantity that is supported is shown for two processors installed.

Internal storage

The internal drive bays of the x3500 M5 are shown in the following figure.

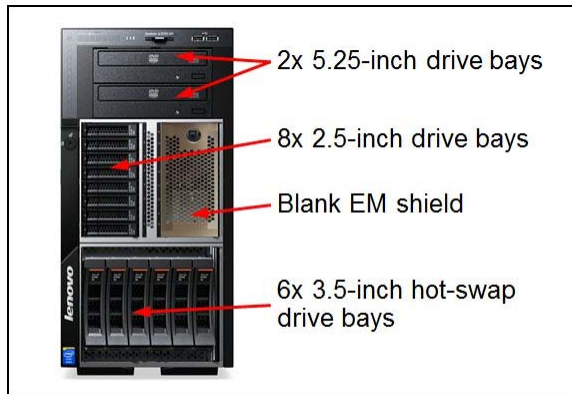


Figure 5. Internal drive bays

The System x3500 M5 server supports the following internal storage configurations:

- Configurations with 2.5-inch hot-swap drives:
 - 8x 2.5-inch hot-swap drives (1 RAID adapter)
 - 16x 2.5-inch hot-swap drives (1 RAID adapter)
 - 16x 2.5-inch hot-swap drives (2 RAID adapters)
 - 24x 2.5-inch hot-swap drives (1 RAID adapter)
 - 24x 2.5-inch hot-swap drives (2 RAID adapters)
 - 32x 2.5-inch hot-swap drives (1 RAID adapter)
 - 32x 2.5-inch hot-swap drives (2 RAID adapters)
- Configurations with 3.5-inch hot-swap drives:
 - 6x 3.5-inch hot-swap hard disk drives (1 RAID adapter)
 - 12x 3.5-inch hot-swap hard disk drives (2 RAID adapters)
- Configurations with 2.5-inch and 3.5-inch hot-swap drives: 6x 3.5-inch hot-swap hard disk drives + 16x 2.5-inch hot-swap drives (2 RAID adapters)
- Configurations with 3.5-inch simple-swap drives:
 - 6x 3.5-inch simple-swap hard disk drives (6 Gb SATA onboard connectors)
 - 6x 3.5-inch simple-swap hard disk drives (1 adapter)

Note: A configuration of 12 simple-swap drives is not supported.

The following drive type mixing rules apply:

- Hot-swap SATA HDDs and hot-swap SAS HDDs can be intermixed on the same backplane, but cannot be intermixed in the same RAID array.
- Hot-swap SATA HDDs and hot-swap SAS HDDs can be intermixed with SSDs on the same backplane, but SAS nor SATA HDDs can be configured with SSDs within the same RAID array.

Backplanes

The following table lists the available backplanes for the x3500 M5. Standard models ship with one 8x 2.5-inch hot-swap backplane or one 6x 3.5-inch hot-swap backplane, as listed.

Table 7. Internal storage backplane (configure to order)

Feature code	Name	Models where used	Maximum supported
A5D4	System x3500 M5 2.5-inch Hot Swap SAS: <ul style="list-style-type: none"> 8x 2.5-inch hot-swap drives Connect to 1 adapter (2 ports) or 2 adapters (1 port each) Supported by M5210, M1215, or N2215 	All other standard models	2
A5N5	System x3500 M5 2.5-inch Hot Swap SAS 8-16: <ul style="list-style-type: none"> 8x 2.5-inch hot-swap drives Includes a SAS expander Connects to backplane A5D4 to support up to 16 drives per port Supported by M5210, M1215, or N2215 	-	2
A5D5	System x3500 M5 3.5-inch Hot Swap SAS: <ul style="list-style-type: none"> 6x 3.5-inch hot-swap drives Supported by M5210, M1215, or N2215 	C3x, C4x	2
A5UM	System x3500 M5 3.5-inch Simple Swap: <ul style="list-style-type: none"> 6x 3.5-inch simple-swap drives Connections to onboard SATA ports 	-	1
A5D2	System x3500 M5 3.5-inch Simple Swap: <ul style="list-style-type: none"> 6x 3.5-inch simple-swap drives Connections to RAID controller 	-	1

The following table list the available hot-swap drive bay upgrades.

Table 8. Drive bay upgrade options

Option part number	Name
00AL540	8x 2.5-inch Hot-Swap SAS/SATA Upgrade Kit for 16 or 24 HDDs: <ul style="list-style-type: none"> ● For existing configurations with 8x or 16x 2.5-inch bays ● Adds 8x 2.5-inch hot-swap drives ● Backplane Includes a SAS expander ● Same backplane as feature A5N5
00AL541	8x 2.5-inch Hot-Swap SAS/SATA Upgrade Kit for 32 HDDs: <ul style="list-style-type: none"> ● For existing configurations with 24x 2.5-inch bays ● Adds 8x 2.5-inch hot-swap drives ● Same backplane as feature A5D4
00AL542	6x 3.5-inch Hot-Swap SAS/SATA Upgrade Kit for 12 HDDs: <ul style="list-style-type: none"> ● For existing configurations with 6x 3.5-inch drives ● Adds 6x 3.5-inch hot-swap drives ● Same backplane as feature A5D5
00AL543	6x 3.5-inch Hot-Swap SAS/SATA Upgrade Kit for 22 HDDs (Intermix): <ul style="list-style-type: none"> ● For existing configurations with 16x 2.5-inch drives ● Adds 6x 3.5-inch hot-swap drives ● Same backplane as feature A5D5
00AL544	8x 2.5-inch Hot-Swap SAS/SATA Upgrade Kit for 14 HDDs (Intermix): <ul style="list-style-type: none"> ● For existing configurations with 6x 3.5-inch drives ● Adds 8x 2.5-inch hot-swap drives ● Same backplane as feature A5D4
00KG037	8x 2.5-inch Hot-Swap SAS/SATA Upgrade Kit for 22 HDDs (Intermix): <ul style="list-style-type: none"> ● For existing configurations with 6x 3.5-inch and 8x 2.5-inch drives ● Adds 8x 2.5-inch hot-swap drives ● Same backplane as feature A5N5
00AL539	SAS cable option for Dual RAID array (RAID adapter not included): <ul style="list-style-type: none"> ● For configurations with two RAID cards ● Only needed when upgrading from 8x 2.5-inch drives to 16, 24 or 32 drives, as shown in Figure 7. ● Connects second adapter to backplane

Drive bay configurations

The following figure shows how models with eight 2.5-inch drive bays can be upgraded to a total of 32 drive bays. In such configurations, all drives are connected to one RAID controller. Supported adapters are the ServeRAID M5210, ServeRAID M1215, and N2215 host bus adapter.

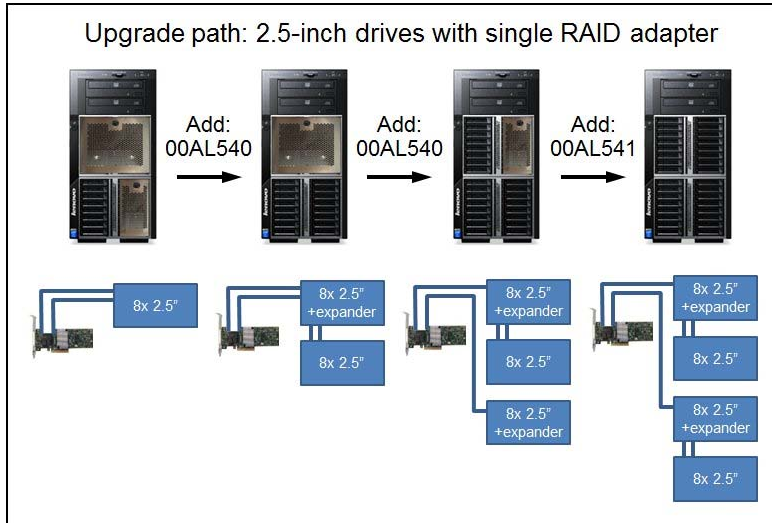


Figure 6. Configurations of 2.5-inch drives with one RAID adapter

The following figure shows how models with eight 2.5-inch drive bays can be upgraded to a total of 32 drive bays that use two RAID controller for added performance. Supported adapters are the ServeRAID M5210, ServeRAID M1215, and N2215 host bus adapter.

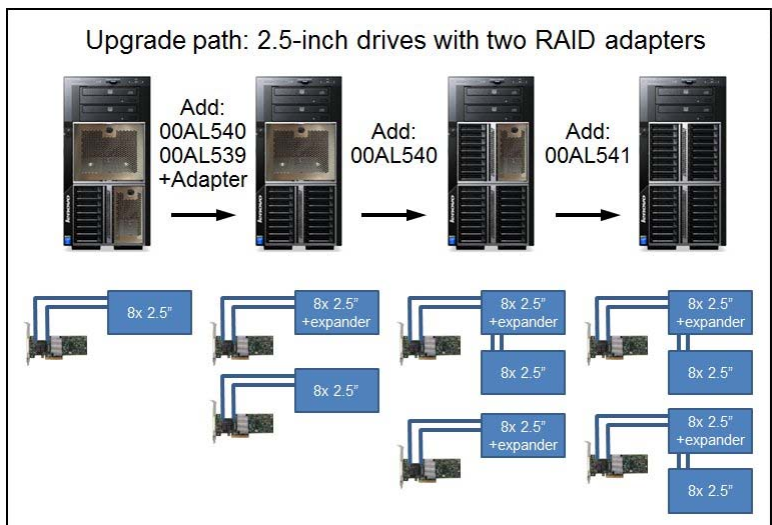


Figure 7. Configurations of 2.5-inch drives with two RAID adapters

The following figure shows how models with six 3.5-inch hot-swap drive bays can be upgraded to 12 drive bays. Such a configuration requires two RAID controllers. Supported adapters are the ServeRAID M5210, ServeRAID M1215, and N2215 host bus adapter.

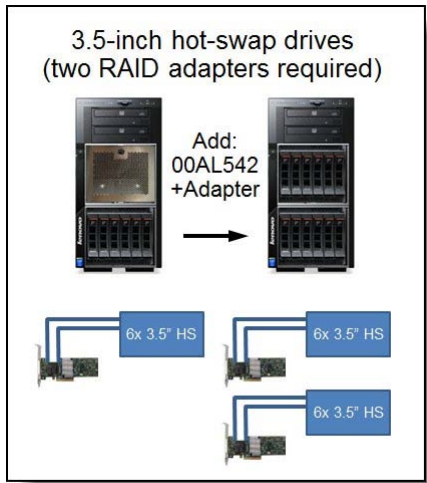


Figure 8. Configurations of 3.5-inch drives

For configure-to-order configurations, the server also supports simple-swap 3.5-inch drives. The simple-swap drives can be connected to the 6 Gb SATA ports on the system board of the server or to a RAID controller. Only six 3.5-inch drives are supported; a configuration of 12 simple-swap drives is not supported.

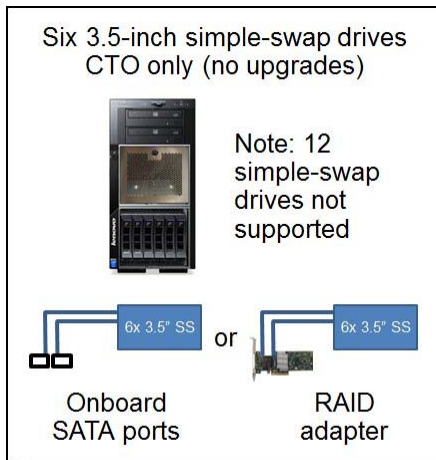


Figure 9. Simple-swap 3.5-inch drives

The server also supports combinations of 2.5-inch drive bays (up to 16) and 3.5-inch drive bays (6 bays). The upgrade path from models with 2.5-inch drives is shown in the following figure. The 3.5-inch drives must be connected to a separate RAID adapter.

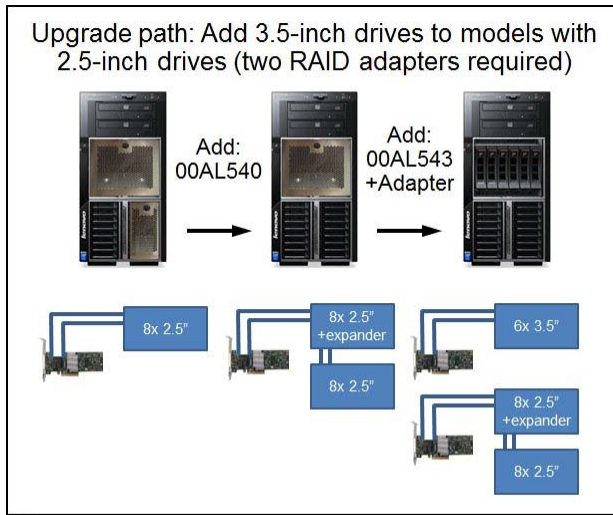


Figure 10. Combinations of 2.5-inch and 3.5-inch drive bays from a 2.5-inch base

The following figure shows the upgrade path from models with 3.5-inch drives.

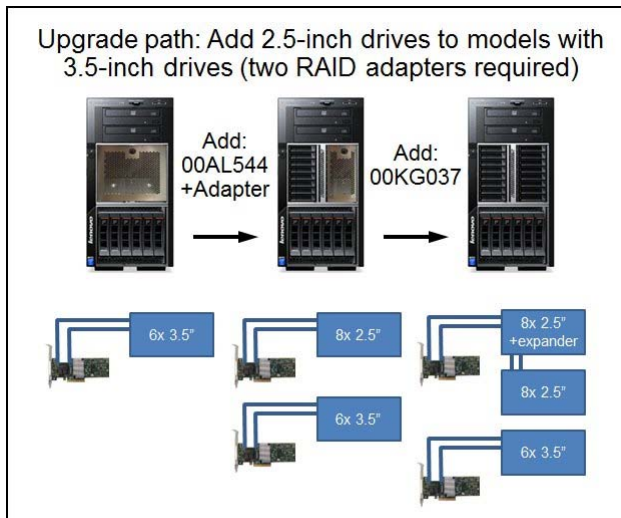


Figure 11. Combinations of 2.5-inch and 3.5-inch drive bays from a 3.5-inch base

Controllers for internal storage

The following table lists the RAID controllers and additional options that are used for internal disk storage of the x3500 M5 server.

Table 9. RAID controllers and HBAs for internal storage

Part number	Feature code	Description	Maximum supported	Standard models where used
12 Gb Controllers				
46C9114	A45W	ServeRAID M1215 SAS/SATA Controller	2	A2x, B2x, C2x, C3x, C4x, D2x
46C9110	A3YZ	ServeRAID M5210 SAS/SATA Controller	2	G2x, G3x, H2x, J2x
47C8675	A3YY	N2215 SAS/SATA HBA	2	-
6 Gb Controllers				
46M0907	5982	6Gb SAS HBA	4	-
Hardware upgrades for the M5210				
47C8656	A3Z0	ServeRAID M5200 Series 1GB Cache/RAID 5 Upgrade	2	-
47C8660	A3Z1	ServeRAID M5200 Series 1GB Flash/RAID 5 Upgrade	2	G2x, G3x
47C8664	A3Z2	ServeRAID M5200 Series 2GB Flash/RAID 5 Upgrade	2	H2x, J2x
47C8668	A3Z3	ServeRAID M5200 Series 4GB Flash/RAID 5 Upgrade	2	-
Feature on Demand upgrades for the M1215†				
00AE930	A5H5	ServeRAID M1200 Zero Cache/RAID 5 Upgrade	1†	-
Feature on Demand upgrades for the M5210†				
47C8708	A3Z6	ServeRAID M5200 Series Zero Cache/RAID 5 Upgrade	1†	-
47C8706	A3Z5	ServeRAID M5200 Series RAID 6 Upgrade	1†*	-
47C8710	A3Z7	ServeRAID M5200 Series Performance Accelerator	1†*	-
47C8712	A3Z8	ServeRAID M5200 Series SSD Caching Enabler	1†*	-

* Requires cache memory upgrade (47C8656, 47C8660, or 47C8664).

† Features on Demand (FoD) upgrades for ServeRAID adapters are applied system-wide; that is, one FoD upgrade is required to activate the feature on all RAID controllers of the same type installed in the server.

The ServeRAID M1215 SAS/SATA Controller has the following specifications:

- Eight internal 12 Gbps SAS/SATA ports
- Up to 12 Gbps throughput per port
- Two internal mini-SAS HD connectors (SFF-8643)
- Supports connections to SAS/SATA HDDs and SSDs
- LSI SAS3008 12 Gbps RAID on Chip (ROC) controller
- Support for RAID levels 0, 1, and 10 standard; support for RAID 5, 50 with optional FoD upgrade
- Zero Controller Cache, no battery/flash backup
- Optional support for self-encrypting drives (SEDs) with MegaRAID SafeStore (with RAID 5 upgrade)
- Fixed stripe size of 64 KB

The ServerRAID M5210 SAS/SATA Controller has the following specifications:

- Eight internal 12 Gbps SAS/SATA ports
- Up to 12 Gbps throughput per port
- Two x4 HD mini-SAS internal connectors (SFF-8643)
- Supports connections to SAS/SATA HDDs and SSDs and SAS Expanders
- Supports RAID 0, 1, and 10
- Supports RAID 5 and 50 with optional M5200 Series RAID 5 upgrades
- Supports RAID 6 and 60 with the optional M5200 Series RAID 6 upgrade
- Optional support for self-encrypting drives (SEDs) with MegaRAID SafeStore (with RAID 5 upgrade)
- Supports 1 GB non-backed cache or 1 GB, 2 GB or 4 GB flash-backed cache
- PCIe 3.0 x8 host interface
- Based on the LSI SAS3108 12 Gbps ROC controller

The N2215 SAS/SATA HBA has the following specifications:

- Eight internal 12 Gbps SAS/SATA ports
- Up to 12 Gbps throughput per port
- Two x4 HD mini-SAS internal connectors (SFF-8643)
- Supports connections to SAS/SATA HDDs and SSDs
- Optimized for SSD performance
- No RAID support
- PCIe 3.0 x8 host interface
- Based on the LSI SAS3008 12 Gbps controller

For more information, see the list of Lenovo Press Product Guides in the RAID adapters category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=raid>

Internal drive options

The following table lists hard drive options for internal disk storage of the x3500 M5 server.

Table 10. Drive options for internal disk storage (Part 1)

Part number	Feature code	Description	Maximum supported
3.5-inch hot-swap HDDs - 12 Gbps NL SAS			
00FN188	A5VP	2TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e HDD	12
00FN208	A5VQ	4TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e HDD	12
00FN228	A5VR	6TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e HDD	12
3.5-inch hot-swap SEDs - 12 Gbps NL SAS			
00FN238	A5VS	2TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e SED	12
00FN248	A5VT	4TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e SED	12
00FN258	A5VU	6TB 7.2K 12Gbps NL SAS 3.5-inch G2HS 512e SED	12
3.5-inch hot-swap HDDs - 12 Gbps NL SATA			
81Y9794	A22T	2TB 7.2K 6Gbps NL SATA 3.5-inch G2HS HDD	12
81Y9798	A22S	3TB 7.2K 6Gbps NL SATA 3.5-inch G2HS HDD	12
49Y6002	A3W9	4TB 7.2K 6Gbps NL SATA 3.5-inch G2HS HDD	12
3.5-inch hot-swap HDDs - 6 Gbps NL SATA			
00FN113	A5VD	2TB 7.2K 6Gbps NL SATA 3.5-inch G2HS 512e HDD	12
00FN128	A5VF	3TB 7.2K 6Gbps NL SATA 3.5-inch G2HS 512e HDD	12
00FN143	A5VH	4TB 7.2K 6Gbps NL SATA 3.5-inch G2HS 512e HDD	12
00FN158	A5VK	5TB 7.2K 6Gbps NL SATA 3.5-inch G2HS 512e HDD	12
00FN173	A5VM	6TB 7.2K 6Gbps NL SATA 3.5-inch G2HS 512e HDD	12
3.5-inch simple-swap HDDs - 6 Gbps NL SATA			
00FN118	A5VE	2TB 7.2K 6Gbps NL SATA 3.5-inch G2SS 512e HDD	6
00FN133	A5VG	3TB 7.2K 6Gbps NL SATA 3.5-inch G2SS 512e HDD	6
00FN148	A5VJ	4TB 7.2K 6Gbps NL SATA 3.5-inch G2SS 512e HDD	6
00FN163	A5VL	5TB 7.2K 6Gbps NL SATA 3.5-inch G2SS 512e HDD	6
00FN178	A5VN	6TB 7.2K 6Gbps NL SATA 3.5-inch G2SS 512e HDD	6
81Y9810	A22W	2TB 7.2K 6Gbps NL SATA 3.5-inch G2SS HDD	6
81Y9814	A22V	3TB 7.2K 6Gbps NL SATA 3.5-inch G2SS HDD	6
49Y6012	A3WA	4TB 7.2K 6Gbps NL SATA 3.5-inch G2SS HDD	6

Table 10. Drive options for internal disk storage (Part 2)

Part number	Feature code	Description	Maximum supported
2.5-inch hot-swap 10K HDDs - 6 Gbps SAS			
00AJ096	A4TL	300GB 10K 6Gbps SAS 2.5-inch G3HS HDD	32
00AJ091	A4TM	600GB 10K 6Gbps SAS 2.5-inch G3HS HDD	32
00AJ071	A4TN	900GB 10K 6Gbps SAS 2.5-inch G3HS HDD	32
00AJ146	A4TP	1.2TB 10K 6Gbps SAS 2.5-inch G3HS HDD	32
2.5-inch hot-swap 15K HDDs - 12 Gbps SAS			
00AJ081	A4TR	300GB 15K 6Gbps SAS 2.5-inch G3HS HDD	32
00AJ126	A4TS	600GB 15K 6Gbps SAS 2.5-inch G3HS HDD	32
2.5-inch hot-swap HDDs - 6 Gbps NL SAS			
00AJ086	A4TU	1TB 7.2K 6Gbps NL SAS 2.5-inch G3HS HDD	32
00AJ121	A4TT	500GB 7.2K 6Gbps NL SAS 2.5-inch G3HS HDD	32
2.5-inch hot-swap HDDs - 6 Gbps NL SATA			
00AJ136	A4TW	500GB 7.2K 6Gbps NL SATA 2.5-inch G3HS HDD	32
00AJ141	A4TX	1TB 7.2K 6Gbps NL SATA 2.5-inch G3HS HDD	32
2.5-inch hot-swap 6 Gbps SAS SSDs - Enterprise			
00AJ217	A4UC	800GB SAS 2.5-inch MLC G3HS Enterprise SSD	32
2.5-inch hot-swap 6 Gbps SATA SSDs - Enterprise			
00AJ161	A4U4	S3700 400GB SATA 2.5-inch MLC G3HS Enterprise SSD	32
2.5-inch hot-swap 6 Gbps SATA SSDs - Enterprise Value			
00AJ405	A579	480GB SATA 2.5-inch MLC G3HS Enterprise Value SSD	32
2.5-inch hot-swap 6 Gbps SATA SSDs - Entry			
00FN347	AS0J	960GB SATA 2.5-inch MLC G3HS Entry SSD	32

Internal backup units

The server supports the internal backup unit options that are listed in the following table.

Table 11. Internal tape drives

Part number	Feature code	Description	Maximum supported
-	A2U7	RDX 3 Internal USB Drive	1
00D2786	A2VE	RDX Internal USB 3.0 Dock with 320 GB Cartridge (includes USB cable)	1
00D2787	A2VF	RDX Internal USB 3.0 Dock with 500 GB Cartridge (includes USB cable)	1
00D2788	A2VG	RDX Internal USB 3.0 Dock with 1 TB Cartridge (includes USB cable)	1

USB devices are attached to the internal USB connector. For option part number orders, the USB cable is included with the RDX drive. For CTO, use feature code 9266.

For more information, see the list of Product Guide, *RDX USB 3.0 Disk Backup Solution*, which is available at this website:

<http://www.redbooks.ibm.com/abstracts/tips0894.html?Open>

Optical drives

The server supports the optical drive options that are listed in the following table.

Table 12. Optical drives

Part number	Feature code	Description	Maximum supported	Standard models where used
None*	4154	Half-High SATA DVD-ROM	2	All standard models
81Y6404	4155	Half-High SATA Multiburner	2	-

* This option is available via CTO only or is already installed in standard models.

The two half-high drives in the table can be installed in any open 5.25-inch drive bay.

The Half-High SATA DVD-ROM drive supports the following media and speeds for reading:

- CD-ROM 48X
- CD-DA (DAE) 40X
- CD-R 48X
- CD-RW 40X
- DVD-ROM (single layer) 16X
- DVD-ROM (dual layer) 12X
- DVD-R (4.7 GB) 16X
- DVD-R DL 12X
- DVD+R 16X
- DVD+R DL 12X
- DVD-RW (4.7 GB) 12X
- DVD+RW 12X
- DVD-RAM (4.7/9.4 GB) 6X

The Half-High SATA multiburner drive supports the same media and speeds for reading as HH DVD-ROM. In addition, this drive supports the following media and speeds for writing:

- CD-R 24X
- CD-RW 4X
- High Speed CD-RW 10X
- Ultra Speed CD-RW 16X
- DVD-R 8X
- DVD-R DL 8X
- DVD+R 8X
- DVD+R DL 8X
- DVD-RW 6X
- DVD+RW 8X
- DVD-RAM 3X

I/O expansion options

The server supports up to seven PCIe 3.0 slots: Four slots (1 - 4) when one CPU is installed or seven slots when two CPUs are installed. The following slot form factors are available:

- Slot 1: PCIe 3.0 x8 (x8 wired); full-height, half-length
- Slot 2: PCIe 3.0 x16 (x8 wired); full-height, full-length
- Slot 3: PCIe 3.0 x16 (x16 wired); full-height, full-length
- Slot 4: PCIe 3.0 x8 (x8 wired); full-height, full-length
- Slot 5: PCIe 3.0 x8 (x8 wired); full-height, half-length (requires second processor)
- Slot 6: PCIe 3.0 x16 (x16 wired); full-height, full-length (requires second processor)
- Slot 7: PCIe 3.0 x16 (x16 wired) full-height, full-length (requires second processor)

Slots 3 and 6 support double-wide GPUs

The COM Port Bracket, part number 00KC332, is used for making an external serial port available at the rear of the server. This option includes the bracket and the cable. The COM Port option is mounted in one of the PCIe slots and that PCIe slot cannot be used. The following table lists the PCIe slot options.

Table 13. System x3500 M5 COM Port Kit ordering information

Part number	Feature code	Description	Maximum supported
00KC332	ARZ0	System x3500 M5 COM Port Kit	1

Network adapters

The x3550 M5 supports four integrated Gigabit Ethernet ports with the following features:

- A Broadcom BCM5719 chip
- Four Gigabit Ethernet ports
- NIC Teaming (load balancing and failover)
- Ethernet features:
 - Compliant with 1 Gb Ethernet IEEE 802.3, 802.3u, and 802.3ab PHY specifications
 - Integrated PHY for 10/100/1000 Mbps for multispeed, full, and half-duplex auto-negotiation
 - Automatic MDI crossover
 - IEEE 802.3x-compliant flow control support
 - IEEE 1588 protocol and 802.1AS time synchronization implementation
 - IEEE802.3az - Energy Efficient Ethernet (EEE)
- I/O Virtualization features:
 - I/O Virtualization support for VMware NetQueue and Microsoft virtual machine queue (VMQ)
 - Function Level Reset (FLR)
 - IEEE 802.1q Virtual Local Area Network (VLAN) tagging support
- Stateless offload and performance features:
 - TCP, IP, and User Datagram Protocol (UDP) checksum offload
 - TCP segmentation offload (TCO)
 - Large Send Offload (LSO)
 - Receive Side Scaling (RSS) and Transmit Side Scaling (TSS)
 - Message Signal Interrupt (MSI) and Message Signal Interrupt Extension (MSI-X) support
 - Support for jumbo frames up to 9600 bytes

The following table lists other supported network adapters.

Table 14. Network adapters

Part number	Feature code	Description	Maximum supported (1 CPU / 2 CPUs)
40 Gb Ethernet			
00D9550	A3PN	Mellanox ConnectX-3 40GbE / FDR IB VPI Adapter*	4 / 7
10 Gb Ethernet			
44T1370	A5GZ	Broadcom NetXtreme 2x10GbE BaseT Adapter	4 / 7
94Y5180	A4Z6	Broadcom NetXtreme Dual Port 10GbE SFP+ Adapter*	4 / 7
49Y7960	A2EC	Intel X520 Dual Port 10GbE SFP+ Adapter*	4 / 7
49Y7970	A2ED	Intel X540-T2 Dual Port 10GBaseT Adapter	4 / 7
00D9690	A3PM	Mellanox ConnectX-3 10 GbE Adapter*	4 / 7
90Y4600	A3MR	QLogic 8200 Dual Port 10GbE SFP+ VFA*	4 / 7
00Y5624	A3MT	QLogic 8200 VFA FCoE/iSCSI License for System x (FoD) (Features on Demand upgrade for 90Y4600)	4 / 7
47C9977	A522	Solarflare SFN7122F 2x10GbE SFP+ Flareon Ultra*	4 / 7
1 Gb Ethernet			
42C1780	2995	Broadcom NetXtreme 2xGbE BaseT Adapter	4 / 7
90Y9370	A2V4	Broadcom NetXtreme I Dual Port GbE Adapter	4 / 7
90Y9352	A2V3	Broadcom NetXtreme I Quad Port GbE Adapter	4 / 7
49Y4230	5767	Intel Ethernet Dual Port Server Adapter I340-T2	4 / 7
49Y4240	5768	Intel Ethernet Quad Port Server Adapter I340-T4	4 / 7

* Require SFP+ optical transceivers or DAC cables that must be purchased separately.

For more information, see the list of Lenovo Press Product Guides in the Networking adapters category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=networkadapters>

Storage host bus adapters

The following table lists storage HBAs that are supported by the x3500 M5 server.

Table 15. Storage adapters

Part number	Feature code	Description	Maximum supported (1 CPU / 2 CPUs)
16 Gb Fibre Channel			
81Y1675	A2XV	Brocade 16Gb FC Dual-port HBA for System x	4 / 7
81Y1668	A2XU	Brocade 16Gb FC Single-port HBA for System x	4 / 7
81Y1662	A2W6	Emulex 16Gb FC Dual-port HBA for System x	4 / 7
81Y1655	A2W5	Emulex 16Gb FC Single-port HBA for System x	4 / 7
00Y3341	A3KX	QLogic 16Gb FC Dual-port HBA for System x	4 / 7
00Y3337	A3KW	QLogic 16Gb FC Single-port HBA for System x	4 / 7
8 Gb Fibre Channel			
46M6050	3591	Brocade 8Gb FC Dual-port HBA for System x	4 / 7
46M6049	3589	Brocade 8Gb FC Single-port HBA for System x	4 / 7
42D0494	3581	Emulex 8Gb FC Dual-port HBA for System x	4 / 7
42D0485	3580	Emulex 8Gb FC Single-port HBA for System x	4 / 7
42D0510	3579	QLogic 8Gb FC Dual-port HBA for System x	4 / 7
42D0501	3578	QLogic 8Gb FC Single-port HBA for System x	4 / 7
SAS			
46M0907	5982	6 Gb SAS HBA Controller	4 / 7
00AE912	A5M0	N2225 SAS/SATA HBA for System x	4 / 7
00AE916	A5M1	N2226 SAS/SATA HBA for System x	4 / 7

For more information, see the list of Lenovo Press Product Guides in the Host bus adapters category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=hba>

PCIe SSD adapters

The server currently does not support High IOPS SSD adapters.

GPU adapters

The x3500 M5 server supports graphics processing units (GPUs) that are listed in the following table. Up to two GPUs are supported, depending on the number of processors that are installed in a server.

Table 16. GPU adapters

Part number	Feature code	Description	Maximum supported (1 CPU / 2 CPUs)
00FP672	A3YV	NVIDIA Quadro K6000	1 / 2
00FP676	A5FG	NVIDIA Tesla K40c	1 / 2

The following other rules apply:

- If two GPUs are installed, they must be identical
- The first GPU is installed in slot 3; the second GPU is installed in slot 6 and requires the second processor to be installed.
- The number of GPUs that can be installed depends on the type of power supply that is installed and the type and number of other components that are installed. For more information, see the Power Supply section.
- If a NVIDIA card is installed, the maximum memory that can be installed is 1 TB.

Power supplies and redundant cooling

The server supports up to two redundant power supplies. Standard models come with one or two power supplies (depending on the model).

The server also comes standard with two (for models with one processor installed) or four (for models with two processors installed) hot-swap cooling fans. For models with only one processor, an optional Redundant Cooling Kit provides N+1 cooling redundancy. The following table lists the power supplies and redundant cooling upgrade options.

Table 17. Power supplies

Part number	Feature code	Description	Maximum supported	Standard models where used
00AL533	A5MY	System x 550W High Efficiency Platinum AC Power Supply	2	A2x, B2x, C2x, C3x, C4x, D2x
00AL534	A5MZ	System x 750W High Efficiency Platinum AC Power Supply	2	G2x, G3x
00AL536	A5N0	System x 900W High Efficiency Platinum AC Power Supply	2	H2x, J2x
00AL535	A5N1	System x 750W High Efficiency Titanium AC Power Supply	2	-
None*	A5CH	System x 550W High Efficiency Platinum AC Fixed Power Supply	1	-
81Y7132	A5D6	System x3500 M5 Redundant Cooling Kit	1	-

* CTO only

The following table shows the combinations supported.

Table 18. Supported configurations (Part 1: 550 W and 750 W power supply units)

Power supply	550 W (A)	550 W (B)	750 W (A)	750 W (B)
Maximum processors	1	2, max 90W	1	2
Memory maximums (mutually exclusive)				
RDIMMs	No limit	No limit	No limit	No limit
LRDIMMs	0	0	0	0
Drive maximums (mutually exclusive)				
3.5-inch drives only	No limit	6	No limit	No limit
2.5-inch drives only	16	8	16	16
Intermix 3.5-in and 2.5-in drives	6x 3.5 + 8x 2.5	No	6x 3.5 + 8x 2.5	6x 3.5 + 8x 2.5
PCIe adapters (non-GPU)*	No limit	No limit	No limit	No limit
Maximum GPUs	0	0	1	0

* GPUs use two PCIe slots; therefore, if a GPU is installed, the number of non-GPU adapters installed is reduced by two.

Table 18. Supported configurations (Part 2: 900 W power supply units)

Power supply	900 W (1A)	900 W (2A)	900 W (2B)	900 W (2C)	900 W (2D)	900 W (2E)
Maximum processors	1	2	2	2	2, max 135W	2, max 90W
Memory maximums (mutually exclusive)						
RDIMMs	No limit	No limit	No limit	No limit	No limit	12
LRDIMMs	0	12	0	No limit	0	0
Drive maximums (mutually exclusive)						
3.5-inch drives only	No limit	No limit	6	6	No limit	6
2.5-inch drives only	No limit	24	8	8	No limit	8
Intermix 3.5-in and 2.5-in drives	No limit	No limit	0	0	No limit	0
PCIe adapters (non-GPU)*	No limit	No limit	No limit	No limit	No limit	2
Maximum GPUs	1	0	1	0	0	2

* GPUs use two PCIe slots; therefore, if a GPU is installed, the number of non-GPU adapters that are installed is reduced by two.

AC power supply options ships without a line cord, it must be purchased separately. Country-specific line cords and rack cables can be ordered if needed, as listed in the following table.

Table 19. Power cables

Part number	Feature code	Description
Rack power cables		
39Y7932	6263	4.3m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
39Y7937	6201	1.5m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
39Y7938	6204	IEC309 C20 to C13 rack jumper cable
Country-specific power cords		
39Y7917	6212	European 10A line C13 to CEE 7/7 (2.8M)
39Y7918	6213	Denmark 10A line C13 to DK2-5A (2.8M)
39Y7919	6216	Switzerland 10A line C13 to SEV 1011 (2.8M)
39Y7920	6218	Israel 10A line C13 to SI 32 (2.8M)
39Y7921	6217	Italy 10A line C13 to CEE 7/7 (2.8M)
39Y7922	6214	South Africa 10A line C13 to SABS 164/1 (2.8M)
39Y7923	6215	United Kingdom 10A line C13 to BS 1363 (2.8M)
39Y7924	6211	Australia/NZ 10A line C13 to SAA-AS C112 (2.8M)
39Y7925	6219	Korea 7A line C13 to KETI 15A/250V (2.8M)
39Y7927	6269	India 6A line C13 to Fig 68 (2.8M)
39Y7928	6210	China 6A line C13 to GB 2099.1 (2.8M)
39Y7929	6223	Brazil 10A line C13 to NBR 6147 (2.8M)
39Y7930	6222	Argentina 10A line C13 to IRAM 2063 (2.8M)
39Y7931	6207	Power Cable - C13 / NEMA 5-15P 14ft
00CG265	A53E	Power Cord Taiwan AC plug 10A/250V, 2.8M; OPT
00CG267	A53F	Power Cord Taiwan AC plug 15A/125V; 2.8M; OPT
46M2592	A1RF	10A/250V C13 to NEMA 6-15P 2.8m line cord
46M2593	A1RE	Japan 10A/100V C13 to JIS C-8303 2.8m line cord

Integrated virtualization

The server supports the VMware vSphere (ESXi) hypervisor on one or two SD cards with the optional SD Media Adapter for System x. This adapter is in a dedicated connector on the system board, as shown in the following figure.



Figure 12. SD Media Adapter with one SD Card installed

When only one SD card is installed in the adapter, you can create up to 16 volumes, each of which is presented to UEFI as a bootable device. When two SD Media cards are inserted, volumes can be mirrored (RAID 1) across both cards, up to a total of eight mirrored volumes. The use of mirrored volumes improves system availability because the server remains operational, even if one SD card fails. The RAID functionality is handled internally by the SD Media Adapter.

The following table shows the available options. The table also indicates whether the option includes the SD Media RAID Adapter and how many SD cards are included.

Table 20. Virtualization options

Part number	Feature code	Description	Includes Adapter	SD Cards Included
00ML706	A5TJ	SD Media Adapter for Systems x (Option 00ML706 includes 2 blank 32GB SD cards)	Yes	2*
00ML700	AS2V	Blank 32GB SD Media for System x	No	2
None**	AS4B	RAID Adapter for SD Media w/ VMware ESXi 5.1 U2 (2 SD Media, RAIDed)	Yes	2
None**	ASCG	RAID Adapter for SD Media w/ VMware ESXi 5.1 U2 (1 SD Media)	Yes	1

* Option 00ML706 includes two 32GB SD cards; however, for CTO orders, feature code A5TJ does not include SD media and the 32GB cards and VMware vSphere preload must be selected separately.

** CTO only.

Systems management

The server contains IMM2.1, which provides advanced service-processor control, monitoring, and an alerting function. If an environmental condition exceeds a threshold or if a system component fails, the IMM2.1 lights LEDs to help you diagnose the problem, records the error in the event log, and alerts you to the problem. Optionally, the IMM2.1 also provides a virtual presence capability for remote server management capabilities.

The IMM provides remote server management through the following industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3
- Common Information Model (CIM)
- Web browser

The optional Integrated Management Module Advanced Upgrade is required for enabling remote presence and blue-screen capture features. The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel colors, regardless of the system state
- Remotely accessing the server by using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition. Table 19 lists the remote management option.

Table 21. Remote management option

Part number	Feature code	Description	Maximum supported
90Y3901	A1ML	Integrated Management Module Advanced Upgrade	1

All standard models include basic light path diagnostics, which include system LEDs on the front of the server (see the following figure) and LEDs near the monitored components (for example, the DIMM error LED on the system board). The server also offers an optional upgrade to supply another array of light path diagnostic LEDs on the front of the chassis.

The following table lists the ordering information for the light path diagnostics panel upgrade kit.

Table 22. Remote management option

Part number	Feature code	Description	Maximum supported
00AL566	A5N3	System x3500 M5 Lightpath Upgrade Kit	1

The following figure shows the meaning of each LED.

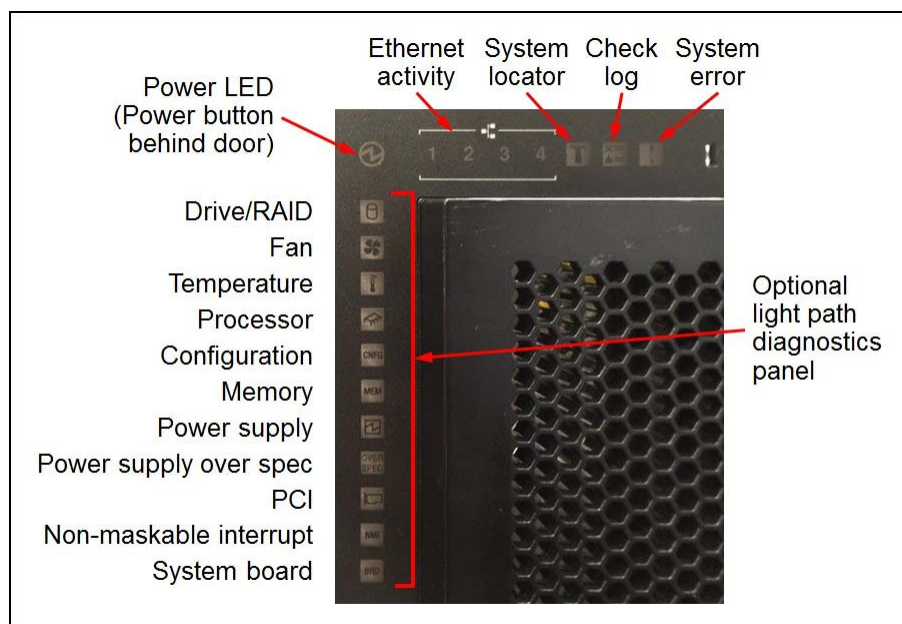


Figure 13. System LEDs and the optional light path diagnostics panel

Note: The light path diagnostics panel upgrade kit supplies the array of LEDs that is mounted inside the server, as shown in the following figure. The light path diagnostics indicators are still visible on the front of the server, even if the upgrade kit is not installed.



Figure 14. System x3500 M5 Lightpath Upgrade Kit

IBM Security Key Lifecycle Manager for System x SEDs - FoD (SKLM - FoD) is an optional feature, which is available in System x environments that centralizes, simplifies, and automates the data encryption key management process to help minimize risk and reduce operational costs. SKLM - FoD offers a simple and robust solution for key storage, key serving, and key lifecycle management for self-encrypting drives (SEDs) in local and distributed System x environments. The FoD upgrade can be configured with the ServeRAID M5210 and M1215 RAID controllers paired with SEDs. The following table lists SKLM-FoD part numbers.

Table 23. Security Key Lifecycle Manager - FoD part numbers

Part number	Feature code	Description	Maximum supported
United States, Canada, Asia Pacific and Japan			
00D9998	A5U1	IBM SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	1
00D9999	AS6C	IBM SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	1
Latin America, Europe, Middle East and Africa			
00FP648	A5U1	IBM SKLM for System x w/SEDs - FoD per Install w/1Yr S&S	1
00FP649	AS6C	IBM SKLM for System x w/SEDs - FoD per Install w/3Yr S&S	1

Supported operating systems

The server supports the following operating systems:

- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2012
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 7
- SUSE Enterprise Linux Server (SLES) 12
- SUSE Linux Enterprise Server 12 with XEN
- VMware vSphere 5.5 (ESXi)
- VMware vSphere 5.1 (ESXi)

Some operating systems might have support delayed until 60 or 90 days after general availability. For more information about the supported specific versions and service levels and any other prerequisites, see the following ServerProven® website :

<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

Physical and electrical specifications

The server features the following dimensions and weight (approximate):

- Tower:
 - Width: 218 mm (8.6 in)
 - Depth: 720 mm (28.3 in)
 - Height: 440 mm (17.25 in)
 - Weight fully configured: 45.5 kg (100.3 lb)
 - Weight minimum configuration: 30.8 kg (67.9 lb)
- With rack conversion kit:
 - Width: 423 mm (16.6 in)
 - Depth: 706 mm (27.8 in)
 - Height: 218 mm (8.6 in)
 - Weight fully configured: 44.2 kg (97.4 lb)
 - Weight minimum configuration: 29.5 kg (65 lb) minimum configuration

The server features the following supported environment:

- Air temperature:
 - Server on: 5 - 40 °C (41 to 104 °F); altitude: 0 - 950 m (3,100 ft)
 - Server on: 5 - 28 °C (41 - 82 °F); altitude: 915 m (3,000 ft) - 3050 m (10,000 ft)
 - Server off (with standby power): 5 - 45 °C (41 - 113 °F)
 - Storage: 1 - 60 °C (34 - 140 °F)
 - Shipping: -40 - 60 °C (-40 - 140 °F)
- Humidity: 8 - 85%, Max. Dew Point 24 °C
- Electrical:
 - Models with 900 W AC power supplies:
 - 100 - 127 (nominal) V ac; 50 Hz or 60 Hz; 10.3 A
 - 200 - 240 (nominal) V ac; 50 Hz or 60 Hz; 5.0 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.15 kVA
 - Maximum configuration: 1.194 kVA
 - Models with 750 W Platinum AC power supplies:
 - 100 - 127 (nominal) V ac; 50 Hz or 60 Hz; 8.6 A
 - 200 - 240 (nominal) V ac; 50 Hz or 60 Hz; 4.2 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.15 kVA
 - Maximum configuration: 1.015 kVA
 - Models with 750 W Titanium AC power supplies:
 - 200 - 240 (nominal) V ac; 50 Hz or 60 Hz; 4.2 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.15 kVA
 - Maximum configuration: 0.965 kVA
 - Models with 550 W AC power supplies:
 - 100 to 127 (nominal) V ac; 50 Hz or 60 Hz; 6.5 A
 - 200 to 240 (nominal) V ac; 50 Hz or 60 Hz; 3.3 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.16 kVA
 - Maximum configuration: 0.732 kVA
- BTU output:
 - Base configuration: 2931 Btu/hr (859 watts)
 - Maximum configuration: 4043 Btu/hr (1185 watts)

Warranty options

The Lenovo System x3500 M5 has a 3-year onsite warranty with 9x5/next business day terms. Lenovo offers the warranty service upgrades through ServicePacs, which are described in this section. The ServicePac is a series of prepackaged warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

ServicePac offerings are country-specific; that is, each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of ServicePacs might be available in a particular country. For more information about ServicePac offerings that are available in your country, see the ServicePac Product Selector at this website:

<https://www-304.ibm.com/sales/gss/download/spst/servicepac>

The following table describes the warranty service definitions.

Table 24. Warranty service definitions

Term	Description
Onsite repair	A service technician comes to the server's location for equipment repair.
24x7x2 hour	A service technician is scheduled to arrive at your customer's location within two hours after remote problem determination is completed. We provide service around the clock, every day, including holidays.
24x7x4 hour	A service technician is scheduled to arrive at your customer's location within four hours after remote problem determination is completed. We provide service around the clock, every day, including holidays.
9x5x4 hour	A service technician is scheduled to arrive at your customer's location within four business hours after remote problem determination is completed. We provide service 8:00 a.m. - 5:00 p.m. in the customer's local time zone, Monday - Friday, excluding holidays. If after 1:00 p.m. it is determined that onsite service is required, the customer can expect the service technician to arrive the morning of the following business day. For noncritical service requests, a service technician arrives by the end of the following business day.
9x5 next business day	A service technician is scheduled to arrive at your customer's location on the business day after we receive your call, following remote problem determination. We provide service 8:00 a.m. - 5:00 p.m. in the customer's local time zone, Monday - Friday, excluding holidays.

In general, the following types of ServicePacs are available:

- Warranty and maintenance service upgrades:
 - One, two, three, four, or five years of 9x5 or 24x7 service coverage
 - Onsite repair from next business day to four or two hours
 - One or two years of warranty extension
- Remote technical support services:
 - One or three years with 24x7 coverage (severity 1) or 9x5/next business day for all severities
 - Installation and startup support for System x servers
 - Remote technical support for System x servers
 - Software support - Support Line:
 - Microsoft or Linux software
 - VMware
 - IBM Systems Director

Regulatory compliance

The server conforms to the following standards:

- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 5, Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1-07
- NOM-019
- Argentina IEC60950-1
- Japan VCCI, Class A
- IEC-60950-1 (CB Certificate and CB Test Report)
- Australia/New Zealand AS/NZS CISPR 22:2006, Class A; AS/NZS 60950.1
- Taiwan BSMI CNS13438, Class A ;CNS14336-1
- GB9254 Class A, GB17625.1
- China CCC GB4943.1
- Korea KN22, Class A; KN24

External disk storage expansion

The server supports attachment to external storage expansion enclosures, such as the EXP2500 series, by using the ServeRAID M5225 SAS/SATA Controller. The server can also be attached to supported external storage systems, such as the IBM System Storage® DS3500 series, by using a supported HBA. For more information, see the following table.

Table 25. RAID controllers and options for external disk storage expansion

Part number	Feature code	Description	Maximum supported	Standard models where used
12 Gb RAID controllers				
00AE938	A5ND	ServeRAID M5225-2GB SAS/SATA Controller	4	-
Feature on Demand (FoD) upgrades for the M5225				
47C8706	A3Z5	ServeRAID M5200 Series RAID 6 Upgrade	1*	-
47C8710	A3Z7	ServeRAID M5200 Series Performance Accelerator	1*	-
47C8712	A3Z8	ServeRAID M5200 Series SSD Caching Enabler	1*	-

* One FoD upgrade for the M5225 activates the feature on all M5225 controllers that are installed in a server.

The ServeRAID M5225 SAS/SATA Controller has the following specifications:

- Eight external 12 Gbps SAS/SATA ports
- Supports 12, 6, and 3 Gb/s SAS and 6 and 3 Gb/s SATA data transfer rates
- Two external x4 mini-SAS HD connectors (SFF-8644)
- Supports 2 GB flash-backed cache (standard)
- Supports RAID levels 0, 1, 5, 10, and 50 (standard)
- Supports RAID 6 and 60 with the optional M5200 Series RAID 6 Upgrade
- Supports optional M5200 Series Performance Accelerator and SSD Caching upgrades
- PCIe x8 Gen 3 host interface
- Based on the LSI SAS3108 12 Gbps ROC controller
- Supports connectivity to the EXP2512 and EXP2524 storage expansion enclosures

The ServeRAID M5225 SAS/SATA Controller supports connectivity to the IBM System Storage external expansion enclosures that are listed in the following table. Up to nine expansion enclosures can be daisy-chained per one M5225 external port. For better performance, distribute expansion enclosures evenly across both M5225 ports.

Table 26. IBM System Storage external expansion enclosures

Part number	Description	Maximum quantity supported per one M5225
610012X	EXP2512 Storage Enclosure	17
610024X	EXP2524 Storage Enclosure	9

The external SAS cables that are listed in the following table support connectivity between external expansion enclosures and the ServeRAID M5225 SAS/SATA Controller.

Table 27. External SAS cables for external storage expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
Server to Expansion enclosure connectivity (Mini-SAS HD x4 to Mini-SAS x4)		
00MJ162	0.6m SAS Cable (mSAS HD to mSAS)	1
00MJ163	1.5m SAS Cable (mSAS HD to mSAS)	1
00MJ166	3m SAS Cable (mSAS HD to mSAS)	1
Expansion enclosure to Expansion enclosure connectivity (Mini-SAS x4 to Mini-SAS x4)		
39R6529	1 m SAS Cable	1
39R6531	3 m SAS Cable	1

The following table lists drives that are supported by EXP2512 external expansion enclosures.

Table 28. Drive options for EXP2512 external expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
3.5-inch NL SAS HS HDDs		
00NC555	2TB 7,200 rpm 6Gb SAS NL 3.5-inch HDD	12
00NC557	3TB 7,200 rpm 6Gb SAS NL 3.5-inch HDD	12
00NC559	4TB 7,200 rpm 6Gb SAS NL 3.5-inch HDD	12

The following table lists HDDs that are supported by EXP2524 external expansion enclosures.

Table 29. Drive options for EXP2524 external expansion enclosures

Part number	Description	Maximum quantity supported per one enclosure
2.5-inch NL SAS HS HDDs		
00NC571	1TB 7,200 rpm 6Gb SAS NL 2.5-inch HDD	24
2.5-inch SAS HS HDDs		
00NC561	146GB 15,000 rpm 6Gb SAS 2.5-inch HDD	24
00NC563	300GB 15,000 rpm 6Gb SAS 2.5-inch HDD	24
00NC565	600GB 10,000 rpm 6Gb SAS 2.5-inch HDD	24
00NC567	900GB 10,000 rpm 6Gb SAS 2.5-inch HDD	24
00NC569	1.2TB 10,000 rpm 6Gb SAS 2.5-inch HDD	24
2.5-inch SAS HS SSDs		
00NC573	200GB 6Gb SAS 2.5-inch SSD	24
00NC575	400GB 6Gb SAS 2.5-inch SSD	24

External disk storage systems

The following table lists the external storage systems that are supported by the server and can be ordered through the System x sales channel.

Table 30. External disk storage systems

Part number	Description
2071CU2	Storwize V3500 LFF Dual Control Enclosure
2071CU3	Storwize V3500 SFF Dual Control Enclosure
6099L2C	Storwize V3700 3.5-inch Storage Controller Unit
6099S2C	Storwize V3700 2.5-inch Storage Controller Unit
6099T2C	Storwize V3700 2.5-inch DC Storage Controller Unit

For more information, see the list of Product Guides in the System Storage category at this website:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=externalstorage>

External backup units

The server supports the external backup attachment options that are listed in the following table.

Table 31. External backup options

Part number	Description
External tape expansion enclosures for internal tape drives	
87651UX	1U Tape Drive Enclosure
87651NX	1U Tape Drive Enclosure (with Nema 5-15P LineCord)
Tape enclosure adapters (with cables)	
44E8869	USB Enclosure Adapter Kit
40K2599	SAS Enclosure Adapter Kit
Internal backup drives supported by external tape enclosures	
00D2786	RDX Internal USB 3.0 Dock with 320GB Cartridge
00D2787	RDX Internal USB 3.0 Dock with 500GB Cartridge
00D2788	RDX Internal USB 3.0 Dock with 1TB Cartridge
49Y9898	Half High LTO Gen 5 Internal SAS Tape Drive
00D8924	Half High LTO Ultrium Gen 6 Internal SAS Tape Drive
External backup units*	
362532Y	RDX External USB 3.0 Dock with 320GB Cartridge
362550Y	RDX External USB 3.0 Dock with 500GB Cartridge
36251TY	RDX External USB 3.0 Dock with 1TB Cartridge
3628L5X	Half High LTO Gen 5 External SAS Tape Drive (with US line cord)
3628N5X	Half High LTO Gen 5 External SAS Tape Drive (without line cord)

* These external tape drives can be ordered through the System x sales channel. The server might support other tape drives that are not listed in this table. For more information, see the IBM System Storage Interoperation Center (SSIC) at this website:

<http://www.ibm.com/systems/support/storage/ssic>

For more information, see the list of Lenovo Press Product Guides in the Backup units category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=tape>

Top-of-rack Ethernet switches

The server supports the top-of-rack Ethernet switches that are listed in the following table.

Table 32. Top-of-rack switches

Part number	Description
1 Gb top-of-rack switches	
7309BAX	RackSwitch G7028 (24 ports)
7309CAX	RackSwitch G7028 (48 ports)
7309CAX	RackSwitch G7052
0446013	RackSwitch G8000R
7309CFC	RackSwitch G8000F
7309G52	RackSwitch G8052R
730952F	RackSwitch G8052F
10 Gb top-of-rack switches	
7309DRX	RackSwitch G8264CS (Rear to Front)
7309DFX	RackSwitch G8264CS (Front to Rear)
7309BR6	RackSwitch G8124ER
7309BF7	RackSwitch G8124EF
7309G64	RackSwitch G8264R
730964F	RackSwitch G8264F
7309CR9	RackSwitch G8264TR
7309CF9	RackSwitch G8264TF
40 Gb top-of-rack switches	
8036BRX	RackSwitch G8332 (Rear to Front)
8036BFX	RackSwitch G8332 (Front to Rear)
8036ARX	RackSwitch G8316R
8036AFX	RackSwitch G8316F

For more information, see the list of Lenovo Press Product Guides in the Top-of-rack switches category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=tor>

Uninterruptible power supply units

The server supports attachments to the uninterruptible power supply (UPS) units that are listed in the following table.

Table 33. Uninterruptible power supply units

Part number	Description
Rack-mounted or tower UPS units	
55941AX	RT1.5kVA 2U Rack or Tower UPS (100-125VAC)
55941KX	RT1.5kVA 2U Rack or Tower UPS (200-240VAC)
55942AX	RT2.2kVA 2U Rack or Tower UPS (100-125VAC)
55942KX	RT2.2kVA 2U Rack or Tower UPS (200-240VAC)
55943AX	RT3kVA 2U Rack or Tower UPS (100-125VAC)
55943KX	RT3kVA 2U Rack or Tower UPS (200-240VAC)
55945KX	RT5kVA 3U Rack or Tower UPS (200-240VAC)
55946KX	RT6kVA 3U Rack or Tower UPS (200-240VAC)
55948KX	RT8kVA 6U Rack or Tower UPS (200-240VAC)
55949KX	RT11kVA 6U Rack or Tower UPS (200-240VAC)
55948PX	RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55949PX	RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
Rack-mounted UPS units	
53951AX	1500VA LCD 2U Rack UPS (100V/120V)
53951KX	1500VA LCD 2U Rack UPS (230V)
53952AX	2200VA LCD 2U Rack UPS (100V/120V)
53952KX	2200VA LCD 2U Rack UPS (230V)
53953AX	3000VA LCD 3U Rack UPS (100 V/120 V)
53953JX	3000VA LCD 3U Rack UPS (200 V/208 V)
53956AX	6000VA LCD 4U Rack UPS (200 V/208 V)
53956KX	6000VA LCD 4U Rack UPS (230 V)
53959KX	11000VA LCD 5U Rack UPS (200V/208V/230V)
24195KX	UPS5000
21303RX	UPS 7500XHV
21304RX	UPS 10000XHV

For more information, see the list of Lenovo Press Product Guides in the Power infrastructure category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=power>

Power distribution units

The server supports attachments to the power distribution units (PDUs) are listed in the following table.

Table 34. Power distribution units (Part 1)

Part number	Description
Switched and Monitored PDUs	
46M4002	1U 9 C19/3 C13 Active Energy Manager DPI PDU
46M4003	1U 9 C19/3 C13 Active Energy Manager 60A 3 Phase PDU
46M4004	1U 12 C13 Active Energy Manager DPI PDU
46M4005	1U 12 C13 Active Energy Manager 60A 3 Phase PDU
46M4167	1U 9 C19/3 C13 Switched and Monitored 30A 3 Phase PDU
46M4116	0U 24 C13 Switched and Monitored 30A PDU
46M4119	0U 24 C13 Switched and Monitored 32A PDU
46M4134	0U 12 C19/12 C13 Switched and Monitored 50A 3 Phase PDU
46M4137	0U 12 C19/12 C13 Switched and Monitored 32A 3 Phase PDU
Enterprise PDUs	
71762MX	Ultra Density Enterprise PDU C19 PDU+ (WW)
71762NX	Ultra Density Enterprise PDU C19 PDU (WW)
71763MU	Ultra Density Enterprise PDU C19 3 Phase 60A PDU+ (NA)
71763NU	Ultra Density Enterprise PDU C19 3 Phase 60A PDU (NA)
39M2816	DPI C13 Enterprise PDU without line cord
39Y8923	DPI 60A Three Phase C19 Enterprise PDU with IEC309 3P+G (208 V) fixed line cord
39Y8941	DPI Single Phase C13 Enterprise PDU without line cord
39Y8948	DPI Single Phase C19 Enterprise PDU without line cord
Front-end PDUs	
39Y8934	DPI 32 amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8935	DPI 63 amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8938	30 amp/125 V Front-end PDU with NEMA L5-30P connector
39Y8939	30 amp/250 V Front-end PDU with NEMA L6-30P connector
39Y8940	60 amp/250 V Front-end PDU with IEC 309 60A 2P+N+Gnd connector

Table 34. Power distribution units (Part 2)

Part number	Description
Universal PDUs	
39Y8951	DPI Universal Rack PDU with US LV and HV line cords
39Y8952	DPI Universal Rack PDU with CEE7-VII Europe LC
39Y8953	DPI Universal Rack PDU with Denmark LC
39Y8954	DPI Universal Rack PDU with Israel LC
39Y8955	DPI Universal Rack PDU with Italy LC
39Y8956	DPI Universal Rack PDU with South Africa LC
39Y8957	DPI Universal Rack PDU with UK LC
39Y8958	DPI Universal Rack PDU with AS/NZ LC
39Y8959	DPI Universal Rack PDU with China LC
39Y8962	DPI Universal Rack PDU (Argentina)
39Y8960	DPI Universal Rack PDU (Brazil)
39Y8961	DPI Universal Rack PDU (India)
0U Basic PDUs	
46M4122	0U 24 C13 16A 3 Phase PDU
46M4125	0U 24 C13 30A 3 Phase PDU
46M4128	0U 24 C13 30A PDU
46M4131	0U 24 C13 32A PDU
46M4140	0U 12 C19/12 C13 60A 3 Phase PDU
46M4143	0U 12 C19/12 C13 32A 3 Phase PDU

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Rack options

The x3500 M5 server can be installed in the rack with the Tower to Rack Conversion Kit (00AL538). The resulting server is a 5U rack-mountable server, as shown in the following figure.



Figure 15. The x3500 M5 with the 5U Tower to Rack Conversion Kit (included slide kit shown)

The Tower to Rack Conversion Kit (00AL538) includes a cable management arm; however, standard rack models (for example, 5464-C3x and G3x) do not include a cable management arm. Therefore, the arm must be ordered separately by using part number 00KC334.

The tower-to-rack conversion kit, supported cable management arm kit, rack console switches, monitor kits, and management gateways are listed in the following table.

Table 35. Rack options

Part number	Feature code	Description
Rack options for the x3500 M5		
00KC334	ARZ2	System x3500 M5 Cable Management Kit
00AL538	A5N4	System x3500 M5 Tower to Rack Conversion Kit
Monitor kits and keyboard trays		
17238BX	1723HC1 fc A3EK	1U 18.5" Standard Console
17238EX	1723HC1 fc A3EL	1U 18.5" Enhanced Media Console
Console switches		
1754D2X	1754HC2 fc 6695	Global 4x2x32 Console Manager (GCM32)
1754D1X	1754HC1 fc 6694	Global 2x2x16 Console Manager (GCM16)
1754A2X	1754HC4 fc 0726	Local 2x16 Console Manager (LCM16)
1754A1X	1754HC3 fc 0725	Local 1x8 Console Manager (LCM8)
Console cables		
43V6147	3757	Single Cable USB Conversion Option (UCO)
39M2895	3756	USB Conversion Option (4 Pack UCO)
46M5383	5341	Virtual Media Conversion Option Gen2 (VCO2)
46M5382	5340	Serial Conversion Option (SCO)
Universal management gateway and cables		
3858D3X	3858HC1 fc A4X1	Avocent Universal Management Gateway 6000
00AK142	A4X4	UM KVM Module VGA+SD Dual RJ45

For more information, see the list of Lenovo Press Product Guides in the Rack cabinets and options category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=rack>

Rack cabinets

Supported rack cabinets are listed in the following table.

Table 36. Rack cabinets

Part number	Description
Tower to rack conversion kits	
00KC334	System x3500 M5 Cable Management Kit
00AL538	System x3500 M5 Tower to Rack Conversion Kit
Rack cabinets	
201886X	11U Office Enablement Kit
93072RX	25U Standard Rack
93072PX	25U Static S2 Standard Rack
93634EX	42U 1100mm Dynamic Expansion Rack
93634PX	42U 1100mm Dynamic Rack
93604EX	42U 1200mm Deep Dynamic Expansion Rack
93604PX	42U 1200mm Deep Dynamic Rack
93614EX	42U 1200mm Deep Static Expansion Rack
93614PX	42U 1200mm Deep Static Rack
93084EX	42U Enterprise Expansion Rack
93084PX	42U Enterprise Rack
93074RX	42U Standard Rack
93074XX	42U Standard Rack Extension
93624EX	47U 1200mm Deep Static Expansion Rack
93624PX	47U 1200mm Deep Static Rack
93634BX	PureFlex® System 42U Expansion Rack
93634DX	PureFlex System 42U Expansion Rack
93634AX	PureFlex System 42U Rack
93634CX	PureFlex System 42U Rack

For more information, see the list of Lenovo Press Product Guides in the Rack cabinets and options category at this website:

<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=rack>

Related publications and links

For more information, see the following resources:

- Lenovo System x3500 M5 product page:
<http://ibm.com/systems/x/hardware/tower/x3500m5/>
- ServerProven hardware compatibility page for the x3500 M5:
<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/xseries/5464.html>
- Lenovo Press Product Guides for System x servers and options:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pgbycat>
- *System x Configuration and Options Guide*:
<http://www.ibm.com/systems/xbc/cog/>
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<http://www.redbooks.ibm.com/xref>
- System x Support Portal:
<http://ibm.com/support/entry/portal/>
http://ibm.com/support/entry/portal/Downloads/Hardware/Systems/System_x/System_x3500_M5
- IBM System Storage Interoperation Center (SSIC):
<http://www.ibm.com/systems/support/storage/ssic>

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