

# Lenovo ThinkSystem ST650 V3 Server

## Product Guide

The Lenovo ThinkSystem ST650 V3 is an ideal 2-socket 4U tower server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The ST650 V3 is based on the new 4th generation Intel Xeon Scalable processor family.

The ST650 V3 is designed to handle a wide range of workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), infrastructure security, systems management, enterprise applications, collaboration/email, streaming media, web, and HPC.



Figure 1. Lenovo ThinkSystem ST650 V3

### Did you know?

The ThinkSystem ST650 V3 is an enterprise-grade tower server with support for hot-swap power supplies, fans, and drives. It also offers full support of Lenovo XClarity Administrator for comprehensive systems management and includes the UEFI-based Lenovo XClarity Provisioning Manager for system setup and diagnosis, and the Lenovo XClarity Controller management processor for ongoing systems management and alerting. These tools make the ST650 V3 easy to deploy, integrate, service, and manage.

The ST650 V3 is a very storage-rich tower offering, supporting up to 32x 2.5-inch drives or up to 16x 3.5-inch drives. Support includes up to 24x NVMe drives. The tower server can also be converted to a 4U rack server if needed.

## Key features

The ThinkSystem ST650 V3 is a high-performance dual-socket tower server based on the 4th Gen Intel Xeon Scalable processors, supporting a wide range of processors to suit a wide range of budgets and application requirements.

### Scalability and performance

The ST650 V3 offers numerous features to boost performance, improve scalability and reduce costs:

- Supports one or two fourth-generation Intel Xeon Processor Scalable processors
  - Up to 32 cores and 64 threads
  - Core speeds of up to 3.7 GHz
  - TDP ratings of up to 250 W
- Support for DDR5 memory DIMMs to maximize the performance of the memory subsystem:
  - Up to 32 DDR5 memory DIMMs, 16 DIMMs per processor
  - 8 memory channels per processor (2 DIMMs per channel)
  - Supports 1 DIMM per channel operating at 4800 MHz
  - Supports 2 DIMMs per channel operating at 4400 MHz
  - Using 128GB 3DS RDIMMs, the server supports up to 4TB of system memory
- Supports up to eight single-width GPUs or four double-wide GPUs, for substantial processing power in a tower system.
- Supports a variety of front-accessible drive bays:
  - Up to 32x 2.5-inch hot-swap drive bays with two 5.25-inch media bays
  - Up to 12x 3.5-inch hot-swap drive bays with two 5.25-inch media bays
  - Up to 16x 3.5-inch hot-swap drive bays without the media bays
- Supports up to 24x NVMe drives to maximize drive I/O performance, in terms of throughput, bandwidth, and latency.
- Supports up to 12x SATA drives using the onboard SATA controller (no additional adapter needed), enabling lower cost, high capacity storage solution.
- Supports high-speed RAID controllers from Broadcom providing 12 Gb SAS connectivity to the drive backplanes. A variety of PCIe 3.0 and PCIe 4.0 RAID adapters are available, including custom form factor (CFF) adapters that are cabled and don't occupy a PCIe slot.
- Supports M.2 drives for convenient operating system boot functions or data storage. Available M.2 adapters support either one M.2 drive or two M.2 drives.
- The server has two integrated 10GBASE-T ports for 10 GbE networking as well as support for additional network adapter cards.
- The server offers PCI Express 5.0 I/O expansion capabilities that doubles the theoretical maximum bandwidth of PCIe 4.0 (32GT/s in each direction for PCIe Gen 5, compared to 16 GT/s with PCIe Gen 4 and 8 GT/s with PCIe Gen 3). A PCIe 5.0 x16 slot provides 128 GB/s bandwidth, enough to support a dual-port 200GbE network connection.
- Up to nine PCIe slots, five of which are PCIe 5.0.

### Availability and serviceability

The ST650 V3 provides many features to simplify serviceability and increase system uptime:

- Designed to run 24 hours a day, 7 days a week
- The server offers Single Device Data Correction (SDDC, also known as Chipkill), Adaptive Double-Device Data Correction (ADDDC, also known as Redundant Bit Steering or RBS), and memory mirroring for redundancy in the event of a non-correctable memory failure. Note: ADDDC is not supported with 9x4 RDIMMs.
- The server offers hot-swap drives, supporting RAID redundancy for data protection and greater system uptime.

- Available M.2 adapters support RAID-1 (Intel VROC) which can enable two SATA or two NVMe M.2 drives to be configured as a redundant pair.
- The server has up to two hot-swap redundant power supplies and up to four large hot-swap redundant fans to provide availability for business-critical applications.
- The power-source-independent light path diagnostics uses LEDs to lead the technician to failed (or failing) components, which simplifies servicing, speeds up problem resolution, and helps improve system availability.
- Solid-state drives (SSDs) offer more reliability than traditional mechanical HDDs for greater uptime.
- Proactive Platform Alerts (including PFA and SMART alerts): Processors, voltage regulators, memory, internal storage (SAS/SATA HDDs and SSDs, NVMe SSDs, M.2 storage, flash storage adapters), fans, power supplies, RAID controllers, server ambient and subcomponent temperatures. Alerts can be surfaced through the XClarity Controller to managers such as Lenovo XClarity Administrator, VMware vCenter, and Microsoft System Center. These proactive alerts let you take appropriate actions in advance of possible failure, thereby increasing server uptime and application availability.
- The built-in XClarity Controller continuously monitors system parameters, triggers alerts, and performs recovery actions in case of failures to minimize downtime.
- Built-in diagnostics in UEFI, using Lenovo XClarity Provisioning Manager, speed up troubleshooting tasks to reduce service time.
- Lenovo XClarity Provisioning Manager supports diagnostics and can save service data to a USB key drive or remote CIFS share folder for troubleshooting and reduce service time.
- Auto restart in the event of a momentary loss of AC power (based on power policy setting in the XClarity Controller service processor)
- Offers a diagnostics port located at the rear of the server to allow you to attach an external diagnostics handset for enhanced systems management capabilities.
- Support for the XClarity Administrator Mobile app running on a supported smartphone and connected to the server through the service-enabled USB port, enables additional local systems management functions.
- Three-year or one-year customer-replaceable unit and onsite limited warranty, 9 x 5 next business day. Optional service upgrades are available.

### **Manageability and security**

Systems management features simplify local and remote management of the ST650 V3:

- The server includes XClarity Controller 2 (XCC2) to monitor server availability. Optional upgrade to XCC Platinum to provide remote control (keyboard video mouse) functions, support for the mounting of remote media files (ISO and IMG image files), boot capture, power capping and new XCC2 Platinum features. New XCC2 Platinum features include System Guard, new security modes including a CNSA-compliant mode, FIPS 140-3 and NIST 800-193 support, and a new Neighbor Group feature.
- Toolless cover removal provides easy access to upgrades and serviceable parts, such as CPU, memory, and adapter cards.
- Lenovo XClarity Administrator offers comprehensive hardware management tools that help to increase uptime, reduce costs and improve productivity through advanced server management capabilities.
- UEFI-based Lenovo XClarity Provisioning Manager, accessible from F1 during boot, provides system inventory information, graphical UEFI Setup, platform update function, RAID Setup wizard, operating system installation function, and diagnostic functions.
- Support for Lenovo XClarity Energy Manager, which captures real-time power and temperature data from the server and provides automated controls to lower energy costs.

- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Support for industry standard management protocols, IPMI 2.0, SNMP 3.0, Redfish REST API, serial console via IPMI
- Available physical security features include a lockable front door and a chassis intrusion switch to help prevent unauthorized access and notify administrators when the server cover has been removed.
- An integrated hardware Trusted Platform Module (TPM) supporting TPM 2.0 enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Administrator and power-on passwords help protect from unauthorized access to the server.
- Supports Secure Boot to ensure only a digitally signed operating system can be used. Supported with HDDs and SSDs, as well as M.2 drives.
- Industry-standard Advanced Encryption Standard (AES) NI support for faster, stronger encryption.
- Intel Execute Disable Bit functionality can prevent certain classes of malicious buffer overflow attacks when combined with a supported operating system.
- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, allowing an application to run in its own isolated space, protected from all other software running on a system.

### Energy efficiency

The ST650 V3 offers the following energy-efficiency features to save energy, reduce operational costs, and increase energy availability:

- Energy-efficient planar components help lower operational costs.
- High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications
- Solid-state drives (SSDs) consume as much as 80% less power than traditional spinning 2.5-inch HDDs.
- The server uses hexagonal ventilation holes, which can be grouped more densely than round holes, providing more efficient airflow through the system and thus keeping your system cooler.
- Optional Lenovo XClarity Energy Manager provides advanced data center power notification, analysis, and policy-based management to help achieve lower heat output and reduced cooling needs.

### Comparing the ST650 V3 to the ST650 V2

The ThinkSystem ST650 V3 improves on the previous generation ST650 V2, as summarized in the following table.

Table 1. Comparing the ThinkSystem ST650 V3 to the previous generation ST650 V2

| Feature   | ST650 V2   | ST650 V3   | Benefits   |
|-----------|--|--|--|
| Processor | <ul style="list-style-type: none"> <li>• 2x 3rd Gen Intel Xeon Scalable Processors</li> <li>• Core speeds up to 3.6 GHz</li> <li>• Up to 36 cores</li> <li>• TDP ratings up to 250W</li> <li>• 64x PCIe 4.0 lanes per processor</li> </ul> | <ul style="list-style-type: none"> <li>• 2x 4th Gen Intel Xeon Scalable Processors</li> <li>• Core speeds up to 3.7 GHz</li> <li>• Up to 32 cores</li> <li>• TDP ratings up to 250W</li> <li>• 80x PCIe 5.0 lanes per processor</li> </ul> | <ul style="list-style-type: none"> <li>• Latest generation processors</li> <li>• Increased performance</li> <li>• New PCIe 5.0 support means higher performance networking and NVMe storage</li> </ul> |

| Feature          | ST650 V2  | ST650 V3  | Benefits  |
|------------------|---|---|---|
| Memory           | <ul style="list-style-type: none"> <li>• DDR4 memory operating up to 3200 MHz</li> <li>• 8 channels per CPU</li> <li>• 32 DIMMs (16 per processor), 2 DIMMs per channel</li> <li>• Supports RDIMMs and 3DS RDIMMs</li> <li>• Up to 4TB of system memory</li> <li>• Intel Optane Persistent Memory 200 Series</li> </ul>   | <ul style="list-style-type: none"> <li>• DDR5 memory operating up to 4800 MHz</li> <li>• 8 channels per CPU</li> <li>• 32 DIMMs (16 per processor), 2 DIMMs per channel</li> <li>• Supports RDIMMs, 3DS RDIMMs and 9x4 RDIMMs</li> <li>• Up to 4TB of system memory</li> <li>• No persistent memory support</li> </ul>  | <ul style="list-style-type: none"> <li>• New DDR5 memory offers significant performance improvements over DDR4</li> <li>• Support for lower-cost 9x4 DIMMs</li> </ul>   |
| Internal storage | <ul style="list-style-type: none"> <li>• Up to 16x 3.5" HS SAS/SATA (up to 8x optional NVMe SSDs)</li> <li>• Up to 32x 2.5" HS SAS/SATA (up to 16x optional NVMe SSDs)</li> <li>• Up to 12x 3.5" SS SATA</li> <li>• Optional 2x 5.25" drive bays for optical/backup drives</li> <li>• 2x Internal M.2 with RAID (hardware RAID or Intel VROC)</li> <li>• 8x Onboard NVMe ports</li> <li>• NVMe Retimer adapters for 16x NVMe</li> </ul> | <ul style="list-style-type: none"> <li>• Up to 16x 3.5" HS SAS/SATA (up to 16x optional NVMe SSDs)</li> <li>• Up to 32x 2.5" HS SAS/SATA (up to 24x optional NVMe SSDs)</li> <li>• No support for simple-swap drives</li> <li>• Optional 2x 5.25" drive bays for optical/backup drives</li> <li>• 2x Internal M.2 with RAID (Intel VROC)</li> <li>• 12x Onboard NVMe ports</li> <li>• NVMe Retimer adapters for 24x NVMe</li> </ul> | <ul style="list-style-type: none"> <li>• Flexible storage offerings</li> <li>• Up to 24x NVMe drives for high-performance storage</li> <li>• 2X performance improvement with PCIe Gen5 NVMe</li> <li>• Additional NVMe ports means no need for Retimer adapters, freeing up slots for other adapters</li> </ul> |
| RAID             | <ul style="list-style-type: none"> <li>• 8-, 16- and 32-port RAID adapters with up to 8GB flash</li> <li>• Support for Lenovo and Broadcom adapters</li> <li>• Support for PCIe or Internal cabled (CFF) form factor adapters</li> <li>• Storage HBAs available</li> <li>• PCIe 3.0 and PCIe 4.0 adapter choices</li> <li>• Onboard SATA and NVMe support with VROC RAID</li> </ul>   | <ul style="list-style-type: none"> <li>• 8-, 16- and 32-port RAID adapters with up to 8GB flash</li> <li>• Support for Lenovo and Broadcom adapters</li> <li>• Support for PCIe or Internal cabled (CFF) form factor adapters</li> <li>• Storage HBAs available</li> <li>• PCIe 3.0 and PCIe 4.0 adapter choices with support for Gen 5 adapters when available</li> <li>• Onboard SATA and NVMe support with VROC RAID</li> </ul>  | <ul style="list-style-type: none"> <li>• Consistent RAID/HBA support</li> <li>• Flexible config solution</li> <li>• PCIe Gen 5 allows for greater storage performance</li> </ul>  |
| Networking       | <ul style="list-style-type: none"> <li>• 2x 10GbE embedded</li> <li>• 1GbE dedicated Management port</li> <li>• Additional PCIe adapters supported</li> </ul>   | <ul style="list-style-type: none"> <li>• 2x 10GbE embedded</li> <li>• 1GbE dedicated Management port</li> <li>• Additional PCIe adapters supported</li> </ul>   | <ul style="list-style-type: none"> <li>• 10GbE for built-in networking</li> </ul>   |

| Feature                 | ST650 V2   | ST650 V3   | Benefits  |
|-------------------------|--|--|---|
| PCIe                    | <ul style="list-style-type: none"> <li>• Supports PCIe Gen4</li> <li>• Up to 9 slots total (1 is optional)</li> <li>• 4x PCIe Gen4 x16 slots</li> <li>• Up to 4x PCIe x8 (3x Gen4, 1x Gen3)</li> <li>• 1x PCIe Gen4 x4 slot</li> <li>• Separate M.2 adapter support</li> </ul>                 | <ul style="list-style-type: none"> <li>• Supports PCIe Gen5</li> <li>• Up to 9 slots total</li> <li>• 5x PCIe Gen5 slots (three x16 slots and two x8 slots)</li> <li>• 4x PCIe Gen4 slots (one x16 slots and three x8 slots)</li> <li>• 12x onboard NVMe connectors (12 x Gen4)</li> <li>• Separate M.2 adapter support</li> </ul> | <ul style="list-style-type: none"> <li>• PCIe Gen 5 allows for greater I/O performance</li> <li>• Flexible PCIe offerings</li> </ul>  |
| GPU support             | <ul style="list-style-type: none"> <li>• Up to 4x active DW or 8x SW GPU adapters</li> </ul>   | <ul style="list-style-type: none"> <li>• Up to 4x active DW or 8x SW GPU adapters</li> </ul>   | <ul style="list-style-type: none"> <li>• Support for the latest GPUs</li> </ul>   |
| Management and security | <ul style="list-style-type: none"> <li>• XClarity Controller</li> <li>• Support for full XClarity toolset including XClarity Administrator</li> <li>• Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT)</li> <li>• Tamper Switch security solution (intrusion switch)</li> </ul> | <ul style="list-style-type: none"> <li>• Integrated XClarity Controller 2</li> <li>• Support for full XClarity toolset including XClarity Administrator</li> <li>• Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT)</li> <li>• Tamper Switch security solution (intrusion switch)</li> </ul>                        | <ul style="list-style-type: none"> <li>• New XCC2 offers improved management capabilities</li> <li>• Same system management tool with previous generation</li> <li>• Silicon-level security solution</li> </ul> |
| Power                   | <ul style="list-style-type: none"> <li>• 2x Hot-swap PSUs up to 2400W, Platinum</li> <li>• 750W Hot-swap Titanium PSU</li> <li>• 240V HVDC support for PRC customers</li> <li>• Active-Standby mode</li> </ul>   | <ul style="list-style-type: none"> <li>• 2x Hot-swap PSUs up to 2600W, Platinum</li> <li>• Available in Titanium and Platinum efficiency levels</li> <li>• 1100W -48VDC Platinum general support</li> <li>• 240V HVDC support for PRC customers</li> <li>• Active-Standby mode</li> </ul>  | <ul style="list-style-type: none"> <li>• Multiple PSU offerings to suit the configuration selected</li> <li>• New ErP Lot 9-compliant offerings</li> </ul>  |

## Components and connectors

The following figure shows the front of the server.

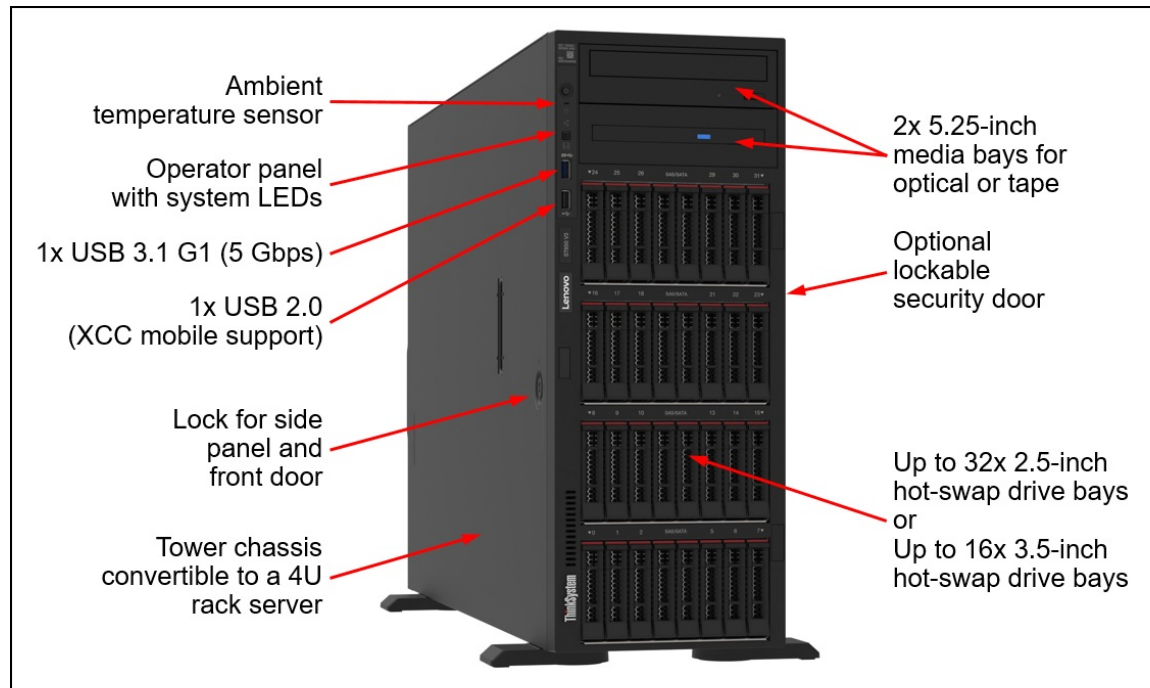


Figure 2. Front view of the ThinkSystem ST650 V3

The following figure shows the four drive bay combinations that the server supports.

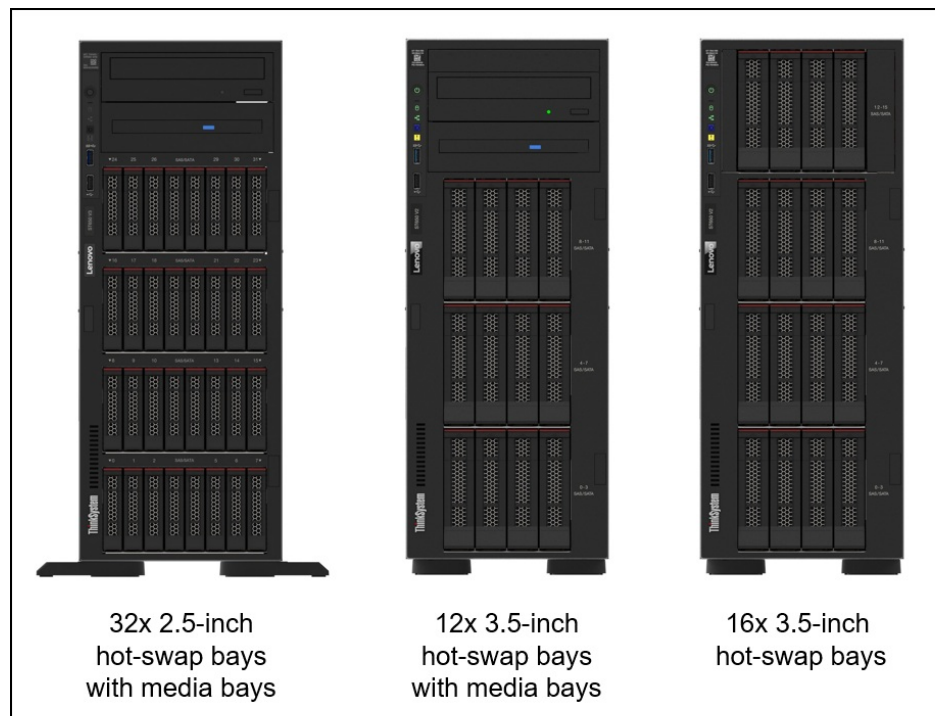


Figure 3. Drive bay combinations of the ThinkSystem ST650 V3

The following figure shows the components visible from the rear of the server.

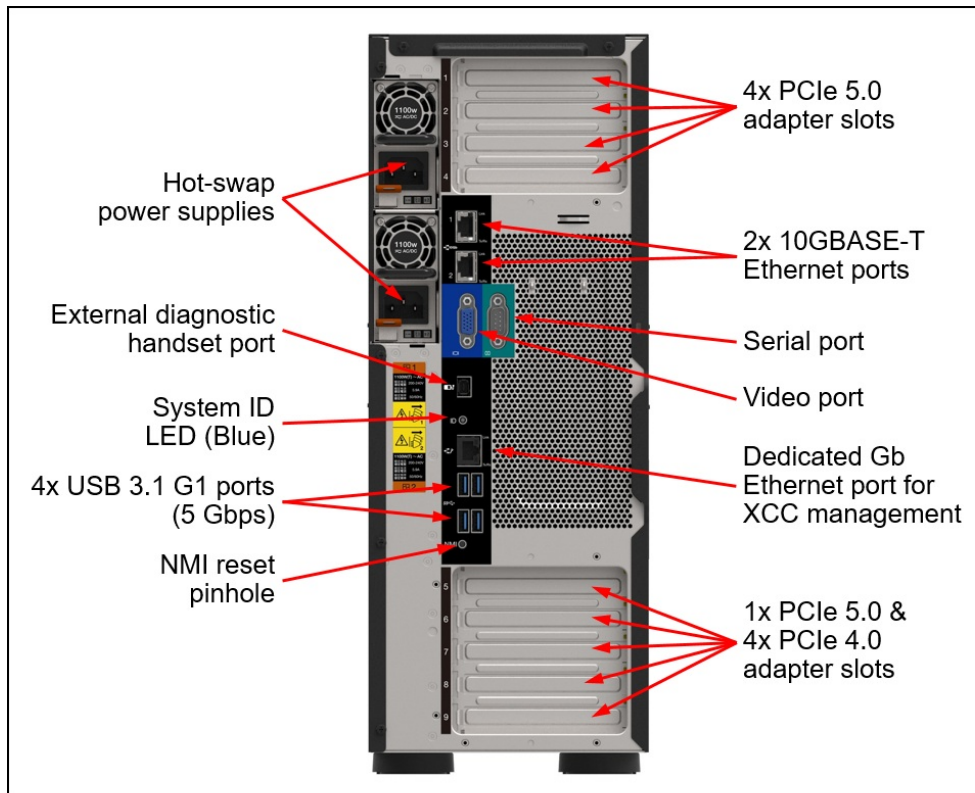


Figure 4. Rear view of the ThinkSystem ST650 V3



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

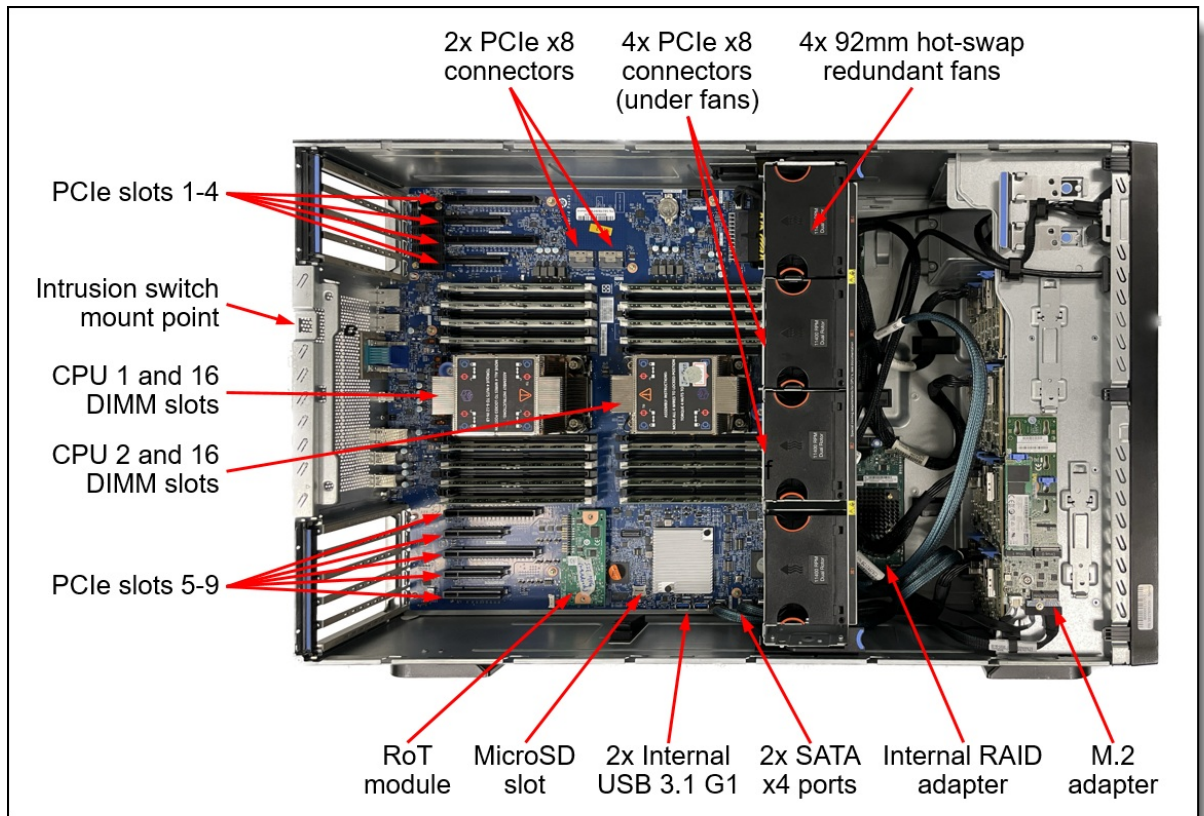


Figure 5. Internal view of the ThinkSystem ST650 V3

## System architecture

The following figure shows the architectural block diagram of the ST650 V3, showing the major components and their connections.

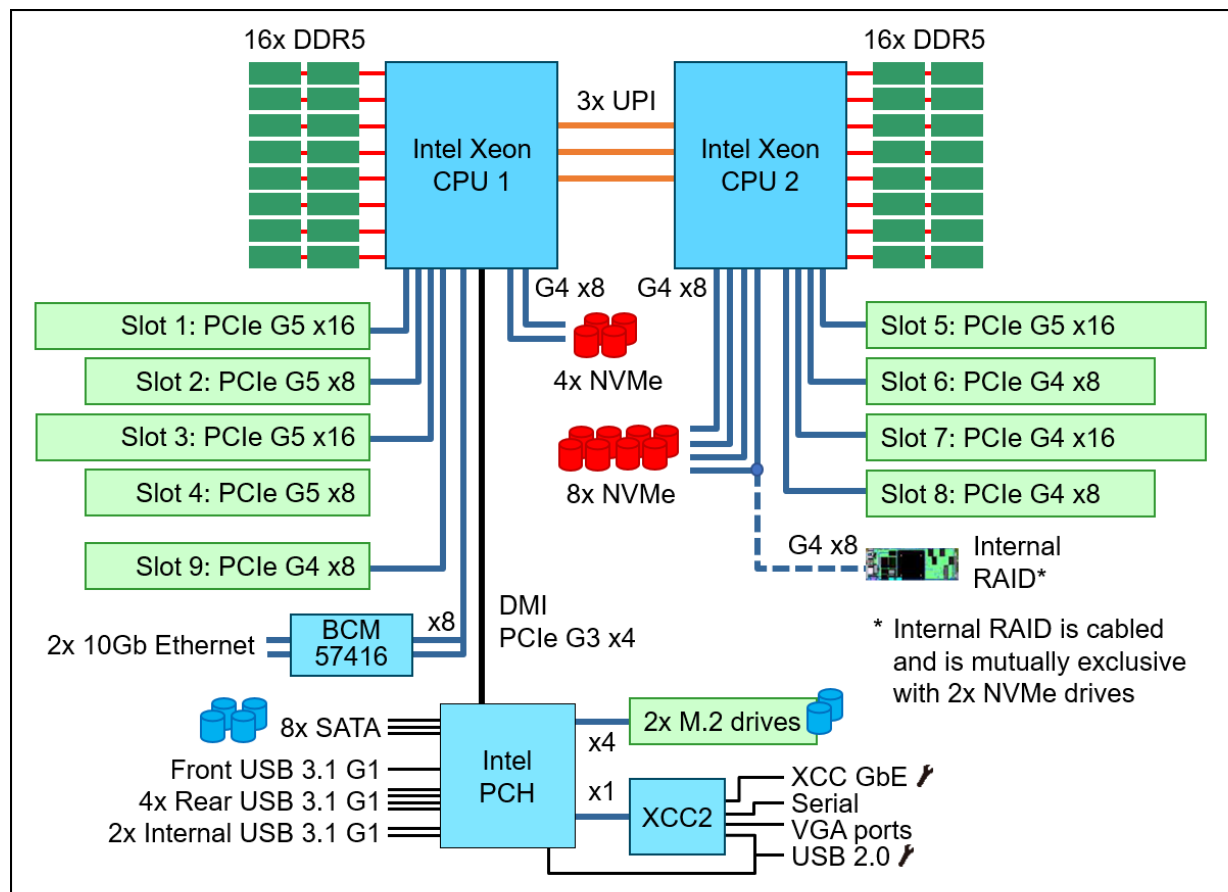


Figure 6. ST650 V3 system architectural block diagram

## Standard specifications

The following table lists the standard specifications.

Table 2. Standard specifications

| Components    | Specification   |
|---------------|---|
| Machine types | 7D7B - 1 year warranty<br>7D7A - 3 year warranty  |
| Form factor   | Tower or 4U Rack  |
| Processor     | One or two 4th Gen Intel Xeon Scalable processor (formerly codenamed "Sapphire Rapids"). Supports processors up to 32 cores, core speeds of up to 3.7 GHz, and TDP ratings of up to 250 W.  |
| Chipset       | Intel C741 "Emmitsburg" chipset, part of the platform codenamed "Eagle Stream"  |
| Memory        | 32 DIMM slots with two processors (16 DIMM slots per processor). Each processor has 8 memory channels, with 2 DIMMs per channel (DPC). Lenovo TruDDR5 RDIMMs, 9x4 RDIMMs, and 3DS RDIMMs are supported. DIMMs operate at up to 4800 MHz at 1 DPC and up to 4400 MHz at 2 DPC. |

| <b>Components</b>                 | <b>Specification</b>   |
|-----------------------------------|--|
| Persistent memory                 | No support   |
| Memory maximum                    | Up to 4TB by using 32x 128GB 3DS RDIMMs  |
| Memory protection                 | ECC, SDDC (for x4-based memory DIMMs), ADDDC (for x4-based memory DIMMs excluding 9x4 RDIMMs, requires Platinum or Gold processors), and memory mirroring.   |
| Disk drive bays                   | <p>2.5-inch drive bays:</p> <ul style="list-style-type: none"> <li>Up to 32x 2.5-inch hot-swap bays (24x NVMe) plus 2x 5.25-inch media bays</li> </ul> <p>3.5-inch drive bays:</p> <ul style="list-style-type: none"> <li>Up to 16x 3.5-inch hot-swap bays (16x NVMe) (no media bays)</li> <li>Up to 12x 3.5-inch hot-swap bays (12x NVMe) plus 2x 5.25-inch media bays</li> </ul> <p>Internal drives for OS boot or drive storage:</p> <ul style="list-style-type: none"> <li>Internal M.2 module supporting up to two M.2 drives</li> </ul>  |
| Maximum internal storage          | <ul style="list-style-type: none"> <li>2.5-inch drives: <ul style="list-style-type: none"> <li>245.76TB using 32x 7.68TB 2.5-inch SAS/SATA SSDs</li> <li>92.16TB using 24x 3.84TB 2.5-inch NVMe SSDs</li> <li>76.8TB using 32x 2.4TB 2.5-inch HDDs</li> </ul> </li> <li>3.5-inch drives: <ul style="list-style-type: none"> <li>352TB using 16x 22TB 3.5-inch HDDs</li> <li>122.88TB using 16x 7.68TB 3.5-inch SAS/SATA SSDs</li> <li>61.44TB using 16x 3.84TB 3.5-inch NVMe SSDs</li> </ul> </li> </ul>   |
| Storage controller                | <ul style="list-style-type: none"> <li>8x onboard SATA ports (Intel VROC SATA RAID, formerly known as Intel RSTe RAID)</li> <li>Up to 12x onboard NVMe ports (includes Intel VROC NVMe RAID, with optional license for non-Intel NVMe SSDs)</li> <li>NVMe Retimer Adapter (supports Intel VROC NVMe RAID)</li> <li>12 Gb SAS/SATA RAID adapters <ul style="list-style-type: none"> <li>8, 16 or 32 ports</li> <li>Up to 8GB flash-backed cache</li> <li>PCIe 4.0 or PCIe 3.0 host interface</li> </ul> </li> <li>12 Gb SAS/SATA HBA (non-RAID) <ul style="list-style-type: none"> <li>8-port and 16-port</li> <li>PCIe 4.0 or PCIe 3.0 host interface</li> </ul> </li> </ul> |
| Optical drive and tape drive bays | Two half-height 5.25-inch media bays, available in most configurations. Supports two of LTO tape drive, RDX drive, or slim DVD-RW optical drive.   |
| Network interfaces                | Two onboard 10GBASE-T Ethernet RJ45 ports based on a Broadcom BCM57416 controller. Additional dedicated Gigabit port for remote management via the XClarity Controller (XCC) management processor.   |

| Components                  | Specification  |
|-----------------------------|--|
| PCI Expansion slots         | <p>9x PCIe slots: 5x PCIe 5.0 and 4x PCIe 4.0 slots. All nine slots are mounted on the system board. Slots 1-8 are full height, full length (FHFL); slot 9 is full height, half length (FHHL). Slots 4-8 require CPU 2 installed.</p> <ul style="list-style-type: none"> <li>● Slot 1: PCIe 5.0 x16 (CPU 1)</li> <li>● Slot 2: PCIe 5.0 x8 (x8 physical slot) (CPU 1)</li> <li>● Slot 3: PCIe 5.0 x16 (CPU 1)</li> <li>● Slot 4: PCIe 5.0 x8 (x8 physical slot) (CPU 1)</li> <li>● Slot 5: PCIe 5.0 x16 (CPU 2)</li> <li>● Slot 6: PCIe 4.0 x8 (x8 physical slot) (CPU 2)</li> <li>● Slot 7: PCIe 4.0 x16 (CPU 2)</li> <li>● Slot 8: PCIe 4.0 x8 (x8 physical slot) (CPU 2)</li> <li>● Slot 9: PCIe 4.0 x8 (x8 physical slot) (CPU 1)</li> </ul> <p>The server also supports the installation of a RAID adapter or HBA in a dedicated area that does not consume any of the PCIe slots. See the location of the Internal RAID adapter (cabled) in the <a href="#">Internal view</a> of the server.</p> |
| GPU support                 | Supports up to 8x single-wide GPUs or up to 4x double-wide GPUs  |
| Ports                       | <p>Front: 1x USB 3.2 G1 (5 Gb/s) port, 1x USB 2.0 port (also for XCC local management)</p> <p>Rear: 2x 10GBASE-T RJ45 Ethernet ports, 4x USB 3.2 G1 (5 Gb/s) ports, 1x VGA video port, 1x DB-9 COM serial port, 1x 1GbE RJ-45 systems management port for XCC remote management, External diagnostics port</p> <p>Internal: 2x USB 3.2 G1 connector for operating system or license key purposes</p>   |
| Cooling                     | Up to 4x single-rotor or dual-rotor hot swap 92 mm fans, configuration dependent. Fans are N+1 redundant. One additional fan integrated in each power supply.  |
| Power supply                | Up to two hot-swap redundant AC power supplies, 80 PLUS Platinum or 80 PLUS Titanium certification. 750 W, 1100 W, 1800 W and 2600 W AC options, supporting 220 V AC. 750 W and 1100 W options also support 110V input supply. In China only, all power supply options support 240 V DC.   |
| Video                       | Embedded graphics with 16 MB memory with 2D hardware accelerator, integrated into the XClarity Controller 2 management controller. Maximum resolution is 1920x1200 32bpp at 60Hz.  |
| Hot-swap parts              | Drives, power supplies, and fans.  |
| Systems management          | Operator panel with status LEDs. Optional External Diagnostics Handset with LCD display. XClarity Controller 2 (XCC2) embedded management controller, XClarity Administrator centralized infrastructure delivery, XClarity Integrator plugins, and XClarity Energy Manager centralized server power management. Optional XClarity Controller Platinum to enable remote control and other functions.  |
| Security features           | Power-on password, administrator's password, Root of Trust module supporting TPM 2.0 and Platform Firmware Resiliency (PFR). Optional lockable front security door and optional chassis intrusion switch.  |
| Operating systems supported | Microsoft Windows Server, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, VMware ESXi. See the <a href="#">Operating system support</a> section for specifics.   |
| Limited warranty            | Three-year or one-year (model dependent) customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD).   |
| Service and support         | Optional service upgrades are available through Lenovo Services: 4-hour or 2-hour response time, 6-hour fix time, 1-year or 2-year warranty extension, software support for Lenovo hardware and some third-party applications.   |

| Components | Specification   |
|------------|---|
| Dimensions | Width: 175 mm (6.9 in.), height: 462 mm (18.2 in.), depth: 734 mm (28.9 in.). See <a href="#">Physical and electrical specifications</a> for details. |
| Weight     | 39.1 kg (86.2 lb) maximum   |

## Models

ThinkSystem ST650 V3 models can be configured by using the [Lenovo Data Center Solution Configurator \(DCSC\)](#).

Topics in this section:

- [CTO models](#)
- [Base feature codes](#)
- [Preconfigured models](#)

### CTO models

ThinkSystem ST650 V3 models can be configured by using the [Lenovo Data Center Solution Configurator \(DCSC\)](#).

**Controlled GPU models:** The "Controlled GPU" base CTO models listed in the table are the only models that support high-performance GPUs and accelerators. These models are classified under US Government ECCN regulations and have limited market and customer availability. All other base models do not support high-performance GPUs.

Preconfigured server models may also be available for the ST650 V3, however these are region-specific; that is, each region may define their own server models, and not all server models are available in every region.

The following table lists the base CTO models of the ThinkSystem ST650 V3 server.

Table 3. Base CTO models

| Machine Type/Model | Description   |
|--------------------|---|
| 7D7ACTO1WW         | ThinkSystem ST650 V3 3yr Warranty                     |
| 7D7ACTOAWW         | ThinkSystem ST650 V3 3yr Warranty with Controlled GPU |
| 7D7BCTO1WW         | ThinkSystem ST650 V3 – 1-year warranty                |

The following table lists the base CTO models of the ThinkSystem ST658 V3 server, which has the same features as the ST650 V3 but is only available in China.

Table 4. Base CTO model of the ST658 V3

| Machine Type/Model | Description                                       |
|--------------------|---|
| 7D7CCTO1WW         | ThinkSystem ST658 V3 – 3-year Warranty (PRC only) |

### Base feature codes

Models of the ST650 V3 are defined based on whether the server has 2.5-inch drive bays at the front (called the 2.5-inch chassis) or whether it has 3.5-inch drive bays at the front (called the 3.5-inch chassis). For models, the feature codes for these chassis bases are as listed in the following table.

Table 5. Chassis base feature codes

| Feature code | Description                              |
|--------------|--|
| BNW0         | ThinkSystem ST650 V3 - 2.5" Chassis Base |
| BNW1         | ThinkSystem ST650 V3 - 3.5" Chassis Base |

### Preconfigured models

The following tables list the available preconfigured models, grouped by region.

- [Models for Australia and New Zealand](#)
- [Models for Brazil](#)
- [Models for EMEA region](#)
- [Models for India](#)
- [Models for Japan](#)
- [Models for Latin American countries \(except Brazil\)](#)
- [Models for USA and Canada](#)

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

### Models for Australia and New Zealand

Table 6. Models for Australia and New Zealand

| Model   | Intel Xeon Scalable processor†   | Memory          | RAID     | Drive bays              | Top bay               | XCC | Intru. sw. | Fans       | Power supplies | Power cords |
|---|----------------------------------|-----------------|----------|-------------------------|-----------------------|-----|------------|------------|----------------|-------------|
| TopSeller models with a 3-year warranty (machine type 7D7A) |                                  |                 |          |                         |                       |     |            |            |                |             |
| 7D7AA01MAU  | 1x Silver 4410Y<br>12C 150W 2.0G | 1x 16GB         | 5350-8i  | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Std | No         | 3x<br>Perf | 1x750W         | Yes         |
| 7D7AA01QAU  | 1x Silver 4410Y<br>12C 150W 2.0G | 1x 16GB         | 9350-8i  | 4x 3.5" SAS<br>Open bay | 4x 3.5";<br>No media  | Std | No         | 3x<br>Perf | 1x750W         | Yes         |
| 7D7AA01RAU  | 1x Silver 4410Y<br>12C 150W 2.0G | 1x 16GB         | 9350-8i  | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Std | No         | 3x<br>Perf | 1x750W         | Yes         |
| 7D7AA01SAU  | 1x Silver 4410Y<br>12C 150W 2.0G | 1x 16GB         | 9350-16i | 4x 3.5" SAS<br>Open bay | 4x 3.5";<br>No media  | Std | No         | 3x<br>Perf | 1x750W         | Yes         |
| 7D7AA01LAU  | 1x Gold 5416S<br>16C 150W 2.0G   | 1x 32GB<br>2Rx8 | 9350-8i  | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Std | No         | 3x<br>Perf | 1x750W         | Yes         |
| 7D7AA01NAU  | 1x Gold 5418Y<br>24C 185W 2.0G   | 1x 32GB<br>2Rx8 | 9350-8i  | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Std | No         | 3x<br>Perf | 1x750W         | Yes         |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

### Models for Brazil

Table 7. Models for Brazil

| Model  | Intel Xeon Scalable processor†   | Memory          | RAID    | Drive bays              | Top bay               | XCC  | Intru. sw. | Fans       | Power supplies | Power cords |
|--|----------------------------------|-----------------|---------|-------------------------|-----------------------|------|------------|------------|----------------|-------------|
| Standard models with a 3-year warranty (machine type 7D7A) |                                  |                 |         |                         |                       |      |            |            |                |             |
| 7D7AA03FBR   | 1x Silver 4410T<br>10C 150W 2.7G | 1x 32GB<br>1Rx4 | 9350-8i | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | No         | 3x<br>Perf | 1x750W         | Yes         |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

## Models for EMEA region

Table 8. Models for EMEA region

| Model  | Intel Xeon Scalable processor†   | Memory          | RAID          | Drive bays              | Top bay               | XCC  | Intru. sw. | Fans       | Power supplies      | Power cords |
|--|----------------------------------|-----------------|---------------|-------------------------|-----------------------|------|------------|------------|---------------------|-------------|
| Standard models with a 3-year warranty (machine type 7D7A) |                                  |                 |               |                         |                       |      |            |            |                     |             |
| 7D7AA00YEA   | 1x Bronze 3408U<br>8C 125W 1.8G  | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA019EA   | 1x Bronze 3408U<br>8C 125W 1.8G  | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA01JEA   | 1x Bronze 3408U<br>8C 125W 1.8G  | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA00VEA   | 1x Silver 4410Y 12C<br>150W 2.0G | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01AEA   | 1x Silver 4410Y 12C<br>150W 2.0G | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA01KEA   | 1x Silver 4410Y 12C<br>150W 2.0G | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA00ZEA   | 1x Silver 4416+ 20C<br>165W 2.0G | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01BEA   | 1x Silver 4416+ 20C<br>165W 2.0G | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA00WEA   | 1x Gold 5415+ 8C<br>150W 2.9G    | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01CEA   | 1x Gold 5415+ 8C<br>150W 2.9G    | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA011EA   | 1x Gold 5416S 16C<br>150W 2.0G   | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01DEA   | 1x Gold 5416S 16C<br>150W 2.0G   | 1x 32GB<br>1Rx4 | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 3x<br>Std  | 1x1100W<br>Titanium | Yes         |
| 7D7AA00SEA   | 1x Gold 6426Y 16C<br>185W 2.5G   | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01EEA   | 1x Gold 6426Y 16C<br>185W 2.5G   | 1x 64GB         | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA00UEA   | 1x Gold 6438Y+<br>32C 205W 2.0G  | 1x 64GB         | 940-8i<br>4GB | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |
| 7D7AA01FEA   | 1x Gold 6438Y+<br>32C 205W 2.0G  | 1x 64GB         | 9350-8i       | 8x 2.5" SAS<br>Open bay | 2x Media;<br>Open bay | Plat | Yes        | 4x<br>Perf | 1x1100W<br>Titanium | Yes         |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

## Models for India

Table 9. Models for India

| Model   | Intel Xeon Scalable processor† | Memory       | RAID    | Drive bays           | Top bay            | XCC | Intru. sw. | Fans    | Power supplies   | Power cords |
|---|--------------------------------|--------------|---------|----------------------|--------------------|-----|------------|---------|------------------|-------------|
| TopSeller models with a 3-year warranty (machine type 7D7A) |                                |              |         |                      |                    |     |            |         |                  |             |
| 7D7AA02ZSG  | 1x Silver 4410Y 12C 150W 2.0G  | 1x 32GB 2Rx8 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 2x1100W Titanium | No          |
| 7D7AA030SG  | 1x Silver 4410Y 12C 150W 2.0G  | 1x 32GB 2Rx8 | 5350-8i | 8x 3.5" SAS Open bay | 4x 3.5"; No media  | Std | No         | 3x Perf | 2x1100W Titanium | No          |
| 7D7AA033SG  | 1x Silver 4410Y 12C 150W 2.0G  | 1x 32GB 1Rx4 | 5350-8i | 4x 3.5" SAS Open bay | 4x 3.5"; No media  | Std | No         | 3x Perf | 1x1100W Titanium | No          |
| 7D7AA034SG  | 1x Silver 4410Y 12C 150W 2.0G  | 1x 32GB 1Rx4 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 1x1100W Titanium | No          |
| 7D7AA035SG  | 1x Silver 4416+ 20C 165W 2.0G  | 1x 32GB 1Rx4 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 1x1100W Titanium | No          |
| 7D7AA02YSG  | 1x Gold 5412U 24C 185W 2.1G    | 1x 32GB 2Rx8 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 2x1100W Titanium | No          |
| 7D7AA031SG  | 1x Gold 5416S 16C 150W 2.0G    | 1x 32GB 2Rx8 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 2x1100W Titanium | No          |
| 7D7AA032SG  | 1x Gold 5416S 16C 150W 2.0G    | 1x 32GB 1Rx4 | 5350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Std | No         | 3x Perf | 1x1100W Titanium | No          |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

## Models for Japan

**AP models:** Customers in Japan also have access to the [Asia Pacific region](#) models.

All models for Japan have the following features:

- Japanese keyboard
- Optical Wheel Mouse
- Security Door

Table 10. Models for Japan

| Model  | Intel Xeon Scalable processor† | Memory  | RAID    | Drive bays           | Top bay          | XCC | Intru. sw. | Fans   | Power supplies | Power cords |
|--|--------------------------------|---------|---------|----------------------|------------------|-----|------------|--------|----------------|-------------|
| Standard models with a 3-year warranty (machine type 7D7A) |                                |         |         |                      |                  |     |            |        |                |             |
| 7D7AA03DJP   | 1x Silver 4410T 10C 150W 2.7G  | 1x 16GB | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; 1x DVD | Std | No         | 3x Std | 1x750W         | Yes         |
| 7D7AA03EJP   | 1x Gold 5416S 16C 150W 2.0G    | 1x 16GB | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; 1x DVD | Std | No         | 3x Std | 1x750W         | Yes         |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency



## Models for Latin American countries (except Brazil)

Table 11. Models with a 3-year warranty for Latin American countries (except Brazil)

| Model  | Intel Xeon Scalable processor† | Memory  | RAID    | Drive bays           | Top bay           | XCC | Intru. sw. | Fans    | Power supplies | Power cords |
|--|--------------------------------|---------|---------|----------------------|-------------------|-----|------------|---------|----------------|-------------|
| Standard models with a 3-year warranty (machine type 7D7A) |                                |         |         |                      |                   |     |            |         |                |             |
| 7D7AA036LA   | 1x Bronze 3408U 8C 125W 1.8G   | 1x 16GB | 9350-8i | 4x 3.5" SAS Open bay | 4x 3.5"; No media | Std | No         | 3x Perf | 1x750W         | No          |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

## Models for USA and Canada

Table 12. Models for USA and Canada

| Model  | Intel Xeon Scalable processor† | Memory       | RAID    | Drive bays           | Top bay            | XCC  | Intru. sw. | Fans   | Power supplies | Power cords |
|--|--------------------------------|--------------|---------|----------------------|--------------------|------|------------|--------|----------------|-------------|
| Standard models with a 3-year warranty (machine type 7D7A) |                                |              |         |                      |                    |      |            |        |                |             |
| 7D7A1009NA   | 1x Silver 4410T 10C 150W 2.7G  | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |
| 7D7A100BNA   | 1x Silver 4410T 10C 150W 2.7G  | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |
| 7D7A1007NA   | 1x Silver 4410Y 12C 150W 2.0G  | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |
| 7D7A1005NA   | 1x Silver 4416+ 20C 165W 2.0G  | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |
| 7D7A1008NA   | 1x Gold 6426Y 16C 185W 2.5G    | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |
| 7D7A100ANA   | 1x Gold 6426Y 16C 185W 2.5G    | 1x 32GB 2Rx8 | 9350-8i | 8x 2.5" SAS Open bay | 2x Media; Open bay | Plat | No         | 4x Std | 1x750W         | Yes         |

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

## Processors

The ST650 V3 supports processors in the 4th Gen Intel Xeon Scalable Processor family. The server supports one or two processors.

Topics in this section:

- [Processor options](#)
- [Processor features](#)
- [One-processor configurations](#)
- [Thermal restrictions by processor](#)
- [UEFI operating modes](#)

### Processor options

All supported processors have the following characteristics:

- 8 DDR5 memory channels at 2 DIMMs per channel
- Up to 3 UPI links between processors at 16 GT/s
- 80 PCIe 5.0 I/O lanes

The following table lists the 4th Gen processors that are currently supported by the ST650 V3.

Table 13. 4th Gen Intel Xeon Processor support

| Part number | Feature code | SKU   | Description   | Maximum quantity |
|-------------|--------------|-------|---|------------------|
| CTO only    | BQ68         | 3408U | Intel Xeon Bronze 3408U 8C 125W 1.8GHz Processor  | 1*               |
| 4XG7A85277  | BQ64         | 4410T | ThinkSystem ST650 V3 Intel Xeon Silver 4410T 10C 150W 2.7GHz Processor Option Kit w/o Fan | 2                |
| 4XG7A85282  | BQ67         | 4410Y | ThinkSystem ST650 V3 Intel Xeon Silver 4410Y 12C 150W 2.0GHz Processor Option Kit w/o Fan | 2                |
| 4XG7A85296  | BQ69         | 4416+ | ThinkSystem ST650 V3 Intel Xeon Silver 4416+ 20C 165W 2.0GHz Processor Option Kit w/o Fan | 2                |
| CTO only    | BQ6J         | 5411N | Intel Xeon Gold 5411N 24C 165W 1.9GHz Processor   | 1*               |
| CTO only    | BU1V         | 5412U | Intel Xeon Gold 5412U 24C 185W 2.1GHz Processor   | 1*               |
| 4XG7A85293  | BQ63         | 5415+ | ThinkSystem ST650 V3 Intel Xeon Gold 5415+ 8C 150W 2.9GHz Processor Option Kit w/o Fan    | 2                |
| 4XG7A85298  | BQ6L         | 5416S | ThinkSystem ST650 V3 Intel Xeon Gold 5416S 16C 150W 2.0GHz Processor Option Kit w/o Fan   | 2                |
| 4XG7A85287  | BQ6H         | 5418N | ThinkSystem ST650 V3 Intel Xeon Gold 5418N 24C 165W 1.8GHz Processor Option Kit w/o Fan   | 2                |
| 4XG7A85281  | BQ66         | 5418Y | ThinkSystem ST650 V3 Intel Xeon Gold 5418Y 24C 185W 2.0GHz Processor Option Kit w/o Fan   | 2                |
| 4XG7A85279  | BQ65         | 5420+ | ThinkSystem ST650 V3 Intel Xeon Gold 5420+ 28C 205W 2.0GHz Processor Option Kit w/o Fan   | 2                |
| CTO only    | BPPD         | 6414U | Intel Xeon Gold 6414U 32C 250W 2.0GHz Processor   | 1*               |
| 4XG7A85285  | BQ6C         | 6416H | ThinkSystem ST650 V3 Intel Xeon Gold 6416H 18C 165W 2.2GHz Processor Option Kit w/o Fan   | 2                |
| 4XG7A85284  | BQ6B         | 6418H | ThinkSystem ST650 V3 Intel Xeon Gold 6418H 24C 185W 2.1GHz Processor Option Kit w/o Fan   | 2                |
| CTO only    | BQ6G         | 6421N | Intel Xeon Gold 6421N 32C 185W 1.8GHz Processor   | 1*               |

| Part number | Feature code | SKU    | Description   | Maximum quantity |
|-------------|--------------|--------|---|------------------|
| 4XG7A85288  | BPQF         | 6426Y  | ThinkSystem ST650 V3 Intel Xeon Gold 6426Y 16C 185W 2.5GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85289  | BQ6F         | 6428N  | ThinkSystem ST650 V3 Intel Xeon Gold 6428N 32C 185W 1.8GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85278  | BPQC         | 6434   | ThinkSystem ST650 V3 Intel Xeon Gold 6434 8C 195W 3.7GHz Processor Option Kit w/o Fan       | 2                |
| 4XG7A85286  | BQ6E         | 6434H  | ThinkSystem ST650 V3 Intel Xeon Gold 6434H 8C 195W 3.7GHz Processor Option Kit w/o Fan      | 2                |
| 4XG7A85290  | BQ6K         | 6438M  | ThinkSystem ST650 V3 Intel Xeon Gold 6438M 32C 205W 2.2GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85297  | BQ6D         | 6438N  | ThinkSystem ST650 V3 Intel Xeon Gold 6438N 32C 205W 2.0GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85291  | BQ62         | 6438Y+ | ThinkSystem ST650 V3 Intel Xeon Gold 6438Y+ 32C 205W 2.0GHz Processor Option Kit w/o Fan    | 2                |
| 4XG7A85294  | BPQE         | 6442Y  | ThinkSystem ST650 V3 Intel Xeon Gold 6442Y 24C 225W 2.6GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85295  | BQ6A         | 6448H  | ThinkSystem ST650 V3 Intel Xeon Gold 6448H 32C 250W 2.4GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85292  | BPQD         | 6448Y  | ThinkSystem ST650 V3 Intel Xeon Gold 6448Y 32C 225W 2.1GHz Processor Option Kit w/o Fan     | 2                |
| 4XG7A85280  | BPPG         | 8450H  | ThinkSystem ST650 V3 Intel Xeon Platinum 8450H 28C 250W 2.0GHz Processor Option Kit w/o Fan | 2                |

\* These processors are single-socket capable processors and are only available in configure-to-order builds or in preconfigured models. Not available as option part numbers.

Configuration notes:

- Processor options include a heatsink but do not include a system fan

## Processor features

Processors supported by the ST650 V3 introduce new embedded accelerators to add even more processing capability:

- QuickAssist Technology (Intel QAT)  
Help reduce system resource consumption by providing accelerated cryptography, key protection, and data compression with Intel QuickAssist Technology (Intel QAT). By offloading encryption and decryption, this built-in accelerator helps free up processor cores and helps systems serve a larger number of clients.
- Intel Dynamic Load Balancer (Intel DLB)  
Improve the system performance related to handling network data on multi-core Intel Xeon Scalable processors. Intel Dynamic Load Balancer (Intel DLB) enables the efficient distribution of network processing across multiple CPU cores/threads and dynamically distributes network data across multiple CPU cores for processing as the system load varies. Intel DLB also restores the order of networking data packets processed simultaneously on CPU cores.

- Intel Data Streaming Accelerator (Intel DSA)

Drive high performance for storage, networking, and data-intensive workloads by improving streaming data movement and transformation operations. Intel Data Streaming Accelerator (Intel DSA) is designed to offload the most common data movement tasks that cause overhead in data center-scale deployments. Intel DSA helps speed up data movement across the CPU, memory, and caches, as well as all attached memory, storage, and network devices.

- Intel In-Memory Analytics Accelerator (Intel IAA)

Run database and analytics workloads faster, with potentially greater power efficiency. Intel In-Memory Analytics Accelerator (Intel IAA) increases query throughput and decreases the memory footprint for in-memory database and big data analytics workloads. Intel IAA is ideal for in-memory databases, open source databases and data stores like RocksDB, Redis, Cassandra, and MySQL.

- Intel Advanced Matrix Extensions (Intel AMX)

Intel Advanced Matrix Extensions (Intel AMX) is a built-in accelerator in all Silver, Gold, and Platinum processors that significantly improves deep learning training and inference. With Intel AMX, you can fine-tune deep learning models or train small to medium models in just minutes. Intel AMX offers discrete accelerator performance without added hardware and complexity.

The processors also support a separate and encrypted memory space, known as the SGX Enclave, for use by Intel Software Guard Extensions (SGX). The size of the SGX Enclave supported varies by processor model. Intel SGX offers hardware-based memory encryption that isolates specific application code and data in memory. It allows user-level code to allocate private regions of memory (enclaves) which are designed to be protected from processes running at higher privilege levels.

The following table summarizes the key features of all supported 4th Gen processors in the ST650 V3.

Table 14. 4th Gen Intel Xeon Processor features

| CPU model | Cores/ threads | Core speed (Base / TB max†) | L3 cache* | Max memory speed | UPI 2.0 links & speed | TDP  | Accelerators |     |     |     | SGX Enclave Size |
|-----------|----------------|-----------------------------|-----------|------------------|-----------------------|------|--------------|-----|-----|-----|------------------|
|           |                |                             |           |                  |                       |      | QAT          | DLB | DSA | IAA |                  |
| 3408U     | 8 / 8**        | 1.8 / 1.9 GHz               | 22.5 MB*  | 4000 MHz         | None‡                 | 125W | 0            | 0   | 1   | 0   | 64GB             |
| 4410T     | 10 / 20        | 2.7 / 4.0 GHz               | 26.25 MB* | 4000 MHz         | 2 / 16 GT/s           | 150W | 0            | 0   | 1   | 0   | 64GB             |
| 4410Y     | 12 / 24        | 2.0 / 3.9 GHz               | 30 MB*    | 4000 MHz         | 2 / 16 GT/s           | 150W | 0            | 0   | 1   | 0   | 64GB             |
| 4416+     | 20 / 40        | 2.0 / 3.9 GHz               | 37.5 MB   | 4000 MHz         | 2 / 16 GT/s           | 165W | 1            | 1   | 1   | 1   | 64GB             |
| 5411N     | 24 / 48        | 1.9 / 3.9 GHz               | 45 MB     | 4400 MHz         | None‡                 | 165W | 2            | 2   | 1   | 0   | 128GB            |
| 5412U     | 24 / 48        | 2.1 / 3.9 GHz               | 45 MB     | 4400 MHz         | None‡                 | 185W | 0            | 0   | 1   | 0   | 128GB            |
| 5415+     | 8 / 16         | 2.9 / 4.1 GHz               | 22.5 MB*  | 4400 MHz         | 3 / 16 GT/s           | 150W | 1            | 1   | 1   | 1   | 128GB            |
| 5416S     | 16 / 32        | 2.0 / 4.0 GHz               | 30 MB     | 4400 MHz         | 3 / 16 GT/s           | 150W | 2            | 2   | 1   | 0   | 128GB            |
| 5418N     | 24 / 48        | 1.8 / 3.8 GHz               | 45 MB     | 4000 MHz         | 3 / 16 GT/s           | 165W | 2            | 2   | 1   | 0   | 128GB            |
| 5418Y     | 24 / 48        | 2.0 / 3.8 GHz               | 45 MB     | 4400 MHz         | 3 / 16 GT/s           | 185W | 0            | 0   | 1   | 0   | 128GB            |
| 5420+     | 28 / 56        | 2.0 / 4.1 GHz               | 52.5 MB   | 4400 MHz         | 3 / 16 GT/s           | 205W | 1            | 1   | 1   | 1   | 128GB            |
| 6414U     | 32 / 64        | 2.0 / 3.4 GHz               | 60 MB     | 4800 MHz         | None‡                 | 250W | 0            | 0   | 1   | 0   | 128GB            |
| 6416H     | 18 / 36        | 2.2 / 4.2 GHz               | 45 MB*    | 4800 MHz         | 3 / 16 GT/s           | 165W | 0            | 0   | 1   | 1   | 512GB            |
| 6418H     | 24 / 48        | 2.1 / 4.0 GHz               | 60 MB*    | 4800 MHz         | 3 / 16 GT/s           | 185W | 0            | 0   | 1   | 1   | 512GB            |
| 6421N     | 32 / 64        | 1.8 / 3.6 GHz               | 60 MB     | 4400 MHz         | None‡                 | 185W | 0            | 0   | 1   | 0   | 128GB            |
| 6426Y     | 16 / 32        | 2.5 / 4.1 GHz               | 37.5 MB*  | 4800 MHz         | 3 / 16 GT/s           | 185W | 0            | 0   | 1   | 0   | 128GB            |
| 6428N     | 32 / 64        | 1.8 / 3.8 GHz               | 60 MB     | 4000 MHz         | 3 / 16 GT/s           | 185W | 2            | 2   | 1   | 0   | 128GB            |
| 6434      | 8 / 16         | 3.7 / 4.1 GHz               | 22.5 MB*  | 4800 MHz         | 3 / 16 GT/s           | 195W | 0            | 0   | 1   | 0   | 128GB            |
| 6434H     | 8 / 16         | 3.7 / 4.1 GHz               | 22.5 MB*  | 4800 MHz         | 3 / 16 GT/s           | 195W | 0            | 0   | 1   | 1   | 512GB            |
| 6438M     | 32 / 64        | 2.2 / 3.9 GHz               | 60 MB     | 4800 MHz         | 3 / 16 GT/s           | 205W | 0            | 0   | 1   | 1   | 128GB            |
| 6438N     | 32 / 64        | 2.0 / 3.6 GHz               | 60 MB     | 4800 MHz         | 3 / 16 GT/s           | 205W | 2            | 2   | 1   | 0   | 128GB            |
| 6438Y+    | 32 / 64        | 2.0 / 4.0 GHz               | 60 MB     | 4800 MHz         | 3 / 16 GT/s           | 205W | 1            | 1   | 1   | 1   | 128GB            |
| 6442Y     | 24 / 48        | 2.6 / 4.0 GHz               | 60 MB*    | 4800 MHz         | 3 / 16 GT/s           | 225W | 0            | 0   | 1   | 0   | 128GB            |
| 6448H     | 32 / 64        | 2.4 / 4.1 GHz               | 60 MB     | 4800 MHz         | 3 / 16 GT/s           | 250W | 2            | 2   | 1   | 1   | 512GB            |
| 6448Y     | 32 / 64        | 2.1 / 4.1 GHz               | 60 MB     | 4800 MHz         | 3 / 16 GT/s           | 225W | 0            | 0   | 1   | 0   | 128GB            |
| 8450H     | 28 / 56        | 2.0 / 3.5 GHz               | 75 MB*    | 4800 MHz         | 4 / 16 GT/s           | 250W | 0            | 0   | 4   | 4   | 512GB            |

† The maximum single-core frequency at with the processor is capable of operating

\* L3 cache is 1.875 MB per core or larger. Processors with a larger L3 cache per core are marked with an \*

\*\* Bronze 3408U processor does not support Hyper-Threading Technology

‡ SKUs with a U suffix as well as some other SKUs have no UPI links and are are single-socket only

### One-processor configurations

The ST650 V3 can be used with only one processor installed. Most core functions of the server (including the XClarity Controller) are connected to processor 1 as shown in the [System architecture](#) section.

With only one processor, the server has the following capabilities:

- 16 memory DIMMs for a 2TB maximum
- Slots 1-4 and slot 9 are available; Slot 5-8 are not available

Drive support is as follows:

- SAS/SATA drives are supported - 2.5-inch or 3.5-inch
- NVMe drives are supported, up to 4 drives (3.5-inch only)
- M.2 drives are supported

Controller support is as follows:

- 8x onboard SATA
- 4x onboard NVMe
- RAID adapters/HBAs installed in slots 1-4 and slot 9

### Thermal restrictions by processor

Processors with a high TDP value require a lower ambient temperature. See the [Operating environment](#) section for details.

### UEFI operating modes

The ST650 V3 offers preset operating modes that affect energy consumption and performance. These modes are a collection of predefined low-level UEFI settings that simplify the task of tuning the server to suit your business and workload requirements.

The following table lists the feature codes that allow you to specify the mode you wish to preset in the factory for CTO orders.

Table 15. UEFI operating mode presets in DCSC

| Feature code | Description  |
|--------------|--|
| BFYB         | Operating mode selection for: "Maximum Performance Mode"               |
| BFYC         | Operating mode selection for: "Minimal Power Mode"                     |
| BFYD         | Operating mode selection for: "Efficiency Favoring Power Savings Mode" |
| BFYE         | Operating mode selection for: "Efficiency - Favoring Performance Mode" |

The preset modes for the ST650 V3 are as follows:

- **Maximum Performance Mode** (feature BFYB): Achieves maximum performance but with higher power consumption and lower energy efficiency.
- **Minimal Power Mode** (feature BFYC): Minimize the absolute power consumption of the system.
- **Efficiency Favoring Power Savings Mode** (feature BFYD): Maximize the performance/watt efficiency with a bias towards power savings. This is the favored mode for SPECpower benchmark testing, for example.
- **Efficiency Favoring Performance Mode** (feature BFYE): Maximize the performance/watt efficiency with a bias towards performance. This is the favored mode for Energy Star certification, for example.

For details about these preset modes, and all other performance and power efficiency UEFI settings offered in the ST650 V3, see the paper "Tuning UEFI Settings for Performance and Energy Efficiency on Intel Xeon Scalable Processor-Based ThinkSystem Servers", available from <https://lenovopress.lenovo.com/lp1477>.

### Memory options

The ST650 V3 uses Lenovo TruDDR5 memory operating at up to 4800 MHz. The server supports up to 32 DIMMs with 2 processors. The processors have 8 memory channels and support 2 DIMMs per channel (DPC). The server supports up to 4TB of memory using 32x 128GB 3DS RDIMMs and two processors.

DIMMs operate at up to 4800 MHz at 1 DIMM per channel (DPC) and up to 4400 MHz at 2 DPC, depending on the memory bus speed of the processor selected. See the [Processor features](#) section for specifics.

Lenovo TruDDR5 memory uses the highest quality components that are sourced from Tier 1 DRAM suppliers and only memory that meets the strict requirements of Lenovo is selected. It is compatibility tested and tuned to maximize performance and reliability. From a service and support standpoint, Lenovo TruDDR5 memory automatically assumes the system warranty, and Lenovo provides service and support worldwide.

The following table lists the 4800 MHz memory options that are currently supported by the ST650 V3.

Table 16. 4800 MHz memory options

| Part number            | Feature code | Description   | DRAM technology |
|------------------------|--------------|---|-----------------|
| 9x4 RDIMMs - 4800 MHz  |              |   |                 |
| 4X77A77483             | BNW5         | ThinkSystem 32GB TruDDR5 4800MHz (1Rx4) 9x4 RDIMM     | 16Gb            |
| 4X77A77033             | BKTN         | ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 9x4 RDIMM     | 16Gb            |
| 10x4 RDIMMs - 4800 MHz |              |   |                 |
| 4X77A77030             | BNF6         | ThinkSystem 32GB TruDDR5 4800MHz (1Rx4) 10x4 RDIMM    | 16Gb            |
| 4X77A77032             | BNF9         | ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM    | 16Gb            |
| x8 RDIMMs - 4800 MHz   |              |   |                 |
| 4X77A77029             | BKTL         | ThinkSystem 16GB TruDDR5 4800MHz (1Rx8) RDIMM         | 16Gb            |
| 4X77A77031             | BKTM         | ThinkSystem 32GB TruDDR5 4800MHz (2Rx8) RDIMM         | 16Gb            |
| 4X77A87033             | C1HB         | ThinkSystem 48GB TruDDR5 4800MHz (2Rx8) RDIMM         | 24Gb            |
| 3DS RDIMMs - 4800 MHz  |              |   |                 |
| 4X77A77034             | BNFC         | ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM v2 | 16Gb            |
| CTO only               | BY8F         | ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM v1 | 16Gb            |

9x4 RDIMMs (also known as EC4 RDIMMs) are a new lower-cost DDR5 memory option supported in ThinkSystem V3 servers. 9x4 DIMMs offer the same performance as standard RDIMMs (known as 10x4 or EC8 modules), however they support lower fault-tolerance characteristics. Standard RDIMMs and 3DS RDIMMs support two 40-bit subchannels (that is, a total of 80 bits), whereas 9x4 RDIMMs support two 36-bit subchannels (a total of 72 bits). The extra bits in the subchannels allow standard RDIMMs and 3DS RDIMMs to support Single Device Data Correction (SDDC), however 9x4 RDIMMs do not support SDDC. Note, however, that all DDR5 DIMMs, including 9x4 RDIMMs, support Bounded Fault correction, which enables the server to correct most common types of DRAM failures.

For more information on DDR5 memory, see the Lenovo Press paper, *Introduction to DDR5 Memory*, available from <https://lenovopress.com/lp1618>.

The following rules apply when selecting the memory configuration:

- The ST650 V3 only supports quantities of 1, 2, 4, 6, 8, 12, or 16 DIMMs per processor; other quantities not supported
- The server supports three types of DIMMs: 9x4 RDIMMs, RDIMMs, and 3DS RDIMMs; UDIMMs and LRDIMMs are not supported
- Mixing of DIMM types is not supported (9x4 DIMMs with 10x4 RDIMMs, 9x4 DIMMs with 3DS RDIMMs, 10x4 RDIMMs with 3DS RDIMMs)
- Mixing x4 and x8 DIMMs is not supported

- Mixing of DIMM rank counts is supported. Follow the required installation order installing the DIMMs with the higher rank counts first.
- Mixing of DIMM capacities is supported, however only two different capacities are supported across all channels of the processor. Follow the required installation order installing the larger DIMMs first.
- Memory mirroring is not supported with 9x4 DIMMs

For best performance, consider the following:

- Ensure the memory installed is at least the same speed as the memory bus of the selected processor.
- Populate all 8 memory channels.

The following memory protection technologies are supported:

- ECC detection/correction
- Bounded Fault detection/correction
- SDDC (for x4-based memory DIMMs; look for "x4" in the DIMM description)
- ADDDC (for 10x4-based memory DIMMs, not supported with 9x4 DIMMs)
- Memory mirroring

See the Lenovo Press article "RAS Features of the Lenovo ThinkSystem Intel Servers" for more information about memory RAS features: <https://lenovopress.lenovo.com/lp1711-ras-features-of-the-lenovo-thinksystem-intel-servers>

If memory channel mirroring is used, then DIMMs must be installed in pairs (minimum of one pair per processor), and both DIMMs in the pair must be identical in type and size. 50% of the installed capacity is available to the operating system. Memory rank sparing is not supported.

## **Persistent memory**

The ST650 V3 does not support Persistent memory.



## Internal storage

The ST650 V3 supports 2.5-inch or 3.5-inch hot-swap drives, at the front of the server, in a variety of drive bay configurations. Some drive bay configurations are supported with two 5.25-inch media bays for tape, RDX or optical drives.

The server also supports one or two M.2 drives, installed in an M.2 adapter internal to the server.

In this section:

- [Drive bays](#)
- [NVMe drive support](#)
- [Backplanes](#)
- [Storage configurations](#)
- [Field upgrades](#)
- [M.2 drives](#)

### Drive bays

The ST650 V3 supports the drive bay configurations shown in the following figure.

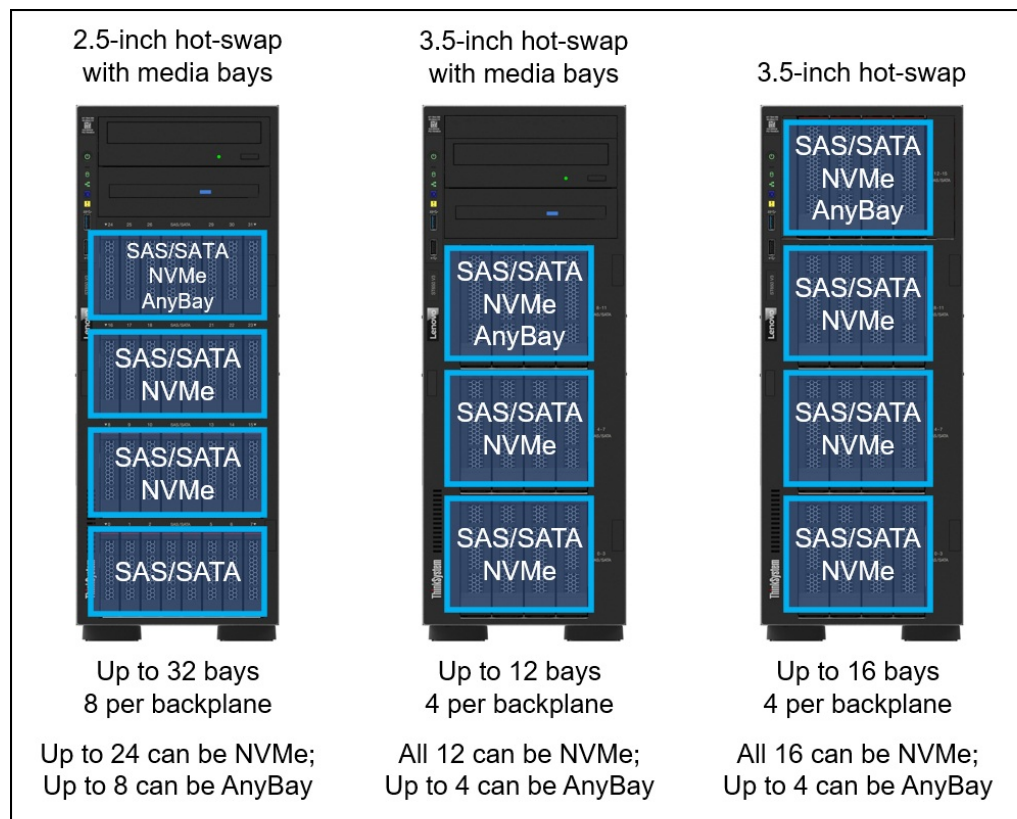


Figure 7. ST650 V3 drive bays

The configurations are as follows:

- 2.5-inch hot-swap drive bays
  - Up to 32 drive bays, 8 drives per backplane
  - All 32 drives can be SAS or SATA
  - 24 drives (3 backplanes) can be NVMe drive bays
  - 8 drives (1 backplane) can be AnyBay drive bays
  - Optional support for 2 media bays

- 12x 3.5-inch hot-swap drive bays
  - Up to 12 drive bays, 4 drives per backplane
  - All 12 drives can be SAS or SATA
  - All 12 drives can be NVMe
  - Up to 4 drives (1 backplane) can be AnyBay drive bays
  - Optional support for 2 media bays
  - Can be upgraded to 16x 3.5-inch drive bays by removing the media bays and installing ThinkSystem ST650 V2/V3 3.5" SAS/SATA 4-Bay Drive Bay 4 Cage Kit (4XF7A79787)
- 16x 3.5-inch hot-swap drive bays
  - Up to 16 drive bays, 4 drives per backplane
  - All 16 drives can be SAS or SATA
  - All 16 drives can be NVMe
  - Up to 4 drives (1 backplane) can be AnyBay drive bays
  - No support for 2 media bays

**Simple-swap bays:** The ST650 V3 does not support simple-swap drive bays

It is also possible to configure a server without any drives or backplanes. Drives and backplanes can be added in the field as described in the [field upgrades](#) section.

### NVMe drive support

The ST650 V3 supports NVMe drives to maximize storage performance.

The server has 12x onboard NVMe ports with 2 processors installed (4x onboard NVMe ports with 1 processor installed).

Depending on the configuration, NVMe drives are connected either to onboard NVMe ports or to retimer adapters installed in PCIe slots.

- 2.5-inch drive configurations:
  - Up to 24 NVMe drives without oversubscription (that is, each x4 drive has a full x4 (4 lanes) connection to the processor)
  - Up to 12 drives can be connected to onboard PCIe Gen4 NVMe ports
  - Other drives in the configuration are connected via retimer adapters
- 3.5-inch hot-swap drive configurations:
  - Up to 16 NVMe drives without oversubscription (that is, each x4 drive has a full x4 (4 lanes) connection to the processor)
  - Up to 12 drives can be connected to onboard PCIe Gen4 NVMe ports
  - Alternatively, drives can be configured using retimer adapters

### Backplanes

The backplanes used to provide the drive bays are listed in the following table.

The table also lists the ordering information for the media bay that provides two 5.25-inch drive bays at the top of the server for a tape drive or optical drive. The media bays are not available when 16x 3.5-inch drive bays are configured.

**Field upgrades:** All backplanes are available as part numbers for field upgrades complete with the necessary cables, as listed in the table and described in the [Field upgrades](#) section below.

Table 17. Backplanes for drive bays

| Part number*      | Feature code | Description   | Maximum supported |
|-------------------|--------------|---|-------------------|
| 2.5-inch hot-swap |              |   |                   |
| 4C57A82405        | B8LU         | ThinkSystem ST650 V3 2.5" SAS/SATA 8-Bay Backplane Kit        | 4                 |
| 4C57A82406        | BH8D         | ThinkSystem ST650 V3 2.5" NVMe 8-Bay Backplane Kit            | 3                 |
| 4C57A82407        | BH8B         | ThinkSystem ST650 V3 2.5" AnyBay 8-Bay Backplane Kit          | 1                 |
| 3.5-inch hot-swap |              |   |                   |
| 4C57A82402        | BA5Q         | ThinkSystem ST650 V3 3.5" SAS/SATA 4-Bay Backplane Kit        | 4                 |
| 4C57A82403        | BCQS         | ThinkSystem ST650 V3 3.5" NVMe 4-Bay Backplane Kit            | 4                 |
| 4C57A82404        | BA5R         | ThinkSystem ST650 V3 3.5" AnyBay 4-Bay Backplane Kit          | 1                 |
| Media bay         |              |   |                   |
| 4M27A60829        | BA5W         | ThinkSystem ST650 V2/V3 3.5" Chassis Media Bay Enablement Kit | 1                 |

\* Part numbers include cables and other components as described in the [Field upgrades](#) section.

## Storage configurations

This section describes the various combinations of front and rear drives that the server supports, as well as M.2 support.

In this section:

- [Overview of configurations](#)
- [Details - Configurations with 3.5-inch front drive bays](#)
- [Details - Configurations with 2.5-inch front drive bays](#)

### Overview of configurations

The following tables summarize the storage configurations for the ST650 V3.

#### Storage configurations - 3.5-inch front drives

The following table summarizes the configurations that use 3.5-inch front drive bays.

Click to jump down to the [details of the 3.5-inch configurations](#).

Table 18. Storage configurations - 3.5-inch front drives

| Config | Total drives (NVMe) | SAS/SATA | AnyBay | NVMe | Backplanes  |
|--------|---------------------|----------|--------|------|---|
| 1      | 4 (0)               | 4        | 0      | 0    | 1x 4x3.5" SAS/SATA (BA5Q)                           |
| 2      | 8 (0)               | 8        | 0      | 0    | 2x 4x3.5" SAS/SATA (BA5Q)                           |
| 3      | 12 (0)              | 12       | 0      | 0    | 3x 4x3.5" SAS/SATA (BA5Q)                           |
| 4      | 16 (0)              | 16       | 0      | 0    | 4x 4x3.5" SAS/SATA (BA5Q)                           |
| 5      | 4 (0)               | 4        | 0      | 0    | 1x 4x3.5" SAS/SATA (BA5Q)                           |
| 6      | 8 (0)               | 8        | 0      | 0    | 2x 4x3.5" SAS/SATA (BA5Q)                           |
| 7      | 4 (4)               | 0        | 0      | 4    | 1x 4x3.5" NVMe (BCQS)                               |
| 8      | 8 (8)               | 0        | 0      | 8    | 2x 4x3.5" NVMe (BCQS)                               |
| 9      | 12 (12)             | 0        | 0      | 12   | 3x 4x3.5" NVMe (BCQS)                               |
| 10     | 16 (16)             | 0        | 0      | 16   | 4x 4x3.5" NVMe (BCQS)                               |
| 11     | 16 (16)             | 0        | 4      | 12   | 1x 4x3.5" AnyBay (BA5R) + 3x 4x3.5" NVMe (BCQS)     |
| 12     | 12 (4)              | 8        | 0      | 4    | 2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)   |
| 13     | 12 (4)              | 8        | 4      | 0    | 2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R) |
| 14     | 16 (4)              | 12       | 0      | 4    | 3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)   |
| 15     | 16 (4)              | 12       | 4      | 0    | 3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R) |

### Storage configurations - 2.5-inch front drives

The following table summarizes the configurations that use 2.5-inch front drive bays.

Click to jump down to the [details of the 2.5-inch configurations](#).

Table 19. Storage configurations - 2.5-inch front drives

| Config | Total drives (NVMe) | SAS/SATA | AnyBay | NVMe | Backplanes  |
|--------|---------------------|----------|--------|------|---|
| 16     | 8 (0)               | 8        | 0      | 0    | 1x 8x2.5" SAS/SATA (B8LU)                           |
| 17     | 8 (0)               | 8        | 0      | 0    | 1x 8x2.5" SAS/SATA (B8LU)                           |
| 18     | 16 (0)              | 16       | 0      | 0    | 2x 8x2.5" SAS/SATA (B8LU)                           |
| 19     | 24 (0)              | 24       | 0      | 0    | 3x 8x2.5" SAS/SATA (B8LU)                           |
| 20     | 32 (0)              | 32       | 0      | 0    | 4x 8x2.5" SAS/SATA (B8LU)                           |
| 21     | 8 (8)               | 0        | 8      | 0    | 1x 8x2.5" AnyBay (BH8B)                             |
| 22     | 8 (8)               | 0        | 0      | 8    | 1x 8x2.5" NVMe (BH8D)                               |
| 23     | 16 (16)             | 0        | 0      | 16   | 2x 8x2.5" NVMe (BH8D)                               |
| 24     | 24 (24)             | 0        | 0      | 24   | 3x 8x2.5" NVMe (BH8D)                               |
| 25     | 16 (16)             | 0        | 8      | 8    | 1x 8x2.5" AnyBay (BH8B) + 1x 8x2.5" NVMe (BH8D)     |
| 26     | 24 (24)             | 0        | 8      | 16   | 1x 8x2.5" AnyBay (BH8B) + 2x 8x2.5" NVMe (BH8D)     |
| 27     | 32 (8)              | 24       | 8      | 0    | 3x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) |
| 28     | 24 (8)              | 16       | 8      | 0    | 2x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) |
| 29     | 16 (8)              | 8        | 8      | 0    | 1x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) |

### Details - 3.5-inch front bays

The following table lists the detailed configurations that use 3.5-inch front drive bays.

Click to go back to the [overview of 3.5-inch configurations](#).

Table 20. Details - 3.5-inch front bays

| Cfg  | CPUs   | SAS/SATA | AnyBay | NVMe | Backplanes  | Supported controllers                                     |
|------|--------|----------|--------|------|---|---|
| 1-1  | 1 or 2 | 4        | 0      | 0    | 1x 4x3.5" SAS/SATA (BA5Q)                         | 1x (9350-8i or 5350-8i or 4350-8i)                        |
| 1-2  | 1 or 2 |          |        |      |   | 1x (940-8i or 540-8i or 440-8i)                           |
| 1-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)                     |
| 1-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)                        |
| 2-1  | 1 or 2 | 8        | 0      | 0    | 2x 4x3.5" SAS/SATA (BA5Q)                         | 1x (9350-8i or 5350-8i or 4350-8i)                        |
| 2-2  | 1 or 2 |          |        |      |   | 1x (940-8i or 540-8i or 440-8i)                           |
| 2-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)                     |
| 2-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)                        |
| 3-1  | 1 or 2 | 12       | 0      | 0    | 3x 4x3.5" SAS/SATA (BA5Q)                         | 2x (9350-8i or 5350-8i or 4350-8i)                        |
| 3-2  | 1 or 2 |          |        |      |   | 2x (940-8i or 540-8i or 440-8i)                           |
| 3-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)                     |
| 3-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)                        |
| 3-5  | 2 only |          |        |      |   | 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)           |
| 3-6  | 1 only |          |        |      |   | 1x (940-16i CFF or 9350-16i CFF)                          |
| 4-1  | 1 or 2 | 16       | 0      | 0    | 4x 4x3.5" SAS/SATA (BA5Q)                         | 2x (9350-8i or 5350-8i or 4350-8i)                        |
| 4-2  | 1 or 2 |          |        |      |   | 2x (940-8i or 540-8i or 440-8i)                           |
| 4-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)                     |
| 4-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)                        |
| 4-5  | 2 only |          |        |      |   | 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)           |
| 4-6  | 1 only |          |        |      |   | 1x (940-16i CFF or 9350-16i CFF)                          |
| 4-7  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)                     |
| 4-8  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)                        |
| 4-9  | 2 only |          |        |      |   | 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)           |
| 4-10 | 1 only |          |        |      |   | 1x (940-16i CFF or 9350-16i CFF)                          |
| 5    | 1 or 2 | 4        | 0      | 0    | 1x 4x3.5" SAS/SATA (BA5Q)                         | 1x OB SATA (SATA drives only, no SAS)                     |
| 6    | 1 or 2 | 8        | 0      | 0    | 2x 4x3.5" SAS/SATA (BA5Q)                         | 2x OB SATA (SATA drives only, no SAS)                     |
| 7-1  | 1 or 2 | 0        | 0      | 4    | 1x 4x3.5" NVMe (BCQS)                             | OB NVMe   |
| 7-2  | 2 only |          |        |      |   | OB NVMe   |
| 8-1  | 2 only | 0        | 0      | 8    | 2x 4x3.5" NVMe (BCQS)                             | OB NVMe   |
| 8-2  | 2 only |          |        |      |   | OB NVMe   |
| 9-1  | 2 only | 0        | 0      | 12   | 3x 4x3.5" NVMe (BCQS)                             | OB NVMe   |
| 9-2  | 2 only |          |        |      |   | OB NVMe + 1x Retimer                                      |
| 10   | 2 only | 0        | 0      | 16   | 4x 4x3.5" NVMe (BCQS)                             | OB NVMe + 1x Retimer                                      |
| 11-1 | 2 only | 0        | 4      | 12   | 1x 4x3.5" AnyBay (BA5R) + 3x 4x3.5" NVMe (BCQS)   | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x Retimer |
| 11-2 | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x Retimer    |
| 12-1 | 1 or 2 | 8        | 0      | 4    | 2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS) | OB NVMe + 2x OB SATA (SATA drives only, no SAS)           |
| 12-2 | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)              |

| Cfg   | CPUs   | SAS/SATA | AnyBay | NVMe | Backplanes  | Supported controllers                                     |
|-------|--------|----------|--------|------|---|---|
| 12-3  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i)                 |
| 12-4  | 2 only |          |        |      |   | OB NVMe + 2x OB SATA (SATA drives only, no SAS)           |
| 12-5  | 2 only |          |        |      |   | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)              |
| 12-6  | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i)                 |
| 13-1  | 1 or 2 | 8        | 4      | 0    | 2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R) | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)              |
| 13-2  | 1 or 2 |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i)                 |
| 13-3  | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 13-4  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 13-5  | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |
| 13-6  | 2 only |          |        |      |   | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)              |
| 13-7  | 2 only |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i)                 |
| 13-8  | 2 only |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 13-9  | 2 only |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 13-10 | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |
| 14-1  | 1 or 2 | 12       | 0      | 4    | 3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)   | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)              |
| 14-2  | 1 or 2 |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i)                 |
| 14-3  | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 14-4  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 14-5  | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |
| 14-6  | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 14-7  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 14-8  | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |
| 15-1  | 1 or 2 | 12       | 4      | 0    | 3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R) | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)              |
| 15-2  | 1 or 2 |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i)                 |
| 15-3  | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 15-4  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 15-5  | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |
| 15-6  | 1 or 2 |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)           |
| 15-7  | 1 or 2 |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)              |
| 15-8  | 2 only |          |        |      |   | OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF) |

### Details - 2.5-inch front bays

The following table lists the detailed configurations that use 2.5-inch front drive bays.

Click to go back to the [overview of 2.5-inch configurations](#).

Table 21. Details - 2.5-inch front bays

| Cfg   | CPUs   | SAS/SATA | AnyBay | NVMe | Backplanes                                      | Supported controllers   |
|-------|--------|----------|--------|------|---|---|
| 16    | 1 or 2 | 8        | 0      | 0    | 1x 8x2.5" SAS/SATA (B8LU)                       | 2x OB SATA (SATA drives only, no SAS)   |
| 17-1  | 1 or 2 | 8        | 0      | 0    | 1x 8x2.5" SAS/SATA (B8LU)                       | 1x (9350-8i or 5350-8i or 4350-8i)  |
| 17-2  | 1 or 2 |          |        |      |   | 1x (940-8i or 540-8i or 440-8i)   |
| 17-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)   |
| 17-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)  |
| 17-5  | 2 only |          |        |      |   | 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF or 9350-8i CFF or 5350-8i CFF) |
| 17-6  | 1 only |          |        |      |   | 1x (940-16i CFF or 9350-16i CFF or 9350-8i CFF or 5350-8i CFF)                |
| 18-1  | 1 or 2 | 16       | 0      | 0    | 2x 8x2.5" SAS/SATA (B8LU)                       | 2x (9350-8i or 5350-8i or 4350-8i)  |
| 18-2  | 1 or 2 |          |        |      |   | 2x (940-8i or 540-8i or 440-8i)   |
| 18-3  | 1 or 2 |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i)   |
| 18-4  | 1 or 2 |          |        |      |   | 1x (940-16i or 540-16i or 440-16i)  |
| 18-5  | 2 only |          |        |      |   | 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)                               |
| 18-6  | 1 only |          |        |      |   | 1x (940-16i CFF or 9350-16i CFF)  |
| 19-1  | 1 or 2 | 24       | 0      | 0    | 3x 8x2.5" SAS/SATA (B8LU)                       | 1x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)    |
| 19-2  | 1 or 2 |          |        |      |   | 1x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)          |
| 19-3  | 1 or 2 |          |        |      |   | 3x (9350-8i or 5350-8i or 4350-8i)  |
| 19-4  | 1 or 2 |          |        |      |   | 3x (940-8i or 540-8i or 440-8i)   |
| 19-5  | 1 or 2 |          |        |      |   | 1x 940-32i  |
| 20-1  | 1 or 2 | 32       | 0      | 0    | 4x 8x2.5" SAS/SATA (B8LU)                       | 2x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)    |
| 20-2  | 1 or 2 |          |        |      |   | 2x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)          |
| 20-3  | 1 or 2 |          |        |      |   | 2x (9350-16i or 5350-16i or 4350-16i)   |
| 20-4  | 1 or 2 |          |        |      |   | 2x (940-16i or 540-16i or 440-16i)  |
| 20-5  | 1 or 2 |          |        |      |   | 1x 940-32i  |
| 20-6  | 1 or 2 |          |        |      |   | 1x 940-32i  |
| 20-7  | 2 only |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF                       |
| 20-8  | 1 only |          |        |      |   | 1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF                       |
| 20-9  | 2 only |          |        |      |   | 1x (940-16i or 540-16i or 440-16i) + 1x (440-16i CFF or 940-16i CFF)          |
| 20-10 | 1 only |          |        |      |   | 1x (940-16i or 540-16i or 440-16i) + 1x 940-16i CFF                           |
| 21-1  | 2 only | 0        | 8      | 0    | 1x 8x2.5" AnyBay (BH8B)                         | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)                                  |
| 21-2  | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i)                                     |
| 22    | 2 only | 0        | 0      | 8    | 1x 8x2.5" NVMe (BH8D)                           | OB NVMe   |
| 23    | 2 only | 0        | 0      | 16   | 2x 8x2.5" NVMe (BH8D)                           | OB NVMe + 1x Retimer  |
| 24    | 2 only | 0        | 0      | 24   | 3x 8x2.5" NVMe (BH8D)                           | OB NVMe + 3x Retimer  |
| 25-1  | 2 only | 0        | 8      | 8    | 1x 8x2.5" AnyBay (BH8B) + 1x 8x2.5" NVMe (BH8D) | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x Retimer                     |
| 25-2  | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x Retimer                        |
| 26-1  | 2 only | 0        | 8      | 16   | 1x 8x2.5" AnyBay (BH8B) + 2x 8x2.5" NVMe (BH8D) | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 3x Retimer                     |

| Cfg  | CPUs   | SAS/SATA | AnyBay | NVMe | Backplanes  | Supported controllers  |
|------|--------|----------|--------|------|---|--|
| 26-2 | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 3x Retimer                               |
| 27-1 | 2 only | 24       | 8      | 0    | 3x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i) |
| 27-2 | 2 only |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)       |
| 27-3 | 2 only |          |        |      |   | OB NVMe + 2x (9350-16i or 5350-16i or 4350-16i)                                      |
| 27-4 | 2 only |          |        |      |   | OB NVMe + 2x (940-16i or 540-16i or 440-16i)   |
| 27-5 | 2 only |          |        |      |   | OB NVMe + 1x 940-32i   |
| 27-6 | 2 only |          |        |      |   | OB NVMe + 1x 940-32i   |
| 27-7 | 2 only |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF                    |
| 27-8 | 2 only |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i) + 1x (440-16i CFF or 940-16i CFF)       |
| 28-1 | 2 only | 16       | 8      | 0    | 2x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) | OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i) |
| 28-2 | 2 only |          |        |      |   | OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)       |
| 28-3 | 2 only |          |        |      |   | OB NVMe + 3x (9350-8i or 5350-8i or 4350-8i)   |
| 28-4 | 2 only |          |        |      |   | OB NVMe + 3x (940-8i or 540-8i or 440-8i)  |
| 28-5 | 2 only |          |        |      |   | OB NVMe + 1x 940-32i   |
| 29-1 | 2 only | 8        | 8      | 0    | 1x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B) | OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)   |
| 29-2 | 2 only |          |        |      |   | OB NVMe + 2x (940-8i or 540-8i or 440-8i)  |
| 29-3 | 2 only |          |        |      |   | OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)                                      |
| 29-4 | 2 only |          |        |      |   | OB NVMe + 1x (940-16i or 540-16i or 440-16i)   |

## Field upgrades

The ST650 V3 is orderable without drive bays, allowing you to add a backplane, cabling and controllers as field upgrades. The server also supports upgrading some configurations by adding additional drive bay backplanes (for example, upgrading from 8 to 16x 2.5-inch drive bays).

**Upgrade path:** The key criteria for upgrade support is to ensure that the target configuration is one of the supported drive bay configurations as listed in the [Storage configurations](#) section.

To add drive bays you will need to order the appropriate backplane kit(s). Backplane kits include the necessary cables.

The following table lists the part numbers for drive backplanes and the media bay cage. For more information, see the Internal Cable Routing section of the Users Guide, available from:

[http://pubs.lenovo.com/st650-v3/internal\\_cable\\_routing](http://pubs.lenovo.com/st650-v3/internal_cable_routing)



Table 22. Field upgrades for drives bay backplanes

| Part number                                   | Description  |
|---|--|
| 2.5-inch backplane kits (includes cables)     |  |
| 4C57A82407                                    | ThinkSystem ST650 V3 2.5" AnyBay 8-Bay Backplane Kit   |
| 4C57A82406                                    | ThinkSystem ST650 V3 2.5" NVMe 8-Bay Backplane Kit   |
| 4C57A82405                                    | ThinkSystem ST650 V3 2.5" SAS/SATA 8-Bay Backplane Kit   |
| 3.5-inch backplane kits (includes cables)     |  |
| 4C57A82404                                    | ThinkSystem ST650 V3 3.5" AnyBay 4-Bay Backplane Kit   |
| 4C57A82403                                    | ThinkSystem ST650 V3 3.5" NVMe 4-Bay Backplane Kit   |
| 4C57A82402                                    | ThinkSystem ST650 V3 3.5" SAS/SATA 4-Bay Backplane Kit   |
| Replace media bay with 4x 3.5-inch drive bays |  |
| 4XF7A79787                                    | ThinkSystem ST650 V2/V3 3.5" SAS/SATA 4-Bay Drive Bay 4 Cage Kit <ul style="list-style-type: none"> <li>• 1x Cage for 4x 3.5-inch drive bays</li> <li>• 4x 3.5-inch drive bay fillers</li> </ul> |

When adding drive bays, you will also need to add the appropriate storage controller(s). Consult the tables in the [Controller selections](#) section to determine what controller sections are supported and what additional controllers you will need. Controllers are described in the [Controllers for internal storage](#) section.

Some field upgrades require additional cable kits, as described in the following table.

Table 23. Cable kits for field upgrades related to drive bays

| Part number | Description  | Purpose   |
|-------------|--|---|
| 4Z57A82408  | ThinkSystem ST650 V3 Internal HBA/RAID Adapter Cable Kit | To add an internal (CFF) storage adapter (HBA or RAID adapter) to a configuration. Either replacing an existing adapter in a rear PCIe slot, or adding the CFF adapter to a server without any storage adapter installed. |
| 4Z57A16098  | ThinkSystem ST650 V2 Retimer Cable Kit for 3.5" HDD      | NVMe cable required when you add a 3.5-inch AnyBay or NVMe backplane and want to connect it to an NVMe retimer adapter.   |
| 4Z57A16104  | ThinkSystem ST650 V2 Retimer Cable Kit for 2.5" HDD      | NVMe cable required when you add a 2.5-inch AnyBay or NVMe backplane and want to connect it to an NVMe retimer adapter.   |
| 4Z57A82409  | ThinkSystem ST650 V3 HW RAID/HBA Adapter Cable Kit       | Your existing configuration uses the onboard SATA ports and you wish to upgrade to a RAID adapter or HBA installed in one of the rear PCIe slots.   |

## M.2 drives

The ST650 V3 supports one or two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution or as additional storage. The M.2 drives install into an M.2 module which is mounted on the side of the drive bays.

The supported M.2 modules are listed in the following table.

Table 24. M.2 modules

| Part number | Feature code | Description                                    | SATA drives | NVMe drives   | RAID       | Max qty |
|-------------|--------------|--|-------------|---------------|------------|---------|
| 4Y37A09738  | B5XJ         | ThinkSystem M.2 SATA/NVMe 2-Bay Enablement Kit | Yes         | Yes (x1 lane) | VROC       | 1       |
| 4Y37A09750  | B8P9         | ThinkSystem M.2 NVMe 2-Bay RAID Adapter        | No          | Yes (x1 lane) | Integrated | 1       |

Supported drives are listed in the [Internal drive options](#) section.

Configuration rules:

- The use of NVMe M.2 drives requires performance (dual-rotor) cooling fans

The ThinkSystem M.2 SATA/NVMe 2-Bay Enablement Kit (4Y37A09738) has the following features:

- Supports one or two M.2 drives, either SATA or NVMe
- When two drives installed, they must be either both SATA or both NVMe
- Support 42mm, 60mm, 80mm and 110mm drive form factors (2242, 2260, 2280 and 22110)
- JBOD native support; RAID can be enabled via Intel VROC (no built-in RAID support)
- Either 6Gbps SATA or PCIe 3.0 x1 interface to the drives depending on the drives installed
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools

The ThinkSystem M.2 NVMe 2-Bay RAID Adapter (4Y37A09750) has the following features:

- Supports one or two NVMe M.2 drives
- Support 42mm, 60mm, 80mm and 110mm drive form factors (2242, 2260, 2280 and 22110)
- RAID support via an onboard Marvell 88NR2241 NVMe RAID Controller
- With 1 drive, supports single-drive RAID-0
- With 2 drives, supports 2-drive RAID-0, 2-drive RAID-1, or two single-drive RAID-0 arrays
- PCIe 3.0 x2 host interface; PCIe 3.0 x1 connection to each drive
- Management and configuration support via UEFI and OS-based tools
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools

For field upgrades, the ST650 V3 also requires an additional M.2 cable kit. Ordering information is listed in the following table.

Table 25. M.2 Cable for field upgrades

| Part number | Description  |
|-------------|--|
| 4Z57A16099  | ThinkSystem ST650 V2 M.2 Cable Kit <ul style="list-style-type: none"> <li>• M.2 Signal &amp; Power Cable, 280mm</li> </ul> |

## Controllers for internal storage

The ST650 V3 offers a variety of controller options for internal 2.5-inch and 3.5-inch drives:

- Onboard SATA ports with software RAID support (Intel VROC SATA RAID, formerly known as Intel RSTe)
- Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID)
- RAID adapters and HBAs for SAS/SATA drives (PCIe slot-based)
- RAID adapters and HBAs for SAS/SATA drives (cabled in a dedicated space)

The following table lists the adapters used for the internal storage of the server.

As well as supporting RAID adapters and HBAs that install in a PCIe slot, the ST650 V3 supports a internal adapter (also known as CFF or custom form factor adapter) that is mounted internally in the server and cabled to one of the onboard NVMe ports. The adapter is mounted adjacent to the drive bays and in front of the fans, and does not occupy a standard PCIe slot. See the [Internal view](#) for the location.

Table 26. Internal storage adapter support

| Part number   | Feature code | Description   | PCIe lanes | Max qty | Slots supported | Form factor | Power module (supercap) |
|---|--------------|---|------------|---------|-----------------|-------------|-------------------------|
| Onboard SATA - up to 8 drives - Intel VROC SATA RAID (Intel RSTe) |              |   |            |         |                 |             |                         |
| None  | AVV0         | On Board SATA Software RAID Mode                              | -          | 1       | Not applicable  | -           | No                      |
| Onboard NVMe - up to 12 drives - Intel VROC NVMe RAID             |              |   |            |         |                 |             |                         |
| 4L47A83669  | BR9B         | Intel VROC (VMD NVMe RAID) Standard                           | -          | 1       | Not applicable  | -           | No                      |
| 4L47A39164  | B96G         | Intel VROC (VMD NVMe RAID) Premium                            | -          | 1       | Not applicable  | -           | No                      |
| SAS HBA - PCIe Gen 3  |              |   |            |         |                 |             |                         |
| 4Y37A72481  | BJHJ         | ThinkSystem 4350-16i SAS/SATA 12Gb HBA                        | PCIe x8    | 2       | All slots       | LP          | No                      |
| 4Y37A72480  | BJHH         | ThinkSystem 4350-8i SAS/SATA 12Gb HBA                         | PCIe x8    | 4       | All slots       | LP          | No                      |
| SAS HBA - PCIe Gen 4  |              |   |            |         |                 |             |                         |
| 4Y37A78601  | BM51         | ThinkSystem 440-8i SAS/SATA PCIe Gen4 12Gb HBA                | PCIe x8    | 4       | All slots       | LP          | No                      |
| 4Y37A78602  | BM50         | ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb HBA               | PCIe x8    | 2       | All slots       | LP          | No                      |
| 4Y37A09725  | B8P1         | ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA      | PCIe x8    | 1       | Cabled (CFF)    | CFF         | No                      |
| RAID controllers - PCIe Gen 3                                     |              |   |            |         |                 |             |                         |
| 4Y37A72482  | BJHK         | ThinkSystem RAID 5350-8i PCIe 12Gb Adapter                    | PCIe x8    | 3       | All slots       | LP          | No                      |
| 4Y37A84028  | BRQV         | ThinkSystem RAID 5350-8i PCIe 12Gb Internal Adapter           | PCIe x8    | 1       | Cabled (CFF)    | CFF         | No                      |
| 4Y37A72483  | BJHL         | ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Adapter          | PCIe x8    | 3       | All slots       | LP          | Included                |
| 4Y37A72484  | BJHM         | ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Internal Adapter | PCIe x8    | 1       | Cabled (CFF)    | CFF         | Included                |

| Part number                   | Feature code | Description  | PCIe lanes | Max qty | Slots supported | Form factor | Power module (supercap) |
|-------------------------------|--------------|--|------------|---------|-----------------|-------------|-------------------------|
| 4Y37A72485                    | BJHN         | ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Adapter              | PCIe x8    | 2       | All slots       | LP          | Included                |
| 4Y37A72486                    | BJHP         | ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Internal Adapter     | PCIe x8    | 1       | Cabled (CFF)    | CFF         | Included                |
| RAID controllers - PCIe Gen 4 |              |  |            |         |                 |             |                         |
| 4Y37A78834                    | BMFT         | ThinkSystem RAID 540-8i PCIe Gen4 12Gb Adapter                     | PCIe x8    | 3       | All slots       | LP          | No                      |
| 4Y37A78835                    | BNAX         | ThinkSystem RAID 540-16i PCIe Gen4 12Gb Adapter                    | PCIe x8    | 2       | All slots       | LP          | No                      |
| 4Y37A09728                    | B8NY         | ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter           | PCIe x8    | 3       | All slots       | LP          | Included                |
| 4Y37A78600                    | BM35         | ThinkSystem RAID 940-16i 4GB Flash PCIe Gen4 12Gb Adapter for U.3  | PCIe x8    | 2       | All slots       | LP          | Included                |
| 4Y37A09730                    | B8NZ         | ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Adapter          | PCIe x8    | 2       | All slots       | LP          | Included                |
| 4Y37A09735                    | B8P0         | ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Internal Adapter | PCIe x8    | 1       | Cabled (CFF)    | CFF         | Included                |
| 4Y37A09733                    | B8P8         | ThinkSystem RAID 940-32i 8GB Flash PCIe Gen4 12Gb Adapter          | PCIe x8    | 1       | 5-9             | FHHL        | Included                |
| NVMe adapters - PCIe Gen 4    |              |  |            |         |                 |             |                         |
| 4C57A65446                    | B98C         | ThinkSystem 4-Port PCIe Gen4 NVMe Retimer Adapter                  | PCIe x16   | 3       | 1,3,5,7         | LP          | No                      |

Configuration notes:

- **Supercap support limits the number of RAID adapters installable** : RAID 9350 and 940 adapters include a power module (supercap) to power the flash memory. The server supports up to 4 supercaps, mounted on the side of the drive bays. The number of supercaps supported also determines the maximum number of RAID adapters with flash that can be installed in the server.
- **E810 Ethernet and X350 RAID/HBAs**: The use of both an Intel E810 network adapter and an X350 HBA/RAID adapter (9350, 5350 and 4350) is currently not supported in ThinkSystem servers. For details see [Support Tip HT513226](#). Planned support for this combination of adapters is 2Q/2024.

The onboard SATA controller has the following features:

- Controller integrated into the Intel PCH
- Supports up to 8 SATA drives
- 6 Gbps SATA host interface
- Supports RAID-0, 1, 5, 10 (Intel VROC SATA RAID, previously known as RSTe)
- Supports JBOD
- Supports HDDs and SSDs; can be mixed

The onboard NVMe support has the following features:

- Controller integrated into the Intel processor
- Supports up to 12 NVMe drives
- Each drive has PCIe 4.0 x4 host interface
- Supports JBOD - Intel and non-Intel NVMe SSDs
- Supports RAID-0, 1, 10 on Intel and non-Intel NVMe SSDs - Intel VROC Standard
- VROC Premium adds RAID-5 support on Intel and non-Intel NVMe SSDs

## Intel VROC onboard RAID

Intel VROC (Virtual RAID on CPU) is a feature of the Intel processor that enables RAID support.

There are two separate functions of VROC in the ST650 V3:

- Intel VROC SATA RAID, formerly known as Intel RSTe
- Intel VROC NVMe RAID

VROC SATA RAID (RSTe) is available and supported with all SATA drives. It offers a 6 Gb/s connection to each drive and on the ST650 V3 implements RAID levels 0, 1, 5, and 10. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

VROC NVMe RAID offers RAID support for any NVMe drives directly connected to the ports on the server's system board or via adapters such as NVMe retimers or NVMe switch adapters. On the ST650 V3, RAID levels implemented are based on the VROC feature selected as indicated in the following table. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

**Performance tip:** For best performance with VROC NVMe RAID, the drives in an array should all be connected to the same processor. Spanning processors is possible however performance will be unpredictable and should be evaluated based on your workload.

The ST650 V3 supports the VROC NVMe RAID offerings listed in the following table.

**Tip:** These feature codes and part numbers are only for VROC RAID using NVMe drives, not SATA drives

Table 27. Intel VROC NVMe RAID ordering information and feature support

| Part number | Feature code | Description                         | Intel NVMe SSDs | Non-Intel NVMe SSDs | RAID 0 | RAID 1 | RAID 10 | RAID 5 |
|-------------|--------------|-------------------------------------|-----------------|---------------------|--------|--------|---------|--------|
| 4L47A83669  | BR9B         | Intel VROC (VMD NVMe RAID) Standard | Yes             | Yes                 | Yes    | Yes    | Yes     | No     |
| 4L47A39164  | B96G         | Intel VROC (VMD NVMe RAID) Premium  | Yes             | Yes                 | Yes    | Yes    | Yes     | Yes    |

Configuration notes:

- If a feature code is ordered in a CTO build, the VROC functionality is enabled in the factory. For field upgrades, order a part number and it will be fulfilled as a Feature on Demand (FoD) license which can then be activated via the XCC management processor user interface.

**Virtualization support:** Virtualization support for Intel VROC is as follows:

- **VROC SATA RAID (RSTe):** VROC SATA RAID is not supported by virtualization hypervisors such as ESXi, KVM, Xen, and Hyper-V. Virtualization is only supported on the onboard SATA ports in AHCI (non-RAID) mode.
- **VROC (VMD) NVMe RAID:** VROC (VMD) NVMe RAID is supported by ESXi, KVM, Xen, and Hyper-V. ESXi support is limited to RAID 1 only; other RAID levels are not supported. Windows and Linux OSes support VROC RAID NVMe, both for host boot functions and for guest OS function, and RAID-0, 1, 5, and 10 are supported. On ESXi, VROC is supported with both boot and data drives.

For specifications about the RAID adapters and HBAs supported by the ST650 V3, see the ThinkSystem RAID Adapter and HBA Comparison, available from:  
<https://lenovopress.com/lp1288-lenovo-thinksystem-raid-adapter-and-hba-reference#st650-v3-support=ST650%2520V3>

For details about these adapters, see the relevant product guide:

- SAS HBAs: <https://lenovopress.com/servers/options/hba>
- RAID adapters: <https://lenovopress.com/servers/options/raid>

## Internal drive options

The following tables list the drive options for internal storage of the server.

2.5-inch hot-swap drives:

- [2.5-inch hot-swap 12 Gb SAS HDDs](#)
- [2.5-inch hot-swap 24 Gb SAS SSDs](#)
- [2.5-inch hot-swap 6 Gb SATA SSDs](#)
- [2.5-inch hot-swap PCIe 4.0 NVMe SSDs](#)

3.5-inch hot-swap drives:

- [3.5-inch hot-swap 12 Gb SAS HDDs](#)
- [3.5-inch hot-swap 6 Gb SATA HDDs](#)
- [3.5-inch hot-swap 24 Gb SAS SSDs](#)
- [3.5-inch hot-swap 6 Gb SATA SSDs](#)
- [3.5-inch hot-swap PCIe 4.0 NVMe SSDs](#)

M.2 drives:

- [M.2 SATA drives](#)
- [M.2 PCIe 4.0 NVMe drives](#)

**M.2 drive support:** The use of M.2 drives requires an additional adapter as described in the [M.2 drives](#) subsection.

**SED support:** The tables include a column to indicate which drives support SED encryption. The encryption functionality can be disabled if needed. Note: Not all SED-enabled drives have "SED" in the description.

Table 28. 2.5-inch hot-swap 12 Gb SAS HDDs

| Part number                                       | Feature code | Description   | SED support | Max Qty |
|---|--------------|---|-------------|---------|
| <b>2.5-inch hot-swap HDDs - 12 Gb SAS 15K</b>     |              |   |             |         |
| 7XB7A00021  | AULV         | ThinkSystem 2.5" 300GB 15K SAS 12Gb Hot Swap 512n HDD     | No          | 32      |
| 7XB7A00022  | AULW         | ThinkSystem 2.5" 600GB 15K SAS 12Gb Hot Swap 512n HDD     | No          | 32      |
| 7XB7A00023  | AULX         | ThinkSystem 2.5" 900GB 15K SAS 12Gb Hot Swap 512e HDD     | No          | 32      |
| <b>2.5-inch hot-swap HDDs - 12 Gb SAS 10K</b>     |              |   |             |         |
| 7XB7A00025  | AULZ         | ThinkSystem 2.5" 600GB 10K SAS 12Gb Hot Swap 512n HDD     | No          | 32      |
| 7XB7A00027  | AUM1         | ThinkSystem 2.5" 1.2TB 10K SAS 12Gb Hot Swap 512n HDD     | No          | 32      |
| 7XB7A00028  | AUM2         | ThinkSystem 2.5" 1.8TB 10K SAS 12Gb Hot Swap 512e HDD     | No          | 32      |
| 4XB7A83970  | BRG7         | ThinkSystem 2.5" 2.4TB 10K SAS 12Gb Hot Swap 512e HDD v2  | No          | 32      |
| <b>2.5-inch hot-swap SED HDDs - 12 Gb SAS 10K</b> |              |   |             |         |
| 7XB7A00031  | AUM5         | ThinkSystem 2.5" 600GB 10K SAS 12Gb Hot Swap 512n HDD SED | Support     | 32      |
| 7XB7A00033  | B0YX         | ThinkSystem 2.5" 1.2TB 10K SAS 12Gb Hot Swap 512n HDD SED | Support     | 32      |

Table 29. 2.5-inch hot-swap 24 Gb SAS SSDs

| Part number  | Feature code | Description   | SED support | Max Qty |
|--|--------------|---|-------------|---------|
| <b>2.5-inch hot-swap SSDs - 24 Gb SAS - Mixed Use/Mainstream (3-5 DWPD)</b>            |              |   |             |         |
| 4XB7A80340   | BNW8         | ThinkSystem 2.5" PM1655 800GB Mixed Use SAS 24Gb HS SSD       | Support     | 32      |
| 4XB7A80341   | BNW9         | ThinkSystem 2.5" PM1655 1.6TB Mixed Use SAS 24Gb HS SSD       | Support     | 32      |
| 4XB7A80342   | BNW6         | ThinkSystem 2.5" PM1655 3.2TB Mixed Use SAS 24Gb HS SSD       | Support     | 32      |
| <b>2.5-inch hot-swap SSDs - 24 Gb SAS - Read Intensive/Entry/Capacity (&lt;3 DWPD)</b> |              |   |             |         |
| 4XB7A80318   | BNWC         | ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD  | Support     | 32      |
| 4XB7A80319   | BNWE         | ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD | Support     | 32      |
| 4XB7A80320   | BNWF         | ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD | Support     | 32      |

Table 30. 2.5-inch hot-swap 6 Gb SATA SSDs

| Part number   | Feature code | Description   | SED support | Max Qty |
|---|--------------|---|-------------|---------|
| <b>2.5-inch hot-swap SSDs - 6 Gb SATA - Mixed Use/Mainstream (3-5 DWPD)</b> |              |   |             |         |
| 4XB7A90884  | BYM2         | ThinkSystem 2.5" Multi Vendor 480GB Mixed Use SATA 6Gb HS SSD v2  | No          | 32      |
| 4XB7A90885  | BYM4         | ThinkSystem 2.5" Multi Vendor 960GB Mixed Use SATA 6Gb HS SSD v2  | No          | 32      |
| 4XB7A90886  | BYM5         | ThinkSystem 2.5" Multi Vendor 1.92TB Mixed Use SATA 6Gb HS SSD v2 | No          | 32      |
| 4XB7A90887  | BYM6         | ThinkSystem 2.5" Multi Vendor 3.84TB Mixed Use SATA 6Gb HS SSD v2 | No          | 32      |
| 4XB7A82289  | BQ21         | ThinkSystem 2.5" 5400 MAX 480GB Mixed Use SATA 6Gb HS SSD         | Support     | 32      |
| 4XB7A82290  | BQ24         | ThinkSystem 2.5" 5400 MAX 960GB Mixed Use SATA 6Gb HS SSD         | Support     | 32      |

| Part number   | Feature code | Description  | SED support | Max Qty |
|---|--------------|--|-------------|---------|
| 4XB7A82291  | BQ22         | ThinkSystem 2.5" 5400 MAX 1.92TB Mixed Use SATA 6Gb HS SSD             | Support     | 32      |
| 4XB7A82292  | BQ23         | ThinkSystem 2.5" 5400 MAX 3.84TB Mixed Use SATA 6Gb HS SSD             | Support     | 32      |
| 4XB7A17125  | BA7Q         | ThinkSystem 2.5" S4620 480GB Mixed Use SATA 6Gb HS SSD                 | No          | 32      |
| 4XB7A17126  | BA4T         | ThinkSystem 2.5" S4620 960GB Mixed Use SATA 6Gb HS SSD                 | No          | 32      |
| 4XB7A17127  | BA4U         | ThinkSystem 2.5" S4620 1.92TB Mixed Use SATA 6Gb HS SSD                | No          | 32      |
| 4XB7A17128  | BK7L         | ThinkSystem 2.5" S4620 3.84TB Mixed Use SATA 6Gb HS SSD                | No          | 32      |
| <b>2.5-inch hot-swap SSDs - 6 Gb SATA - Read Intensive/Entry (&lt;3 DWPD)</b> |              |  |             |         |
| 4XB7A90872  | BYLQ         | ThinkSystem 2.5" Multi Vendor 240GB Read Intensive SATA 6Gb HS SSD v2  | No          | 32      |
| 4XB7A90873  | BYLR         | ThinkSystem 2.5" Multi Vendor 480GB Read Intensive SATA 6Gb HS SSD v2  | No          | 32      |
| 4XB7A90874  | BYLS         | ThinkSystem 2.5" Multi Vendor 960GB Read Intensive SATA 6Gb HS SSD v2  | No          | 32      |
| 4XB7A90875  | BYLT         | ThinkSystem 2.5" Multi Vendor 1.92TB Read Intensive SATA 6Gb HS SSD v2 | No          | 32      |
| 4XB7A90876  | BYLU         | ThinkSystem 2.5" Multi Vendor 3.84TB Read Intensive SATA 6Gb HS SSD v2 | No          | 32      |
| 4XB7A90877  | BYLV         | ThinkSystem 2.5" Multi Vendor 7.68TB Read Intensive SATA 6Gb HS SSD v2 | No          | 32      |
| 4XB7A87524  | BWKN         | ThinkSystem 2.5" PM893a 480GB Read Intensive SATA 6Gb HS SSD           | Support     | 32      |
| 4XB7A87525  | BWKM         | ThinkSystem 2.5" PM893a 960GB Read Intensive SATA 6Gb HS SSD           | Support     | 32      |
| 4XB7A87526  | BWKL         | ThinkSystem 2.5" PM893a 1.92TB Read Intensive SATA 6Gb HS SSD          | Support     | 32      |
| 4XB7A87527  | BWKK         | ThinkSystem 2.5" PM893a 3.84TB Read Intensive SATA 6Gb HS SSD          | Support     | 32      |
| 4XB7A87528  | BYLK         | ThinkSystem 2.5" PM893a 7.68TB Read Intensive SATA 6Gb HS SSD          | Support     | 32      |
| 4XB7A82258  | BQ1Q         | ThinkSystem 2.5" 5400 PRO 240GB Read Intensive SATA 6Gb HS SSD         | Support     | 32      |
| 4XB7A82259  | BQ1P         | ThinkSystem 2.5" 5400 PRO 480GB Read Intensive SATA 6Gb HS SSD         | Support     | 32      |
| 4XB7A82260  | BQ1R         | ThinkSystem 2.5" 5400 PRO 960GB Read Intensive SATA 6Gb HS SSD         | Support     | 32      |
| 4XB7A82261  | BQ1X         | ThinkSystem 2.5" 5400 PRO 1.92TB Read Intensive SATA 6Gb HS SSD        | Support     | 32      |
| 4XB7A82262  | BQ1S         | ThinkSystem 2.5" 5400 PRO 3.84TB Read Intensive SATA 6Gb HS SSD        | Support     | 32      |
| 4XB7A82263  | BQ1T         | ThinkSystem 2.5" 5400 PRO 7.68TB Read Intensive SATA 6Gb HS SSD        | Support     | 32      |
| 4XB7A17072  | B99D         | ThinkSystem 2.5" S4520 240GB Read Intensive SATA 6Gb HS SSD            | No          | 32      |
| 4XB7A17101  | BA7G         | ThinkSystem 2.5" S4520 480GB Read Intensive SATA 6Gb HS SSD            | No          | 32      |
| 4XB7A17102  | BA7H         | ThinkSystem 2.5" S4520 960GB Read Intensive SATA 6Gb HS SSD            | No          | 32      |
| 4XB7A17103  | BA7J         | ThinkSystem 2.5" S4520 1.92TB Read Intensive SATA 6Gb HS SSD           | No          | 32      |
| 4XB7A17104  | BK77         | ThinkSystem 2.5" S4520 3.84TB Read Intensive SATA 6Gb HS SSD           | No          | 32      |
| 4XB7A17105  | BK78         | ThinkSystem 2.5" S4520 7.68TB Read Intensive SATA 6Gb HS SSD           | No          | 32      |



Table 31. 2.5-inch hot-swap PCIe 4.0 NVMe SSDs

| Part number  | Feature code | Description  | SED support | Max Qty |
|--|--------------|--|-------------|---------|
| <b>2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DDPD)</b>   |              |  |             |         |
| 4XB7A17129   | BNEG         | ThinkSystem 2.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD           | Support     | 24      |
| 4XB7A17130   | BNEH         | ThinkSystem 2.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD           | Support     | 24      |
| <b>2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DDPD)</b>   |              |  |             |         |
| 4XB7A95055   | C2BV         | ThinkSystem 2.5" U.3 7500 MAX 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD        | Support     | 24      |
| 4XB7A95056   | C2BW         | ThinkSystem 2.5" U.3 7500 MAX 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD        | Support     | 24      |
| 4XB7A95057   | C2BF         | ThinkSystem 2.5" U.3 7500 MAX 6.4TB Mixed Use NVMe PCIe 4.0 x4 HS SSD        | Support     | 24      |
| 4XB7A95058   | C2BX         | ThinkSystem 2.5" U.3 7500 MAX 12.8TB Mixed Use NVMe PCIe 4.0 x4 HS SSD       | Support     | 24      |
| <b>2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (&lt;3 DDPD)</b> |              |  |             |         |
| 4XB7A13941   | BMGD         | ThinkSystem 2.5" U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD     | Support     | 24      |
| 4XB7A13942   | BMGE         | ThinkSystem 2.5" U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD     | Support     | 24      |
| <b>2.5-inch SSDs - U.3 PCIe 4.0 NVMe - Read Intensive/Entry (&lt;3 DDPD)</b> |              |  |             |         |
| 4XB7A95050   | C2BR         | ThinkSystem 2.5" U.3 7500 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD  | Support     | 24      |
| 4XB7A95051   | C2BS         | ThinkSystem 2.5" U.3 7500 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD  | Support     | 24      |
| 4XB7A95052   | C2BT         | ThinkSystem 2.5" U.3 7500 PRO 7.68TB Read Intensive NVMe PCIe 4.0 x4 HS SSD  | Support     | 24      |
| 4XB7A95053   | C2BU         | ThinkSystem 2.5" U.3 7500 PRO 15.36TB Read Intensive NVMe PCIe 4.0 x4 HS SSD | Support     | 24      |

Table 32. 3.5-inch hot-swap 12 Gb SAS HDDs

| Part number                                  | Feature code | Description   | SED support | Max Qty |
|--|--------------|---|-------------|---------|
| <b>3.5-inch hot-swap HDDs - 12 Gb NL SAS</b> |              |   |             |         |
| 7XB7A00042                                   | AUU5         | ThinkSystem 3.5" 2TB 7.2K SAS 12Gb Hot Swap 512n HDD  | No          | 16      |
| 7XB7A00043                                   | AUU6         | ThinkSystem 3.5" 4TB 7.2K SAS 12Gb Hot Swap 512n HDD  | No          | 16      |
| 7XB7A00044                                   | AUU7         | ThinkSystem 3.5" 6TB 7.2K SAS 12Gb Hot Swap 512e HDD  | No          | 16      |
| 7XB7A00045                                   | B0YR         | ThinkSystem 3.5" 8TB 7.2K SAS 12Gb Hot Swap 512e HDD  | No          | 16      |
| 7XB7A00046                                   | AUUG         | ThinkSystem 3.5" 10TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 7XB7A00067                                   | B117         | ThinkSystem 3.5" 12TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A13906                                   | B496         | ThinkSystem 3.5" 14TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A13911                                   | B7EZ         | ThinkSystem 3.5" 16TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A38266                                   | BCFP         | ThinkSystem 3.5" 18TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A80353                                   | BPKU         | ThinkSystem 3.5" 20TB 7.2K SAS 12Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A83766                                   | BTR7         | ThinkSystem 3.5" 22TB 7.2K SAS 12Gb Hot Swap 512e HDD | Support     | 16      |

Table 33. 3.5-inch hot-swap 6 Gb SATA HDDs

| Part number                                  | Feature code | Description   | SED support | Max Qty |
|--|--------------|---|-------------|---------|
| <b>3.5-inch hot-swap HDDs - 6 Gb NL SATA</b> |              |   |             |         |
| 7XB7A00049                                   | AUUF         | ThinkSystem 3.5" 1TB 7.2K SATA 6Gb Hot Swap 512n HDD  | No          | 16      |
| 7XB7A00050                                   | AUUD         | ThinkSystem 3.5" 2TB 7.2K SATA 6Gb Hot Swap 512n HDD  | No          | 16      |
| 7XB7A00051                                   | AUU8         | ThinkSystem 3.5" 4TB 7.2K SATA 6Gb Hot Swap 512n HDD  | No          | 16      |
| 7XB7A00052                                   | AUUA         | ThinkSystem 3.5" 6TB 7.2K SATA 6Gb Hot Swap 512e HDD  | No          | 16      |
| 7XB7A00053                                   | AUU9         | ThinkSystem 3.5" 8TB 7.2K SATA 6Gb Hot Swap 512e HDD  | No          | 16      |
| 7XB7A00054                                   | AUUB         | ThinkSystem 3.5" 10TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 7XB7A00068                                   | B118         | ThinkSystem 3.5" 12TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A13907                                   | B497         | ThinkSystem 3.5" 14TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A13914                                   | B7F0         | ThinkSystem 3.5" 16TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A38130                                   | BCFH         | ThinkSystem 3.5" 18TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A80354                                   | BPKV         | ThinkSystem 3.5" 20TB 7.2K SATA 6Gb Hot Swap 512e HDD | No          | 16      |
| 4XB7A83765                                   | BTR8         | ThinkSystem 3.5" 22TB 7.2K SATA 6Gb Hot Swap 512e HDD | Support     | 16      |

Table 34. 3.5-inch hot-swap 24 Gb SAS SSDs

| Part number  | Feature code | Description   | SED support | Max Qty |
|--|--------------|---|-------------|---------|
| <b>3.5-inch hot-swap SSDs - 24 Gb SAS - Mixed Use/Mainstream (3-5 DWPD)</b>            |              |   |             |         |
| 4XB7A80344   | BNW7         | ThinkSystem 3.5" PM1655 800GB Mixed Use SAS 24Gb HS SSD       | Support     | 16      |
| 4XB7A80345   | BNWA         | ThinkSystem 3.5" PM1655 1.6TB Mixed Use SAS 24Gb HS SSD       | Support     | 16      |
| 4XB7A80346   | BNWB         | ThinkSystem 3.5" PM1655 3.2TB Mixed Use SAS 24Gb HS SSD       | Support     | 16      |
| <b>3.5-inch hot-swap SSDs - 24 Gb SAS - Read Intensive/Entry/Capacity (&lt;3 DWPD)</b> |              |   |             |         |
| 4XB7A80324   | BNWD         | ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD  | Support     | 16      |
| 4XB7A80325   | BNWG         | ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD | Support     | 16      |
| 4XB7A80326   | BNWH         | ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD | Support     | 16      |

Table 35. 3.5-inch hot-swap 6 Gb SATA SSDs

| Part number   | Feature code | Description  | SED support | Max Qty |
|---|--------------|--|-------------|---------|
| <b>3.5-inch hot-swap SSDs - 6 Gb SATA - Mixed Use/Mainstream (3-5 DWPD)</b>   |              |  |             |         |
| 4XB7A90888  | BYM3         | ThinkSystem 3.5" Multi Vendor 480GB Mixed Use SATA 6Gb HS SSD v2       | No          | 16      |
| 4XB7A90889  | BYM7         | ThinkSystem 3.5" Multi Vendor 960GB Mixed Use SATA 6Gb HS SSD v2       | No          | 16      |
| 4XB7A90890  | BYM8         | ThinkSystem 3.5" Multi Vendor 1.92TB Mixed Use SATA 6Gb HS SSD v2      | No          | 16      |
| 4XB7A90891  | BYLX         | ThinkSystem 3.5" Multi Vendor 3.84TB Mixed Use SATA 6Gb HS SSD v2      | No          | 16      |
| 4XB7A17137  | BA4W         | ThinkSystem 3.5" S4620 480GB Mixed Use SATA 6Gb HS SSD                 | No          | 16      |
| 4XB7A17138  | BA4X         | ThinkSystem 3.5" S4620 960GB Mixed Use SATA 6Gb HS SSD                 | No          | 16      |
| 4XB7A17139  | BA4Y         | ThinkSystem 3.5" S4620 1.92TB Mixed Use SATA 6Gb HS SSD                | No          | 16      |
| 4XB7A17140  | BK7P         | ThinkSystem 3.5" S4620 3.84TB Mixed Use SATA 6Gb HS SSD                | No          | 16      |
| <b>3.5-inch hot-swap SSDs - 6 Gb SATA - Read Intensive/Entry (&lt;3 DWPD)</b> |              |  |             |         |
| 4XB7A90878  | BYLW         | ThinkSystem 3.5" Multi Vendor 240GB Read Intensive SATA 6Gb HS SSD v2  | No          | 16      |
| 4XB7A90879  | BYLJ         | ThinkSystem 3.5" Multi Vendor 480GB Read Intensive SATA 6Gb HS SSD v2  | No          | 16      |
| 4XB7A90880  | BYLY         | ThinkSystem 3.5" Multi Vendor 960GB Read Intensive SATA 6Gb HS SSD v2  | No          | 16      |
| 4XB7A90881  | BYLZ         | ThinkSystem 3.5" Multi Vendor 1.92TB Read Intensive SATA 6Gb HS SSD v2 | No          | 16      |
| 4XB7A90882  | BYM0         | ThinkSystem 3.5" Multi Vendor 3.84TB Read Intensive SATA 6Gb HS SSD v2 | No          | 16      |
| 4XB7A90883  | BYM1         | ThinkSystem 3.5" Multi Vendor 7.68TB Read Intensive SATA 6Gb HS SSD v2 | No          | 16      |
| 4XB7A17118  | BA7K         | ThinkSystem 3.5" S4520 240GB Read Intensive SATA 6Gb HS SSD            | No          | 16      |
| 4XB7A17119  | BA7L         | ThinkSystem 3.5" S4520 480GB Read Intensive SATA 6Gb HS SSD            | No          | 16      |
| 4XB7A17120  | BA7M         | ThinkSystem 3.5" S4520 960GB Read Intensive SATA 6Gb HS SSD            | No          | 16      |
| 4XB7A17121  | BA7N         | ThinkSystem 3.5" S4520 1.92TB Read Intensive SATA 6Gb HS SSD           | No          | 16      |
| 4XB7A17122  | BK7F         | ThinkSystem 3.5" S4520 3.84TB Read Intensive SATA 6Gb HS SSD           | No          | 16      |
| 4XB7A17123  | BK7G         | ThinkSystem 3.5" S4520 7.68TB Read Intensive SATA 6Gb HS SSD           | No          | 16      |

Table 36. 3.5-inch hot-swap PCIe 4.0 NVMe SSDs

| Part number  | Feature code | Description  | SED support | Max Qty |
|--|--------------|--|-------------|---------|
| <b>3.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)</b>   |              |  |             |         |
| 4XB7A17141   | BNEK         | ThinkSystem 3.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD       | Support     | 16      |
| 4XB7A17143   | BNEM         | ThinkSystem 3.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD       | Support     | 16      |
| <b>3.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (&lt;3 DWPD)</b> |              |  |             |         |
| 4XB7A13632   | BNES         | ThinkSystem 3.5" U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD | Support     | 16      |
| 4XB7A76777   | BNET         | ThinkSystem 3.5" U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD | Support     | 16      |

Table 37. M.2 SATA drives

| Part number   | Feature code | Description  | SED support | Max Qty |
|---|--------------|--|-------------|---------|
| <b>M.2 SSDs - 6 Gb SATA - Read Intensive/Entry (&lt;3 DWPD)</b> |              |  |             |         |
| 4XB7A89422  | BYF7         | ThinkSystem M.2 ER3 240GB Read Intensive SATA 6Gb NHS SSD      | Support     | 2       |
| 4XB7A90049  | BYF8         | ThinkSystem M.2 ER3 480GB Read Intensive SATA 6Gb NHS SSD      | Support     | 2       |
| 4XB7A90230  | BYF9         | ThinkSystem M.2 ER3 960GB Read Intensive SATA 6Gb NHS SSD      | Support     | 2       |
| 4XB7A82286  | BQ1Z         | ThinkSystem M.2 5400 PRO 240GB Read Intensive SATA 6Gb NHS SSD | Support     | 2       |
| 4XB7A82287  | BQ1Y         | ThinkSystem M.2 5400 PRO 480GB Read Intensive SATA 6Gb NHS SSD | Support     | 2       |
| 4XB7A82288  | BQ20         | ThinkSystem M.2 5400 PRO 960GB Read Intensive SATA 6Gb NHS SSD | Support     | 2       |
| 7N47A00130  | AUUV         | ThinkSystem M.2 128GB SATA 6Gbps Non-Hot Swap SSD              | No          | 2       |

Table 38. M.2 PCIe 4.0 NVMe drives

| Part number   | Feature code | Description  | SED support | Max Qty |
|---|--------------|--|-------------|---------|
| <b>M.2 SSDs - PCIe 4.0 NVMe - Read Intensive/Entry (&lt;3 DWPD)</b> |              |  |             |         |
| 4XB7A13999  | BKSR         | ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD | Support     | 2       |

## USB memory key

For general portable storage needs, the server also supports the USB memory key option that is listed in the following table.

Table 39. USB memory key

| Part number | Feature | Description                              |
|-------------|---------|--|
| 4X77A77065  | BNWN    | ThinkSystem USB 32GB USB 3.0 Flash Drive |

## Optical drives and backup units

For most configurations, the ST650 V3 has two 5.25-inch half-height drive bays for internal optical drives or backup units. The only configuration that does not support these media bays is the configuration with 4x 2.5-inch backplanes as described in the [Internal storage](#) section.

The drives and media supported by the server are listed in the following table.

**LTO tape drive in a rack conversion kit :** The ST650 V3 is supported installed on its side in a rack mount kit, however the use of an LTO tape drive in this configuration is supported but not recommended.

Table 40. Internal optical drives and backup units

| Part number              | Feature code | Description   | Maximum supported |
|--------------------------|--------------|---|-------------------|
| Optical drives           |              |   |                   |
| 4XA7A81755               | B36S         | ThinkSystem 9.5mm Ultra-Slim USB DVD-RW v2                | 1                 |
| LTO tape drives          |              |   |                   |
| 4T27A80487               | B4BM         | ThinkSystem Internal Half High LTO Gen8 SAS Tape Drive v2 | 1                 |
| LTO media                |              |   |                   |
| 4TP7A09619               | B4BN         | ThinkSystem LTO Gen8 12TB Tape                            | Not applicable    |
| RDX drive and cartridges |              |   |                   |
| 4T27A80485               | AVF6         | ThinkSystem Internal RDX USB 3.0 Dock v2                  | 1                 |
| 7T27A01501               | AVF6         | ThinkSystem Internal RDX USB 3.0 Dock                     | 1                 |
| 7TP7A01601               | AVF8         | ThinkSystem RDX 500GB Cartridge                           | Not applicable    |
| 7TP7A01602               | AVF1         | ThinkSystem RDX 1TB Cartridge                             | Not applicable    |
| 7TP7A04318               | AXD1         | ThinkSystem RDX 4TB Cartridge                             | Not applicable    |
| 7TP7A01603               | AVF0         | ThinkSystem RDX 2TB Cartridge                             | Not applicable    |

For field upgrades, the kits listed in the following table are available.

**RDX upgrades:** The RDX dock part numbers include a power cable however, the cable is not suitable for use in the ST650 V3. Instead you will need to use the cable that is included in either 4Z57A82624 or 4Z57A82626.

Table 41. Internal optical drives and backup units

| Part number | Description   | Purpose  |
|-------------|---|--|
| 4M27A60829  | ThinkSystem ST650 V2/V3 3.5" Chassis Media Bay Enablement Kit <ul style="list-style-type: none"> <li>• 2-bay 5.25" ODD/Tape Cage</li> <li>• Cage for 1x Slim ODD</li> <li>• ODD filler/bezel</li> <li>• Tape filler/bezel</li> </ul> See <a href="#">Enablement Kit documentation</a> | Provides the cage necessary to house two 5.25-inch drives, plus an inner cage for the slim optical drive. Also include blank bezels when a bay is not in use. Order tape drives and cables separately.   |
| 4Z57A16101  | ThinkSystem ST650 V2/V3 Optical Disk Drive Cable Kit <ul style="list-style-type: none"> <li>• Slim ODD Bezel</li> <li>• USB Cable for Slim ODD</li> </ul> See <a href="#">Cable Kit documentation</a>   | Provides the USB cable needed to connect the optical drive   |
| 4Z57A82624  | ThinkSystem ST650 V2/V3 Tape Drive Cable Kit for X30 HBA <ul style="list-style-type: none"> <li>• SAS cable SBB7A10262</li> <li>• MiniSAS cable SBB7A53849</li> <li>• Power cable SBB7A50395</li> </ul> See <a href="#">Cable Kit documentation</a>                                   | Provides the power cable and SAS cable to connect the tape drive to an 4350-8i/16i SAS HBA. Order the SAS HBA separately.<br><br>When adding the RDX dock as a field upgrade, you will need the power cable SBB7A50395 in this kit (also included in kit 4Z57A82626) |
| 4Z57A82626  | ThinkSystem ST650 V2/V3 Tape Drive Cable Kit for X40 HBA <ul style="list-style-type: none"> <li>• SAS cable SBB7A10263</li> <li>• MiniSAS cable SBB7A53850</li> <li>• Power cable SBB7A50395</li> </ul> See <a href="#">Cable Kit documentation</a>                                   | Provides the power cable and SAS cable to connect the tape drive to an 440-8i/16i SAS HBA. Order the SAS HBA separately.<br><br>When adding the RDX dock as a field upgrade, you will need the power cable SBB7A50395 in this kit (also included in kit 4Z57A82624)  |

The ST650 V3 also supports external drives. External tape and RDX drives are described in the [External backup units](#) section.

The server supports the external USB optical drive listed in the following table.

Table 42. External optical drive

| Part number | Feature code | Description  |
|-------------|--------------|--|
| 7XA7A05926  | AVV8         | ThinkSystem External USB DVD RW Optical Disk Drive |

The drive is based on the Lenovo Slim DVD Burner DB65 drive and supports the following formats: DVD-RAM, DVD-RW, DVD+RW, DVD+R, DVD-R, DVD-ROM, DVD-R DL, CD-RW, CD-R, CD-ROM.

## I/O expansion

The ST650 V3 supports a total of 9x PCIe slots: 5x PCIe 5.0 and 4x PCIe 4.0 slots. All nine slots are mounted on the system board. Slots 1-8 are full height, full length (FHFL); slot 9 is full height, half length (FHHL). Slots 4-8 require CPU 2 installed.

- Slot 1: PCIe 5.0 x16 (CPU 1)
- Slot 2: PCIe 5.0 x8 (x8 physical slot) (CPU 1)
- Slot 3: PCIe 5.0 x16 (CPU 1)
- Slot 4: PCIe 5.0 x8 (x8 physical slot) (CPU 1)
- Slot 5: PCIe 5.0 x16 (CPU 2)
- Slot 6: PCIe 4.0 x8 (x8 physical slot) (CPU 2)
- Slot 7: PCIe 4.0 x16 (CPU 2)
- Slot 8: PCIe 4.0 x8 (x8 physical slot) (CPU 2)
- Slot 9: PCIe 4.0 x8 (x8 physical slot) (CPU 1)

The slots are shown in the following figure.

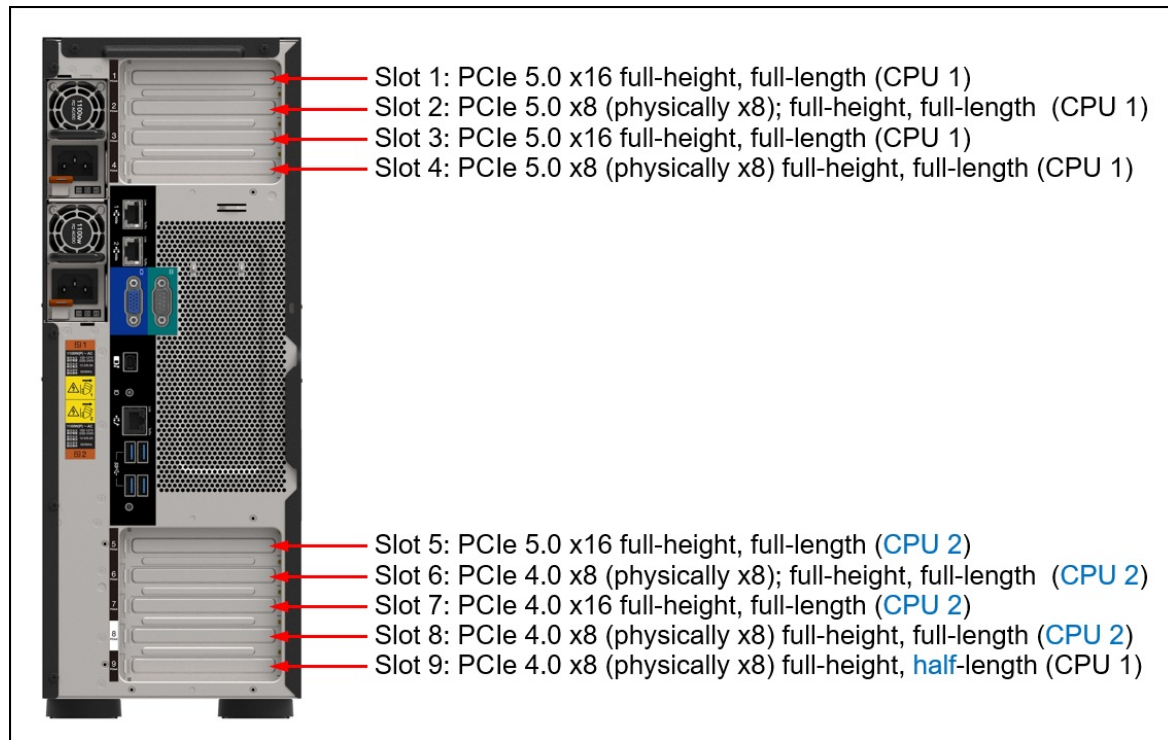


Figure 8. ST650 V3 PCIe slots

For GPUs, additional components may be required. See the [GPU adapters](#) section for details.



## Network adapters

The ST650 V3 has two integrated 10GBASE-T ports for 1/10Gb Ethernet connectivity, based on the Broadcom BCM57416 controller.

The controller has the following features:

- General features
  - PCIe 3.0 x8 host interface
  - Supports 10GbE and 1GbE
    - 10GBASE-T IEEE 802.3an support
    - 1000BASE-T IEEE 802.3ab support
  - Supports IPv4 and IPv6
  - Broadcom TruFlow flow processing engine
- Virtualization features
  - SR-IOV support with up to 128 VFs
  - VXLAN, NVGRE, Geneve, GRE encapsulation and decapsulation
  - vSwitch acceleration
  - Multiqueue, NetQueue, and VMQ
  - Tunnel-aware stateless offloads
  - Message Signal Interrupts (MSI-X) support
- Ethernet features:
  - IPv4 and IPv6 offloads
  - TCP, UDP, and IP checksum offloads
  - Large Send Offload (LSO)
  - Large Receive Offload (LRO)
  - TCP Segmentation Offload (TSO)
  - Receive-side Scaling (RSS)
  - Transmit-side Scaling (TSS)
  - VLAN insertion/removal
  - Interrupt coalescing
  - Jumbo frames up to 9 KB
  - Network boot-PXE, UEFI
  - iSCSI boot
  - Data Plane Development Kit (DPDK) support
- Remote Direct Memory Access (RDMA):
  - Supports RDMA over converged Ethernet (RoCE) specifications
- Data Center Bridging / Converged Enhanced Ethernet (DCB/CEE):
  - Hardware Offloads of Ethernet TCP/IP
  - 802.1Qbb Priority Flow Control (PFC)
  - 802.1Qaz Enhanced Transmission Selection (ETS)
  - 802.1Qaz Data Center Bridging Exchange (DCBX)
- Management:
  - SMBus 2.0
  - MCTP over SMBus
  - NC-SI support
  - Wake on LAN (WOL)

The ST650 V3 also supports network adapters that can be installed in the regular PCIe slots.

Table 43. Supported PCIe Network Adapters

| Part number                         | Feature code | Description  | PCIe lanes | Max qty | Slots supported | Form factor |
|-------------------------------------|--------------|--|------------|---------|-----------------|-------------|
| Gigabit Ethernet                    |              |  |            |         |                 |             |
| 7ZT7A00484                          | AUZV         | ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter               | PCIe x4    | 7       | 2-4, 6-8        | LP          |
| 7ZT7A00535                          | AUZW         | ThinkSystem I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter                      | PCIe x4    | 7       | 2-4, 6-8        | LP          |
| 10 Gb Ethernet - 10GBASE-T          |              |  |            |         |                 |             |
| 7ZT7A00496                          | AUKP         | ThinkSystem Broadcom 57416 10GBASE-T 2-Port PCIe Ethernet Adapter              | PCIe x8    | 7       | 2-4, 6-8        | LP          |
| 4XC7A80266                          | BNWL         | ThinkSystem Intel X710-T2L 10GBase-T 2-Port PCIe Ethernet Adapter              | PCIe x8    | 7       | 2-4, 6-8        | LP          |
| 4XC7A79699                          | BMXB         | ThinkSystem Intel X710-T4L 10GBase-T 4-Port PCIe Ethernet Adapter              | PCIe x8    | 7       | 2-4, 6-8        | LP          |
| 25 Gb Ethernet                      |              |  |            |         |                 |             |
| 4XC7A08238                          | BK1H         | ThinkSystem Broadcom 57414 10/25GbE SFP28 2-port PCIe Ethernet Adapter         | PCIe x8    | 9       | All slots       | LP          |
| 4XC7A80566                          | BNWM         | ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port PCIe Ethernet Adapter         | PCIe x16   | 9       | All slots       | LP          |
| 4XC7A62580                          | BE4U         | ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-Port PCIe Ethernet Adapter | PCIe x8    | 9       | All slots       | LP          |
| 100 Gb Ethernet / HDR100 InfiniBand |              |  |            |         |                 |             |
| 4XC7A08297                          | BK1J         | ThinkSystem Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter        | PCIe x16   | 4       | 1,3,5,7         | LP          |

For more information, including the transceivers and cables that each adapter supports, see the list of Lenovo Press Product Guides in the Networking adapters category:

<https://lenovopress.com/servers/options/ethernet>

**Configuration requirements:**

- Adapters with a x16 host interface require a x16 slot to maximize performance
- PCIe Gen5 adapters will require a Gen5 riser to maximize performance
- **E810 Ethernet and X350 RAID/HBAs:** The use of both an Intel E810 network adapter and an X350 HBA/RAID adapter (9350, 5350 and 4350) is currently not supported in ThinkSystem servers. For details see [Support Tip HT513226](#). Planned support for this combination of adapters is 2Q/2024.

## Fibre Channel host bus adapters

The following table lists the Fibre Channel HBAs supported by the ST650 V3.

Table 44. Fibre Channel HBAs

| Part number                     | Feature code | Description   | PCIe lanes | Max qty | Slots supported | Form factor |
|---------------------------------|--------------|---|------------|---------|-----------------|-------------|
| <b>32 Gb Fibre Channel HBAs</b> |              |   |            |         |                 |             |
| 4XC7A76498                      | BJ3G         | ThinkSystem Emulex LPe35000 32Gb 1-port PCIe Fibre Channel Adapter v2 | PCIe x8    | 9       | All slots       | LP          |
| 4XC7A76525                      | BJ3H         | ThinkSystem Emulex LPe35002 32Gb 2-port PCIe Fibre Channel Adapter V2 | PCIe x8    | 9       | All slots       | LP          |
| <b>16 Gb Fibre Channel HBAs</b> |              |   |            |         |                 |             |
| 01CV840                         | ATZV         | Emulex 16Gb Gen6 FC Dual-port HBA                                     | PCIe x8    | 9       | All slots       | LP          |
| 01CV830                         | ATZU         | Emulex 16Gb Gen6 FC Single-port HBA                                   | PCIe x8    | 9       | All slots       | LP          |

For more information, see the list of Lenovo Press Product Guides in the Host bus adapters category: <https://lenovopress.com/servers/options/hba>

## SAS adapters for external storage

The following table lists SAS HBAs and RAID adapters supported by ST650 V3 server for use with external storage.

Table 45. Adapters for external storage

| Part number                   | Feature code | Description  | PCIe lanes | Max qty | Slots supported | Form factor | Supercap |
|-------------------------------|--------------|--|------------|---------|-----------------|-------------|----------|
| <b>External SAS HBAs</b>      |              |  |            |         |                 |             |          |
| 4Y37A78837                    | BNWK         | ThinkSystem 440-8e SAS/SATA PCIe Gen4 12Gb HBA           | PCIe x8    | 9       | All slots       | LP          | No       |
| 4Y37A09724                    | B8P7         | ThinkSystem 440-16e SAS/SATA PCIe Gen4 12Gb HBA          | PCIe x8    | 9       | All slots       | LP          | No       |
| <b>External RAID adapters</b> |              |  |            |         |                 |             |          |
| 4Y37A78836                    | BNWJ         | ThinkSystem RAID 940-8e 4GB Flash PCIe Gen4 12Gb Adapter | PCIe x8    | 4       | All slots       | LP          | Included |

\* See below regarding supercap requirements

For a comparison of the functions of the supported external storage adapters, see the ThinkSystem RAID Adapter and HBA Reference:

<https://lenovopress.com/lp1288#st650-v3-support=ST650%20V3&internal-or-external-ports=External>

The RAID 940-8e uses a flash power module (supercap), which can be installed in one of four locations on the air baffle in the server. The number of 940-8e RAID adapters supported is based on how many supercaps can be installed in the server. If an internal 940i or 9350i RAID adapter with flash power modules is installed, the maximum number of 940-8e adapters supported is reduced by 1.

For more information, see the list of Lenovo Press Product Guides in the Host bus adapters and RAID adapters categories:

<https://lenovopress.com/servers/options/hba>  
<https://lenovopress.com/servers/options/raid>

## Flash storage adapters

The ST650 V3 currently does not support flash storage adapters.

## GPU adapters

The ST650 V3 supports the following graphics processing units (GPUs).

Table 46. Supported GPUs

| Part number                 | Feature code | Description  | TDP  | PCIe lanes | Max qty | Slots supported | Form factor | Aux power | NVLink support |
|-----------------------------|--------------|--|------|------------|---------|-----------------|-------------|-----------|----------------|
| Single-wide GPUs            |              |  |      |            |         |                 |             |           |                |
| CTO only                    | BP05         | ThinkSystem NVIDIA A2 16GB PCIe Gen4 Passive GPU         | 60W  | PCIe x8    | 8       | 1-8             | LP          | No        | No             |
| 4X67A81547                  | BQZT         | ThinkSystem NVIDIA A2 16GB PCIe Gen4 Passive GPU w/o CEC | 60W  | PCIe x8    | 8       | 1-8             | LP          | No        | No             |
| 4X67A84824                  | BS2C         | ThinkSystem NVIDIA L4 24GB PCIe Gen4 Passive GPU         | 72W  | PCIe x16   | 8       | 1-8             | LP          | No        | No             |
| Double-wide GPUs            |              |  |      |            |         |                 |             |           |                |
| 4X67A76720                  | BMT9         | ThinkSystem NVIDIA RTX A2000 12GB PCIe Active GPU        | 70W  | PCIe x16   | 4       | 1,3,5,7         | FHHL        | No        | No             |
| 4X67A76726                  | BNFD         | ThinkSystem NVIDIA RTX A4500 20GB PCIe Active GPU        | 200W | PCIe x16   | 4       | 1,3,5,7         | FHFL        | Yes       | 1 per pair     |
| 4X67A71310                  | BFT0         | ThinkSystem NVIDIA RTX A6000 48GB PCIe Active GPU        | 300W | PCIe x16   | 4       | 1,3,5,7         | FHFL        | Yes       | 1 per pair     |
| NVLink for double-wide GPUs |              |  |      |            |         |                 |             |           |                |
| 4X67A71309                  | BG3F         | ThinkSystem NVIDIA Ampere NVLink 2-Slot Bridge           | -    | -          | 2       | -               | -           | -         | -              |

Configuration rules:

- Some NVIDIA A Series GPUs are available as two feature codes, one with a CEC chip and one without a CEC chip (ones without the CEC chip have "w/o CEC" in the name). The CEC is a secondary Hardware Root of Trust (RoT) module that provides an additional layer of security, which can be used by customers who have high regulatory requirements or high security standards. NVIDIA uses a multi-layered security model and hence the protection offered by the primary Root of Trust embedded in the GPU is expected to be sufficient for most customers. The CEC defeatured products still offer Secure Boot, Secure Firmware Update, Firmware Rollback Protection, and In-Band Firmware Update Disable. Specifically, without the CEC chip, the GPU does not support Key Revocation or Firmware Attestation. CEC and non-CEC GPUs of the same type of GPU can be

mixed in field upgrades.

- All GPUs installed in a zone must be identical
- NVLink bridges are supported on certain GPUs as listed in the above table, one bridge per pair of GPUs. The use of the NVLink bridge requires that the two GPUs be installed next to each other (slots 1 & 3, or slots 5 & 7)
- When a double-wide GPU is installed in slot 1, 3, 5 or 7, the adjacent slot 2, 4, 6 or 8 respectively is not available
- Dual-rotor cooling fans are required
- Backplane support:
  - Double-wide GPUs: only two backplanes are supported and no optical drive or tape drive can be installed
  - Single-wide GPUs: four backplanes supported (4 dual-rotor fans required)
- When the NVIDIA A2 or NVIDIA L4 are installed, an air duct (4XF7A82410, BPHW) must also be installed in the zone to properly direct airflow. The use of this air duct means that all other adapters installed in the zone can only be low-profile adapters. Full-length adapters are not supported.
- The following rules apply to all double-wide GPUs:
  - When a GPU is installed in Zone 1 (upper slots, slots 1-4), a RAID card, HBA or Retimer cannot also be installed in that zone
  - When a GPU is installed in Zone 2 (lower slots, slots 5-9), a RAID card, HBA or Retimer cannot be installed in slots 5-8. Slot 9 can, however, be used to install the storage adapter

For information about these GPUs, see the ThinkSystem GPU Summary, available at: <https://lenovopress.com/lp0768-thinksystem-thinkagile-gpu-summary>

## GPU field upgrades

The following table lists the field upgrades for GPUs including auxiliary power cables for double-wide GPUs.

**Zones:** PCIe slots in the server are grouped into zones:

- Zone 1 = slots 1, 2, 3, 4 (upper slots)
- Zone 2 = slots 5, 6, 7, 8, 9 (lower slots)

Table 47. GPU field upgrades

| Part number | Feature code | Description  | Purpose  |
|-------------|--------------|--|--|
| 4M27A60836  | BJL8         | ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit <ul style="list-style-type: none"> <li>• 2x adapter brackets</li> <li>• 1x GPU filler</li> </ul> See below for drawings of these components. | 1-2 kit needed per server, if full-length GPUs are installed.<br><br>The two brackets mount on the fan cage to secure the ends of full-length adapters that are installed. The left bracket is for slots in zone 1 and the right bracket is for zone 2.<br><br>The GPU filler is needed in a zone for proper airflow when there is only 1x DW GPU installed in that zone. If there are 2x DW GPUs in a zone, then the filler is not needed.<br><br>1x kit is needed for most configurations. 2x kits are only needed when 2x DW GPUs are installed, one in zone 1 and one in zone 2. |

| Part number | Feature code | Description  | Purpose   |
|-------------|--------------|--|---|
| 4M27A11843  | BGDD         | <p>ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit</p> <ul style="list-style-type: none"> <li>• 1x filler sponge</li> </ul> <p>See below for a drawing of this component.</p>  | <p>1 kit needed for each zone, if an NVIDIA A2 or L4 is installed in that zone.</p> <p>The kit contains a sponge that is mounted to the underside of the server cover and is needed for proper cooling when A2/L4 GPUs are installed.</p> <p><b>Note:</b> Once a sponge is installed in a zone, only low profile adapters can be installed in that zone. Full-height adapters are not supported.</p>  |
| 4XF7A82410  | BPHW         | <p>ThinkSystem ST650 V2/V3 GPU Airduct Kit</p> <ul style="list-style-type: none"> <li>• 1x Air duct for Zone 1 (slots 1-4)</li> <li>• 1x Air duct for Zone 2 (slots 5-8)</li> </ul> <p>See below for drawings of these components.</p> | <p>1 kit needed per server, if NVIDIA A2 or L4 GPUs are installed.</p> <p>The kit contains two air ducts which are mounted on the fan cage to properly route air flow from the low-profile GPU adapters. The air duct for a zone is only needed when an A2 or L4 is installed in that zone.</p> <p><b>Note:</b> Once an air duct is installed in a zone, only low profile adapters can be installed in that zone. Full-height adapters are not supported.</p> |
| 4Z57A82608  | BUN8         | <p>ThinkSystem ST650 V2/V3 RTX A4500 GPU Power Cable Kit</p> <ul style="list-style-type: none"> <li>• 320mm power cable for slots 1-4</li> <li>• 660 mm power cable for slots 5-8</li> </ul>   | <p>1 kit needed per A4500 GPU. Auxiliary power cable for NVIDIA RTX A4500. Use the cable that matches the slot where the GPU is installed.</p>  |
| 4Z57A60816  | BB42         | <p>ThinkSystem ST650 V2/V3 RTX A6000 GPU Power Cable Kit</p> <ul style="list-style-type: none"> <li>• 320mm power cable for slots 1-4</li> <li>• 660 mm power cable for slots 5-8</li> </ul>   | <p>1 kit needed per A6000 GPU. Auxiliary power cable for NVIDIA RTX A6000. Use the cable that matches the slot where the GPU is installed.</p>  |

The following figure shows the components of ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit (4M27A60836).

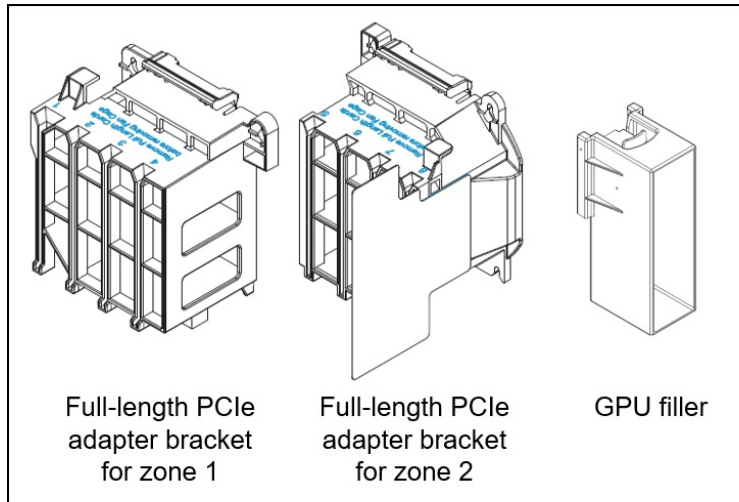


Figure 9. ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit (4M27A60836)

The following figure shows the components of ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit (4M27A11843) and ThinkSystem ST650 V2/V3 GPU Airduct Kit (4XF7A82410).

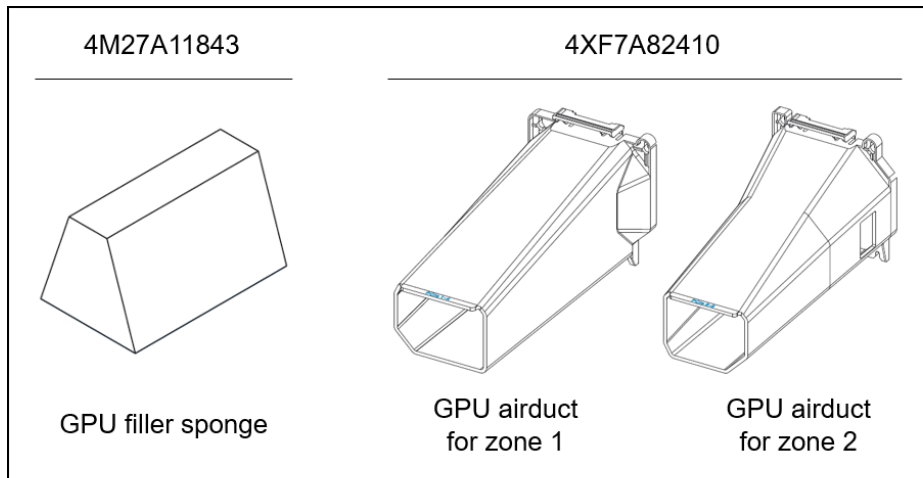


Figure 10. ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit (4M27A11843) and ThinkSystem ST650 V2/V3 GPU Airduct Kit (4XF7A82410)

## Cooling

The ST650 V3 server has up to 4x hot-swap variable-speed 92 mm fans, either Performance or Standard fans, depending on the configuration. Performance fans are dual-rotor counter-rotating units that have two separate spinning fan rotors, one in front of the other, which rotate in opposite directions. Standard fans are single-rotor units.

Performance fans are N+1 rotor redundant and in the event of a rotor failure, the system will continue with no loss of performance provided the ambient temperature is 27 °C or lower. If the ambient temperature is above 27 °C, performance may be degraded. Standard fans are not redundant, and in the event of a fan failure, the server will continue however performance will be degraded.

The server also has one or two additional fans integrated in each of the two power supplies.

Depending on the configuration, Standard fans will be sufficient to provide the necessary air flow, however for CTO orders it will be possible in the DCSC configurator to override the default selection and select Performance fans. Fan types cannot be mixed. Ordering information is listed in the following table.

Table 48. Cooling fan options

| Part number | Feature code | Description  | Quantity required |        |
|-------------|--------------|--|-------------------|--------|
|             |              |  | 1 CPU             | 2 CPUs |
| 4M27A60831  | BA5S         | ThinkSystem ST650 V2 Standard Fan Kit (single-rotor fans)  | 3 or 4            | 4      |
| 4M27A60832  | BA5T         | ThinkSystem ST650 V2 Performance Fan Kit (dual-rotor fans) | 3 or 4            | 4      |

The use of 4x dual-rotor fans supports all configurations, however the use of 3x fans or the use of single-rotor fans is supported under the following conditions:

- 3x single-rotor fans can be used in the following conditions
  - Processor: 1x CPU, TDP < 200W
  - Memory: Total memory ≤ 64GB
  - No GPUs installed
  - Backplanes: only 2 backplanes installed (8x 3.5-inch or 16x 2.5-inch)
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No support for M.2
- 3x double-rotor fans can be used in the following conditions (all must apply):
  - Processor: 1x CPU (no TDP restriction)
  - Memory: Total memory ≤ 128GB
  - GPUs: up to 2 double-wide or 4 single-wide
  - Backplanes: only 2 backplanes installed (8x 3.5-inch or 16x 2.5-inch)
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No restriction
- 4x single-rotor fans can be used in the following conditions (all must apply):
  - Processor: 1 or 2 CPUs, TDP < 200W
  - Memory: Total memory ≤ 64GB
  - GPUs: No support
  - Backplanes: No restriction
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No support for M.2

## Power supplies

The ST650 V3 supports up to two redundant hot-swap power supplies.

The power supply choices are listed in the following table. Both power supplies used in server must be identical.

**Tip:** When configuring a server in the DCSC configurator, power consumption is calculated precisely by interfacing with Lenovo Capacity Planner. You can therefore select the appropriate power supply for your configuration. However, do consider future upgrades that may require additional power needs.



Table 49. Power supply options

| Part number   | Feature code | Description  | Connector | Max qty | 110V AC | 220V AC | 240V DC PRC only |
|---|--------------|--|-----------|---------|---------|---------|------------------|
| <b>AC input power - 80 PLUS Titanium efficiency</b> |              |  |           |         |         |         |                  |
| 4P57A72666  | BLKH         | ThinkSystem 1100W 230V Titanium Hot-Swap Gen2 Power Supply         | C13       | 2       | No      | Yes     | Yes              |
| 4P57A78359  | BPK9         | ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply         | C13       | 2       | No      | Yes     | Yes              |
| 4P57A72667  | BKTJ         | ThinkSystem 2600W 230V Titanium Hot-Swap Gen2 Power Supply         | C19       | 2       | No      | Yes     | Yes              |
| <b>AC input power - 80 PLUS Platinum efficiency</b> |              |  |           |         |         |         |                  |
| 4P57A72670  | BNFG         | ThinkSystem 750W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3  | C13       | 2       | Yes     | Yes     | Yes              |
| 4P57A72671  | BNFH         | ThinkSystem 1100W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3 | C13       | 2       | Yes     | Yes     | Yes              |
| 4P57A78362  | BMUF         | ThinkSystem 1800W 230V Platinum Hot-Swap Gen2 Power Supply v2      | C13       | 2       | No      | Yes     | Yes              |

Supported power supplies are auto-sensing dual-voltage units, supporting both 110V AC (100-127V 50/60 Hz) and 220V AC (200-240V 50/60 Hz) power. For China customers, all power supplies support 240V DC. Power supplies up to 1800W have a C14 connector. Power supplies 2400W and above have a C19 connector.

Power supply options do not include a line cord. For server configurations, the inclusion of a power cord is model dependent. Configure-to-order models can be configured without power cords if desired.

## Power supply LEDs

The supported hot-swap power supplies have the following LEDs:

- Power input LED:
  - Green: The power supply is connected to the AC power source
  - Off: The power supply is disconnected from the AC power source or a power problem has occurred
- Power output LED:
  - Green: The server is on and the power supply is working normally
  - Blinking green: The power supply is in Zero-output/Standby mode (see below)
  - Off: The server is powered off, or the power supply is not working properly

- Power supply error LED:
  - Off: The power supply is working normally
  - Yellow: The power supply has failed

**Zero-output mode:** When Zero-output mode (also known as Standby mode or Cold Redundancy mode) is configured in XCC and the server power load is sufficiently low, one of the installed power supplies enters into the Standby state while the other one delivers entire load. When the power load increases, the standby power supply will switch to Active state to provide sufficient power to the server. Zero-output mode can be enabled or disabled in the XClarity Controller web interface, Server Configuration > Power Policy. If you select Disable, then both power supplies will be in the Active state.

## Power cords

Line cords and rack power cables with C13 connectors can be ordered as listed in the following table.

**110V customers:** If you plan to use the 1100W power supply with a 110V power source, select a power cable that is rated above 10A. Power cables that are rated at 10A or below are not supported with 110V power.

Table 50. Power cords

| Part number                        | Feature code | Description  |
|------------------------------------|--------------|--|
| Rack cables - C13 to C14           |              |  |
| SL67B08593                         | BPHZ         | 0.5m, 10A/100-250V, C13 to C14 Jumper Cord                     |
| 00Y3043                            | A4VP         | 1.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable        |
| 4L67A08367                         | B0N5         | 1.0m, 13A/100-250V, C13 to C14 Jumper Cord                     |
| 39Y7937                            | 6201         | 1.5m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable        |
| 4L67A08368                         | B0N6         | 1.5m, 13A/100-250V, C13 to C14 Jumper Cord                     |
| 4L67A08365                         | B0N4         | 2.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable        |
| 4L67A08369                         | 6570         | 2.0m, 13A/100-250V, C13 to C14 Jumper Cord                     |
| 4L67A08366                         | 6311         | 2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable        |
| 4L67A08370                         | 6400         | 2.8m, 13A/100-250V, C13 to C14 Jumper Cord                     |
| 39Y7932                            | 6263         | 4.3m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable        |
| 4L67A08371                         | 6583         | 4.3m, 13A/100-250V, C13 to C14 Rack Power Cable                |
| Rack cables - C13 to C14 (Y-cable) |              |  |
| 00Y3046                            | A4VQ         | 1.345m, 2X C13 to C14 Jumper Cord, Rack Power Cable            |
| 00Y3047                            | A4VR         | 2.054m, 2X C13 to C14 Jumper Cord, Rack Power Cable            |
| Rack cables - C13 to C20           |              |  |
| 39Y7938                            | 6204         | 2.8m, 10A/100-250V, C13 to IEC 320-C20 Rack Power Cable        |
| Rack cables - C13 to C20 (Y-cable) |              |  |
| 47C2491                            | A3SW         | 1.2m, 16A/100-250V, 2 Short C13s to Short C20 Rack Power Cable |
| 47C2492                            | A3SX         | 2.5m, 16A/100-250V, 2 Long C13s to Short C20 Rack Power Cable  |
| 47C2493                            | A3SY         | 2.8m, 16A/100-250V, 2 Short C13s to Long C20 Rack Power Cable  |
| 47C2494                            | A3SZ         | 4.1m, 16A/100-250V, 2 Long C13s to Long C20 Rack Power Cable   |
| Line cords                         |              |  |
| 39Y7930                            | 6222         | 2.8m, 10A/250V, C13 to IRAM 2073 (Argentina) Line Cord         |
| 81Y2384                            | 6492         | 4.3m 10A/220V, C13 to IRAM 2073 (Argentina) Line Cord          |
| 39Y7924                            | 6211         | 2.8m, 10A/250V, C13 to AS/NZ 3112 (Australia/NZ) Line Cord     |

| Part number | Feature code | Description  |
|-------------|--------------|--|
| 81Y2383     | 6574         | 4.3m, 10A/230V, C13 to AS/NZS 3112 (Aus/NZ) Line Cord    |
| 69Y1988     | 6532         | 2.8m, 10A/250V, C13 to NBR 14136 (Brazil) Line Cord      |
| 81Y2387     | 6404         | 4.3m, 10A/250V, C13 - 2P+Gnd (Brazil) Line Cord          |
| 39Y7928     | 6210         | 2.8m, 220-240V, C13 to GB 2099.1 (China) Line Cord       |
| 81Y2378     | 6580         | 4.3m, 10A/220V, C13 to GB 2099.1 (China) Line Cord       |
| 39Y7918     | 6213         | 2.8m, 10A/250V, C13 to DK2-5a (Denmark) Line Cord        |
| 81Y2382     | 6575         | 4.3m, 10A/230V, C13 to DK2-5a (Denmark) Line Cord        |
| 39Y7917     | 6212         | 2.8m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord       |
| 81Y2376     | 6572         | 4.3m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord       |
| 39Y7927     | 6269         | 2.8m, 10A/250V, C13(2P+Gnd) (India) Line Cord            |
| 81Y2386     | 6567         | 4.3m, 10A/240V, C13 to IS 6538 (India) Line Cord         |
| 39Y7920     | 6218         | 2.8m, 10A/250V, C13 to SI 32 (Israel) Line Cord          |
| 81Y2381     | 6579         | 4.3m, 10A/230V, C13 to SI 32 (Israel) Line Cord          |
| 39Y7921     | 6217         | 2.8m, 220-240V, C13 to CEI 23-16 (Italy/Chile) Line Cord |
| 81Y2380     | 6493         | 4.3m, 10A/230V, C13 to CEI 23-16 (Italy/Chile) Line Cord |
| 46M2593     | A1RE         | 2.8m, 12A/125V, C13 to JIS C-8303 (Japan) Line Cord      |
| 4L67A08362  | 6495         | 4.3m, 12A/200V, C13 to JIS C-8303 (Japan) Line Cord      |
| 39Y7926     | 6335         | 4.3m, 12A/100V, C13 to JIS C-8303 (Japan) Line Cord      |
| 39Y7922     | 6214         | 2.8m, 10A/250V, C13 to SABS 164 (S Africa) Line Cord     |
| 81Y2379     | 6576         | 4.3m, 10A/230V, C13 to SABS 164 (South Africa) Line Cord |
| 39Y7925     | 6219         | 2.8m, 220-240V, C13 to KETI (S Korea) Line Cord          |
| 81Y2385     | 6494         | 4.3m, 12A/220V, C13 to KSC 8305 (S. Korea) Line Cord     |
| 39Y7919     | 6216         | 2.8m, 10A/250V, C13 to SEV 1011-S24507 (Swiss) Line Cord |
| 81Y2390     | 6578         | 4.3m, 10A/230V, C13 to SEV 1011-S24507 (Sws) Line Cord   |
| 23R7158     | 6386         | 2.8m, 10A/125V, C13 to CNS 10917-3 (Taiwan) Line Cord    |
| 81Y2375     | 6317         | 2.8m, 10A/240V, C13 to CNS 10917-3 (Taiwan) Line Cord    |
| 81Y2374     | 6402         | 2.8m, 13A/125V, C13 to CNS 60799 (Taiwan) Line Cord      |
| 4L67A08363  | AX8B         | 4.3m, 10A 125V, C13 to CNS 10917 (Taiwan) Line Cord      |
| 81Y2389     | 6531         | 4.3m, 10A/250V, C13 to 76 CNS 10917-3 (Taiwan) Line Cord |
| 81Y2388     | 6530         | 4.3m, 13A/125V, C13 to CNS 10917 (Taiwan) Line Cord      |
| 39Y7923     | 6215         | 2.8m, 10A/250V, C13 to BS 1363/A (UK) Line Cord          |
| 81Y2377     | 6577         | 4.3m, 10A/230V, C13 to BS 1363/A (UK) Line Cord          |
| 90Y3016     | 6313         | 2.8m, 10A/120V, C13 to NEMA 5-15P (US) Line Cord         |
| 46M2592     | A1RF         | 2.8m, 10A/250V, C13 to NEMA 6-15P Line Cord              |
| 00WH545     | 6401         | 2.8m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord         |
| 4L67A08359  | 6370         | 4.3m, 10A/125V, C13 to NEMA 5-15P (US) Line Cord         |
| 4L67A08361  | 6373         | 4.3m, 10A/250V, C13 to NEMA 6-15P (US) Line Cord         |
| 4L67A08360  | AX8A         | 4.3m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord         |

## Power cords (C19 connectors)

Line cords and rack power cables with C19 connectors can be ordered as listed in the following table.

Table 51. Power cords (C19 connectors)

| Part number        | Feature code | Description  |
|--------------------|--------------|--|
| <b>Rack cables</b> |              |  |
| 4L67A86677         | BPJ0         | 0.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable    |
| 4L67A86678         | B4L0         | 1.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable    |
| 4L67A86679         | B4L1         | 1.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable    |
| 4L67A86680         | B4L2         | 2.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable    |
| 39Y7916            | 6252         | 2.5m, 16A/100-240V, C19 to IEC 320-C20 Rack Power Cable    |
| 4L67A86681         | B4L3         | 4.3m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable    |
| <b>Line cords</b>  |              |  |
| 40K9777            | 6276         | 4.3m, 220-240V, C19 to IRAM 2073 (Argentina) Line cord     |
| 40K9773            | 6284         | 4.3m, 220-240V, C19 to AS/NZS 3112 (Aus/NZ) Line cord      |
| 40K9775            | 6277         | 4.3m, 250V, C19 to NBR 14136 (Brazil) Line Cord            |
| 40K9774            | 6288         | 4.3m, 220-240V, C19 to GB2099.1 (China) Line cord          |
| 40K9769            | 6283         | 4.3m, 16A/230V, C19 to IEC 309-P+N+G (Den/Sws) Line Cord   |
| 40K9766            | 6279         | 4.3m, 220-240V, C19 to CEE7-VII (European) Line cord       |
| 40K9776            | 6285         | 4.3m, 220-240V, C19 to IS6538 (India) Line cord            |
| 40K9771            | 6282         | 4.3m, 220-240V, C19 to SI 32 (Israel) Line cord            |
| 40K9768            | 6281         | 4.3m, 220-240V, C19 to CEI 23-16 (Italy) Line cord         |
| 40K9770            | 6280         | 4.3m, 220-240V, C19 to SABS 164 (South Africa) Line cord   |
| 41Y9231            | 6289         | 4.3m, 15A/250V, C19 to KSC 8305 (S. Korea) Line Cord       |
| 81Y2391            | 6549         | 4.3m, 16A/230V, C19 to SEV 1011 (Sws) Line Cord            |
| 41Y9230            | 6287         | 4.3m, 16A/250V, C19 to CNS 10917-3 (Taiwan) Line Cord      |
| 40K9767            | 6278         | 4.3m, 220-240V, C19 to BS 1363/A w/13A fuse (UK) Line Cord |
| 40K9772            | 6275         | 4.3m, 16A/208V, C19 to NEMA L6-20P (US) Line Cord          |
| 00D7197            | A1NV         | 4.3m, 15A/250V, C19 to NEMA 6-15P (US) Line Cord           |

## Systems management

The ST650 V3 contains an integrated service processor, XClarity Controller 2 (XCC2), which provides advanced control, monitoring, and alerting functions. The XCC2 is based on the AST2600 baseboard management controller (BMC) using a dual-core ARM Cortex A7 32-bit RISC service processor running at 1.2 GHz.

Topics in this section:

- [Local management](#)
- [System status with XClarity Mobile](#)
- [Remote management](#)
- [XCC2 Platinum](#)
- [Lenovo XClarity Provisioning Manager](#)
- [Lenovo XClarity Administrator](#)
- [Lenovo XClarity Integrators](#)
- [Lenovo XClarity Essentials](#)
- [Lenovo XClarity Energy Manager](#)
- [Lenovo Capacity Planner](#)

## Local management

The ST650 V3 offers a front operator panel with key LED status indicators, as shown in the following figure.

### Tips:

- The Network LED only shows network activity of the two 10GBASE-T ports
- The Drive LED is non-functioning in the ST650 V3

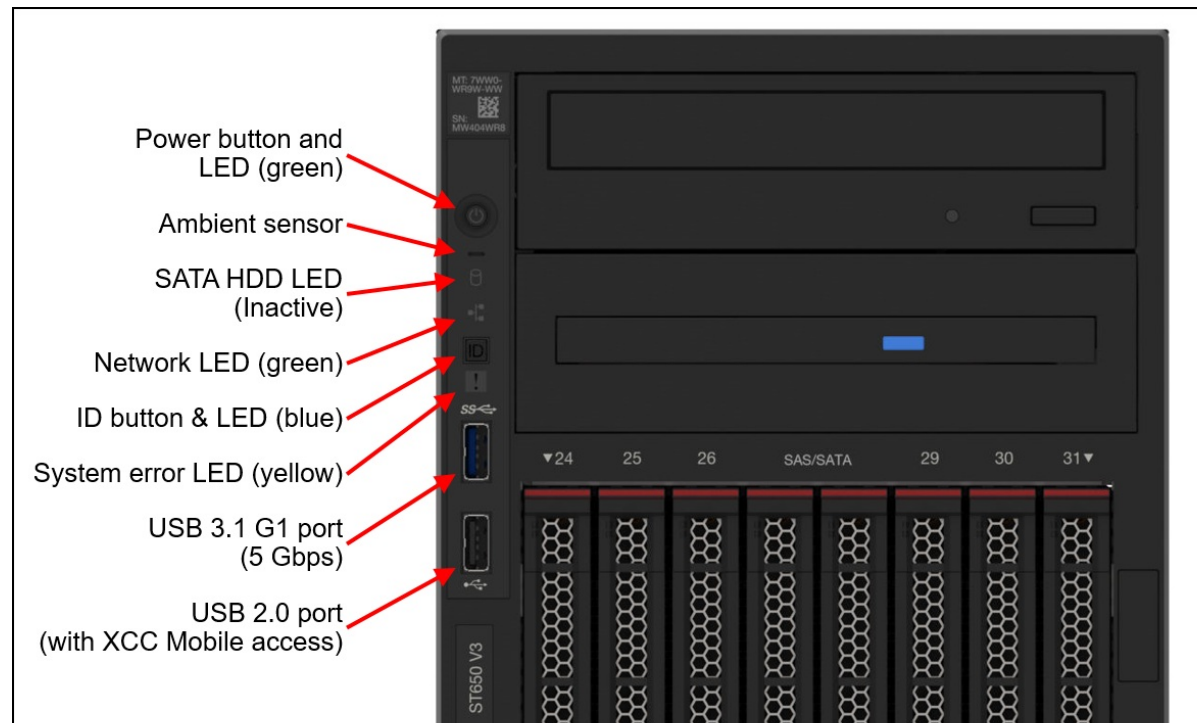


Figure 11. ST650 V3 front operator panel

When you press the ID button on the front panel, the blue system ID LEDs on both the front and rear of the server are lit to help you locate the server among other servers. You also can turn on the system ID LEDs using a remote management program for server presence detection.

### Light path diagnostics

The server offers light path diagnostics. If an environmental condition exceeds a threshold or if a system component fails, XCC lights LEDs inside the server to help you diagnose the problem and find the failing part. The server has fault LEDs next to the following components:

- Each memory DIMM
- Each drive bay
- Each power supply

### External Diagnostics Handset

The ST650 V3 also has a port at the rear of the server to connect an External Diagnostics Handset as shown in the following figure.

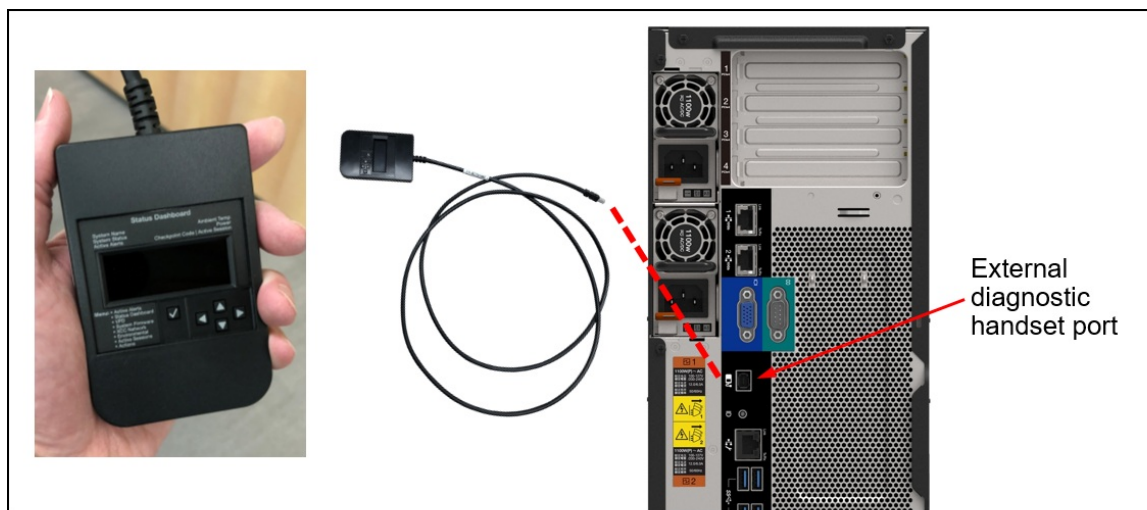


Figure 12. ST650 V3 External Diagnostics Handset

The External Diagnostics Handset allows quick access to system status, firmware, network, and health information. The LCD display on the panel and the function buttons give you access to the following information:

- Active alerts
- Status Dashboard
- System VPD: machine type & mode, serial number, UUID string
- System firmware levels: UEFI and XCC firmware
- XCC network information: hostname, MAC address, IP address, DNS addresses
- Environmental data: Ambient temperature, CPU temperature, AC input voltage, estimated power consumption
- Active XCC sessions
- System reset action

The handset has a magnet on the back of it to allow you to easily mount it on a convenient place on any rack cabinet. Many other ThinkSystem V2 and V3 servers also support the External Diagnostics Handset allowing you to share a handset between multiple systems.

Ordering information for the External Diagnostics Handset with is listed in the following table.


Table 52. External Diagnostics Handset ordering information

| Part number | Feature code | Description                              |
|-------------|--------------|--|
| 4TA7A64874  | BEUX         | ThinkSystem External Diagnostics Handset |

### System status with XClarity Mobile

The XClarity Mobile app includes a tethering function where you can connect your Android or iOS device to the server via USB to see the status of the server.

The steps to connect the mobile device are as follows:

1. Enable USB Management on the server, by holding down the ID button for 3 seconds (or pressing the dedicated USB management button if one is present)
2. Connect the mobile device via a USB cable to the server's USB port with the management symbol 
3. In iOS or Android settings, enable Personal Hotspot or USB Tethering
4. Launch the Lenovo XClarity Mobile app

Once connected you can see the following information:

- Server status including error logs (read only, no login required)
- Server management functions (XClarity login credentials required)

### Remote management

The server offers a dedicated RJ45 port at the rear of the server for remote management via the XClarity Controller management processor. The port supports 10/100/1000 Mbps speeds.

Remote server management is provided through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3 (no SET commands; no SNMP v1)
- Common Information Model (CIM-XML)
- Representational State Transfer (REST) support
- Redfish support (DMTF compliant)
- Web browser - HTML 5-based browser interface (Java and ActiveX not required) using a responsive design (content optimized for device being used - laptop, tablet, phone) with NLS support

The ST650 V3 offers a MicroSD card port on the system board to enable the use of a MicroSD card for additional storage for use with the XCC2 controller. XCC2 can use the storage as a Remote Disc on Card (RDOC) device (up to 4GB of storage). It can also be used to store firmware updates (including N-1 firmware history) for ease of deployment.

**Tip:** Without a MicroSD card installed, the XCC2 controller will have 100MB of available RDOC storage.

Ordering information for the supported Micro SD card is listed in the following table.

Table 53. MicroSD card

| Part number | Feature code | Description   |
|-------------|--------------|---|
| 4X77A77064  | BNWP         | ThinkSystem MicroSD 32GB Class 10 Flash Memory Card |
| 4X77A92672  | C0BC         | ThinkSystem MicroSD 64GB Class 10 Flash Memory Card |

IPMI via the Ethernet port (IPMI over LAN) is supported, however it is disabled by default. For CTO orders you can specify whether you want the feature enabled or disabled in the factory, using the feature codes listed in the following table.

Table 54. IPMI-over-LAN settings

| Feature code | Description                     |
|--------------|---------------------------------|
| B7XZ         | Disable IPMI-over-LAN (default) |
| B7Y0         | Enable IPMI-over-LAN            |

## XCC2 Platinum

The XCC2 service processor in the ST650 V3 supports an upgrade to the Platinum level of features. Compared to the XCC functions of ThinkSystem V2 and earlier systems, Platinum adds the same features as Enterprise and Advanced levels in ThinkSystem V2, plus additional features.

XCC2 Platinum adds the following Enterprise and Advanced functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- International keyboard mapping support
- Syslog alerting
- Redirecting serial console via SSH
- Component replacement log (Maintenance History log)
- Access restriction (IP address blocking)
- Lenovo SED security key management
- Displaying graphics for real-time and historical power usage data and temperature
- Boot video capture and crash video capture
- Virtual console collaboration - Ability for up to 6 remote users to be log into the remote session simultaneously
- Remote console Java client
- Mapping the ISO and image files located on the local client as virtual drives for use by the server
- Mounting the remote ISO and image files via HTTPS, SFTP, CIFS, and NFS
- Power capping
- System utilization data and graphic view
- Single sign on with Lenovo XClarity Administrator
- Update firmware from a repository
- License for XClarity Energy Manager

XCC2 Platinum also adds the following features that are new to XCC2:

- System Guard - Monitor hardware inventory for unexpected component changes, and simply log the event or prevent booting
- Enterprise Strict Security mode - Enforces CNSA 1.0 level security
- Neighbor Group - Enables administrators to manage and synchronize configurations and firmware level across multiple servers

Ordering information is listed in the following table. XCC2 Platinum is a software license upgrade - no additional hardware is required.

Table 55. XCC2 Platinum license upgrade

| Part number | Feature code | Description  |
|-------------|--------------|--|
| 7S0X000KWW  | SBCV         | Lenovo XClarity Controller 2 (XCC2) Platinum Upgrade |



With XCC2 Platinum, for CTO orders, you can request that System Guard be enabled in the factory and the first configuration snapshot be recorded. To add this to an order, select feature code listed in the following table. The selection is made in the Security tab of the DCSC configurator.

Table 56. Enable System Guard in the factory (CTO orders)

| Feature code | Description          |
|--------------|----------------------|
| BUT2         | Install System Guard |

For more information about System Guard, see [https://pubs.lenovo.com/xcc2/NN1ia\\_c\\_systemguard](https://pubs.lenovo.com/xcc2/NN1ia_c_systemguard)

## Lenovo XClarity Provisioning Manager

Lenovo XClarity Provisioning Manager (LXPM) is a UEFI-based application embedded in ThinkSystem servers and accessible via the F1 key during system boot.

LXPM provides the following functions:

- Graphical UEFI Setup
- System inventory information and VPD update
- System firmware updates (UEFI and XCC)
- RAID setup wizard
- OS installation wizard (including unattended OS installation)
- Diagnostics functions

## Lenovo XClarity Administrator

Lenovo XClarity Administrator is a centralized resource management solution designed to reduce complexity, speed response, and enhance the availability of Lenovo systems and solutions. It provides agent-free hardware management for ThinkSystem servers, in addition to ThinkServer, System x, and Flex System servers. The administration dashboard is based on HTML 5 and allows fast location of resources so tasks can be run quickly.

Because Lenovo XClarity Administrator does not require any agent software to be installed on the managed endpoints, there are no CPU cycles spent on agent execution, and no memory is used, which means that up to 1GB of RAM and 1 - 2% CPU usage is saved, compared to a typical managed system where an agent is required.

Lenovo XClarity Administrator is an optional software component for the ST650 V3. The software can be downloaded and used at no charge to discover and monitor the ST650 V3 and to manage firmware upgrades.

If software support is required for Lenovo XClarity Administrator, or premium features such as configuration management and operating system deployment are required, Lenovo XClarity Pro software subscription should be ordered. Lenovo XClarity Pro is licensed on a per managed system basis, that is, each managed Lenovo system requires a license.

The following table lists the Lenovo XClarity software license options.

Table 57. Lenovo XClarity Pro ordering information

| Part number | Feature code | Description   |
|-------------|--------------|---|
| 00MT201     | 1339         | Lenovo XClarity Pro, per Managed Endpoint w/1 Yr SW S&S |
| 00MT202     | 1340         | Lenovo XClarity Pro, per Managed Endpoint w/3 Yr SW S&S |
| 00MT203     | 1341         | Lenovo XClarity Pro, per Managed Endpoint w/5 Yr SW S&S |
| 7S0X000HWW  | SAYV         | Lenovo XClarity Pro, per Managed Endpoint w/6 Yr SW S&S |
| 7S0X000JWW  | SAYW         | Lenovo XClarity Pro, per Managed Endpoint w/7 Yr SW S&S |

Lenovo XClarity Administrator offers the following standard features that are available at no charge:

- Auto-discovery and monitoring of Lenovo systems
- Firmware updates and compliance enforcement
- External alerts and notifications via SNMP traps, syslog remote logging, and e-mail
- Secure connections to managed endpoints
- NIST 800-131A or FIPS 140-2 compliant cryptographic standards between the management solution and managed endpoints
- Integration into existing higher-level management systems such as cloud automation and orchestration tools through REST APIs, providing extensive external visibility and control over hardware resources
- An intuitive, easy-to-use GUI
- Scripting with Windows PowerShell, providing command-line visibility and control over hardware resources

Lenovo XClarity Administrator offers the following premium features that require an optional Pro license:

- Pattern-based configuration management that allows to define configurations once and apply repeatedly without errors when deploying new servers or redeploying existing servers without disrupting the fabric
- Bare-metal deployment of operating systems and hypervisors to streamline infrastructure provisioning

For more information, refer to the Lenovo XClarity Administrator Product Guide:

<http://lenovopress.com/tips1200>

### Lenovo XClarity Integrators

Lenovo also offers software plug-in modules, Lenovo XClarity Integrators, to manage physical infrastructure from leading external virtualization management software tools including those from Microsoft and VMware.

These integrators are offered at no charge, however if software support is required, a Lenovo XClarity Pro software subscription license should be ordered.

Lenovo XClarity Integrators offer the following additional features:

- Ability to discover, manage, and monitor Lenovo server hardware from VMware vCenter or Microsoft System Center
- Deployment of firmware updates and configuration patterns to Lenovo x86 rack servers and Flex System from the virtualization management tool
- Non-disruptive server maintenance in clustered environments that reduces workload downtime by dynamically migrating workloads from affected hosts during rolling server updates or reboots
- Greater service level uptime and assurance in clustered environments during unplanned hardware events by dynamically triggering workload migration from impacted hosts when impending hardware failures are predicted

For more information about all the available Lenovo XClarity Integrators, see the Lenovo XClarity Administrator Product Guide: <https://lenovopress.com/tips1200-lenovo-xclarity-administrator>

## Lenovo XClarity Essentials

Lenovo offers the following XClarity Essentials software tools that can help you set up, use, and maintain the server at no additional cost:

- **Lenovo Essentials OneCLI**  
OneCLI is a collection of server management tools that uses a command line interface program to manage firmware, hardware, and operating systems. It provides functions to collect full system health information (including health status), configure system settings, and update system firmware and drivers.
- **Lenovo Essentials UpdateXpress**  
The UpdateXpress tool is a standalone GUI application for firmware and device driver updates that enables you to maintain your server firmware and device drivers up-to-date and help you avoid unnecessary server outages. The tool acquires and deploys individual updates and UpdateXpress System Packs (UXSPs) which are integration-tested bundles.
- **Lenovo Essentials Bootable Media Creator**  
The Bootable Media Creator (BOMC) tool is used to create bootable media for offline firmware update.

For more information and downloads, visit the Lenovo XClarity Essentials web page: <http://support.lenovo.com/us/en/documents/LNVO-center>

## Lenovo XClarity Energy Manager

Lenovo XClarity Energy Manager (LXEM) is a power and temperature management solution for data centers. It is an agent-free, web-based console that enables you to monitor and manage power consumption and temperature in your data center through the management console. It enables server density and data center capacity to be increased through the use of power capping.

LXEM is a licensed product. A single-node LXEM license is included with the XClarity Controller Platinum upgrade as described in the [XCC2 Platinum](#) section. If your server does not have the XCC Platinum upgrade, Energy Manager licenses can be ordered as shown in the following table.

Table 58. Lenovo XClarity Energy Manager

| Part number | Description   |
|-------------|---|
| 4L40E51621  | Lenovo XClarity Energy Manager Node License (1 license needed per server) |

For more information about XClarity Energy Manager, see the following resources:

- Lenovo Support page:  
<https://datacentersupport.lenovo.com/us/en/solutions/Invo-lxem>
- User Guide for XClarity Energy Manager:  
<https://pubs.lenovo.com/lxem/>

## Lenovo Capacity Planner

Lenovo Capacity Planner is a power consumption evaluation tool that enhances data center planning by enabling IT administrators and pre-sales professionals to understand various power characteristics of racks, servers, and other devices. Capacity Planner can dynamically calculate the power consumption, current, British Thermal Unit (BTU), and volt-ampere (VA) rating at the rack level, improving the planning efficiency for large scale deployments.

For more information, refer to the Capacity Planner web page:

<http://datacentersupport.lenovo.com/us/en/solutions/Invo-lcp>

## Security

Topics in this section:

- [Security features](#)
- [Platform Firmware Resiliency - Lenovo ThinkShield](#)
- [Intel Transparent Supply Chain](#)
- [Security standards](#)

### Security features

The ST650 V3 server offers the following electronic security features:

- Secure Boot function of the Intel Xeon processor
- Support for Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) - see the [Platform Firmware Resiliency](#) section
- Firmware signature processes compliant with FIPS and NIST requirements
- System Guard (part of [XCC Platinum](#)) - Proactive monitoring of hardware inventory for unexpected component changes
- Administrator and power-on password
- Integrated Trusted Platform Module (TPM) supporting TPM 2.0
- Self-encrypting drives (SEDs) with support for enterprise key managers - see the [SED encryption key management](#) section

The ST650 V3 offers the following mechanical security features:

- Lockable side cover to help prevent access to internal components
- Optional chassis intrusion switch
- Optional lockable front security door (not supported with the tower is converted to a 4U rack server)

The server is NIST SP 800-147B compliant.

The optional lockable front security door is shown in the following figure and includes a key that enables you to secure the drives and system controls thereby reducing the chance of unauthorized or accidental access to the server.



Figure 13. Lockable front security door

The following table lists the security options for the ST650 V3.

Table 59. Security features

| Part number | Feature code | Description   |
|-------------|--------------|---|
| 4M27A60834  | BA5U         | ThinkSystem ST650 V2 Security Door                  |
| 4Z57A60817  | BB4F         | ThinkSystem ST650 V2/V3 Chassis Intrusion Cable Kit |

### Platform Firmware Resiliency - Lenovo ThinkShield

Lenovo's ThinkShield Security is a transparent and comprehensive approach to security that extends to all dimensions of our data center products: from development, to supply chain, and through the entire product lifecycle.

The ThinkSystem ST650 V3 includes Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) which enables the system to be NIST SP800-193 compliant. This offering further enhances key platform subsystem protections against unauthorized firmware updates and corruption, to restore firmware to an integral state, and to closely monitor firmware for possible compromise from cyber-attacks.

PFR operates upon the following server components:

- UEFI image – the low-level server firmware that connects the operating system to the server hardware
- XCC image – the management “engine” software that controls and reports on the server status separate from the server operating system
- FPGA image – the code that runs the server’s lowest level hardware controller on the motherboard

The Lenovo Platform Root of Trust Hardware performs the following three main functions:

- Detection – Measures the firmware and updates for authenticity
- Recovery – Recovers a corrupted image to a known-safe image
- Protection – Monitors the system to ensure the known-good firmware is not maliciously written

These enhanced protection capabilities are implemented using a dedicated, discrete security processor whose implementation has been rigorously validated by leading third-party security firms. Security evaluation results and design details are available for customer review – providing unprecedented transparency and assurance.

The ST650 V3 includes support for Secure Boot, a UEFI firmware security feature developed by the UEFI Consortium that ensures only immutable and signed software are loaded during the boot time. The use of Secure Boot helps prevent malicious code from being loaded and helps prevent attacks, such as the installation of rootkits. Lenovo offers the capability to enable secure boot in the factory, to ensure end-to-end protection. Alternatively, Secure Boot can be left disabled in the factory, allowing the customer to enable it themselves at a later point, if desired.

The following table lists the relevant feature code(s).

Table 60. Secure Boot options

| Part number | Feature code | Description              | Purpose  |
|-------------|--------------|--------------------------|--|
| CTO only    | BPKQ         | TPM 2.0 with Secure Boot | Configure the system in the factory with Secure Boot enabled.  |
| CTO only    | BPKR         | TPM 2.0                  | Configure the system without Secure Boot enabled. Customers can enable Secure Boot later if desired. |

**Tip:** If Secure Boot is not enabled in the factory, it can be enabled later by the customer. However once Secure Boot is enabled, it cannot be disabled.

## Intel Transparent Supply Chain

Add a layer of protection in your data center and have peace of mind that the server hardware you bring into it is safe authentic and with documented, testable, and provable origin.

Lenovo has one of the world’s best supply chains, as ranked by Gartner Group, backed by extensive and mature supply chain security programs that exceed industry norms and US Government standards. Now we are the first Tier 1 manufacturer to offer Intel® Transparent Supply Chain in partnership with Intel, offering you an unprecedented degree of supply chain transparency and assurance.

To enable Intel Transparent Supply Chain for the Intel-based servers in your order, add the following feature code in the [DCSC configurator](#), under the Security tab.

Table 61. Intel Transparent Supply Chain ordering information

| Feature code | Description                    |
|--------------|--------------------------------|
| BB0P         | Intel Transparent Supply Chain |

For more information on this offering, see the paper *Introduction to Intel Transparent Supply Chain on Lenovo ThinkSystem Servers*, available from <https://lenovopress.com/lp1434-introduction-to-intel-transparent-supply-chain-on-thinksystem-servers>.

## Security standards

The ST650 V3 supports the following security standards and capabilities:

- **Industry Standard Security Capabilities**

- Intel CPU Enablement
  - AES-NI (Advanced Encryption Standard New Instructions)
  - CBnT (Converged Boot Guard and Trusted Execution Technology)
  - CET (Control flow Enforcement Technology)
  - Hardware-based side channel attack resilience enhancements
  - MKTME/TME (Multi-Key Total Memory Encryption)
  - SGX (Software Guard eXtensions)
  - SGX-TEM (Trusted Environment Mode)
  - TDX (Trust Domain Extensions)
  - TXT (Trusted eXecution Technology)
  - VT (Virtualization Technology)
  - XD (eXecute Disable)
- Microsoft Windows Security Enablement
  - Credential Guard
  - Device Guard
  - Host Guardian Service
- TCG (Trusted Computing Group) TPM (Trusted Platform Module) 2.0
- UEFI (Unified Extensible Firmware Interface) Forum Secure Boot

- **Hardware Root of Trust and Security**

- Independent security subsystem providing platform-wide NIST SP800-193 compliant Platform Firmware Resilience (PFR)
- Management domain RoT supplemented by the Secure Boot features of XCC

- **Platform Security**

- Boot and run-time firmware integrity monitoring with rollback to known-good firmware (e.g., “self-healing”)
- Non-volatile storage bus security monitoring and filtering
- Resilient firmware implementation, such as to detect and defeat unauthorized flash writes or SMM (System Management Mode) memory incursions
- Patented IPMI KCS channel privileged access authorization (USPTO Patent# 11,256,810)
- Host and management domain authorization, including integration with CyberArk for enterprise password management
- KMIP (Key Management Interoperability Protocol) compliant, including support for IBM SKLM and Thales KeySecure
- Reduced “out of box” attack surface
- Configurable network services
- FIPS 140-3 (in progress) validated cryptography for XCC
- CNSA Suite 1.0 Quantum-resistant cryptography for XCC
- Lenovo System Guard

For more information on platform security, see the paper “How to Harden the Security of your ThinkSystem Server and Management Applications” available from <https://lenovopress.com/lp1260-how-to-harden-the-security-of-your-thinksystem-server>.

- **Standards Compliance and/or Support**

- NIST SP800-131A rev 2 “Transitioning the Use of Cryptographic Algorithms and Key Lengths”
- NIST SP800-147B “BIOS Protection Guidelines for Servers”

- NIST SP800-193 “Platform Firmware Resiliency Guidelines”
- ISO/IEC 11889 “Trusted Platform Module Library”
- Common Criteria TCG Protection Profile for “PC Client Specific TPM 2.0”
- European Union Commission Regulation 2019/424 (“ErP Lot 9”) “Ecodesign Requirements for Servers and Data Storage Products” Secure Data Deletion
- Optional FIPS 140-2 validated Self-Encrypting Disks (SEDs) with external KMIP-based key management
- **Product and Supply Chain Security**
  - Suppliers validated through Lenovo’s Trusted Supplier Program
  - Developed in accordance with Lenovo’s Secure Development Lifecycle (LSDL)
  - Continuous firmware security validation through automated testing, including static code analysis, dynamic network and web vulnerability testing, software composition analysis, and subsystem-specific testing, such as UEFI security configuration validation
  - Ongoing security reviews by US-based security experts, with attestation letters available from our third-party security partners
  - Digitally signed firmware, stored and built on US-based infrastructure and signed on US-based Hardware Security Modules (HSMs)
  - Manufacturing transparency via Intel Transparent Supply Chain (for details, see <https://lenovopress.com/lp1434-introduction-to-intel-transparent-supply-chain-on-lenovo-thinksystem-servers>)
  - TAA (Trade Agreements Act) compliant manufacturing, by default in Mexico for North American markets with additional US and EU manufacturing options
  - US 2019 NDAA (National Defense Authorization Act) Section 889 compliant

## Keyboards and Mice

The following table lists the supported full-sized USB keyboards and mice available for Lenovo ThinkSystem servers.

The keyboards have the following features:

- Full-sized 104-key keyboard with 3 special Windows keys
- 3 LEDs for caps lock, scroll lock and num lock
- Wired USB connection with 1.8m cable
- Adjustable feet at the rear of the keyboard

**Tip:** For keyboards that fit in the rack-mounted console kit, see the [KVM console options](#) section, or the [ThinkSystem 18.5-inch LCD Console](#) product guide

Table 62. Lenovo Preferred Pro USB Full-sized keyboards - ThinkSystem

| Part number | Feature code | Description  |
|-------------|--------------|--|
| Mice        |              |  |
| 7M57A04698  | B0LN         | ThinkSystem Optical Wheel Mouse - USB                  |
| Keyboards   |              |  |
| 7ZB7A05521  | AXTM         | ThinkSystem Pref. Pro II USB Keyboard - Arabic         |
| 7ZB7A05520  | AXTN         | ThinkSystem Pref. Pro II USB Keyboard - Arabic/French  |
| 7ZB7A05519  | AXTP         | ThinkSystem Pref. Pro II USB Keyboard - Belgium/French |
| 7ZB7A05518  | AXTQ         | ThinkSystem Pref. Pro II USB Keyboard - Belgium/UK     |



| Part number | Feature code | Description  |
|-------------|--------------|--|
| 7ZB7A05517  | AXTR         | ThinkSystem Pref. Pro II USB Keyboard - Brazil/Portuguese            |
| 7ZB7A05515  | AXTS         | ThinkSystem Pref. Pro II USB Keyboard - Bulgarian                    |
| 7ZB7A05511  | AXTU         | ThinkSystem Pref. Pro II USB Keyboard - Czech                        |
| 7ZB7A05509  | AXTV         | ThinkSystem Pref. Pro II USB Keyboard - Danish                       |
| 7ZB7A05508  | AXTW         | ThinkSystem Pref. Pro II USB Keyboard - Dutch                        |
| 7ZB7A05506  | AXTX         | ThinkSystem Pref. Pro II USB Keyboard - French                       |
| 7ZB7A05496  | AXTZ         | ThinkSystem Pref. Pro II USB Keyboard - French Canadian French       |
| 7ZB7A05504  | AXTY         | ThinkSystem Pref. Pro II USB Keyboard - French Canadian Multilingual |
| 7ZB7A05495  | AXU0         | ThinkSystem Pref. Pro II USB Keyboard - German                       |
| 7ZB7A05494  | AXU1         | ThinkSystem Pref. Pro II USB Keyboard - Greek                        |
| 7ZB7A05493  | AXU2         | ThinkSystem Pref. Pro II USB Keyboard - Hebrew                       |
| 7ZB7A05492  | AXU3         | ThinkSystem Pref. Pro II USB Keyboard - Hungarian                    |
| 7ZB7A05491  | AXU4         | ThinkSystem Pref. Pro II USB Keyboard - Iceland                      |
| 7ZB7A05490  | AXU5         | ThinkSystem Pref. Pro II USB Keyboard - Italy                        |
| 7ZB7A05489  | AXU6         | ThinkSystem Pref. Pro II USB Keyboard -Japanese                      |
| 7ZB7A05488  | AXU7         | ThinkSystem Pref. Pro II USB Keyboard - Korean                       |
| 7ZB7A05487  | AXU8         | ThinkSystem Pref. Pro II USB Keyboard - LA Spanish                   |
| 7ZB7A05486  | AXU9         | ThinkSystem Pref. Pro II USB Keyboard - Norwegian                    |
| 7ZB7A05485  | AXUA         | ThinkSystem Pref. Pro II USB Keyboard - Polish                       |
| 7ZB7A05484  | AXUB         | ThinkSystem Pref. Pro II USB Keyboard- Portugese                     |
| 7ZB7A05483  | AXUC         | ThinkSystem Pref. Pro II USB Keyboard - Romanian                     |
| 7ZB7A05482  | AXUD         | ThinkSystem Pref. Pro II USB Keyboard - Russian/Cy                   |
| 7ZB7A05481  | AXUE         | ThinkSystem Pref. Pro II USB Keyboard - Serbian/Cyrilic              |
| 7ZB7A05480  | AXUF         | ThinkSystem Pref. Pro II USB Keyboard - Slovak                       |
| 7ZB7A05471  | AXUQ         | ThinkSystem Pref. Pro II USB Keyboard - Slovenian                    |
| 7ZB7A05479  | AXUG         | ThinkSystem Pref. Pro II USB Keyboard - Spanish                      |
| 7ZB7A05478  | AXUH         | ThinkSystem Pref. Pro II USB Keyboard- Swedish/Finn                  |
| 7ZB7A05477  | AXUJ         | ThinkSystem Pref. Pro II USB Keyboard - Swiss, F/G                   |
| 7ZB7A05476  | AXUK         | ThinkSystem Pref. Pro II USB Keyboard - Thailand                     |
| 7ZB7A05513  | AXTT         | ThinkSystem Pref. Pro II USB Keyboard - Trad Chinese/US              |
| 7ZB7A05474  | AXUM         | ThinkSystem Pref. Pro II USB Keyboard - Turkish 179                  |
| 7ZB7A05475  | AXUL         | ThinkSystem Pref. Pro II USB Keyboard - Turkish 440                  |
| 7ZB7A05473  | AXUN         | ThinkSystem Pref. Pro II USB Keyboard - UK English                   |
| 7ZB7A05522  | AXTL         | ThinkSystem Pref. Pro II USB Keyboard - US English                   |
| 7ZB7A05472  | AXUP         | ThinkSystem Pref. Pro II USB Keyboard - US Euro                      |

## Rack installation

The ST650 V3 can also be installed in the rack with the Rack Enablement Kit. The resulting server is a 4U rack-mountable server, as shown in the following figure.

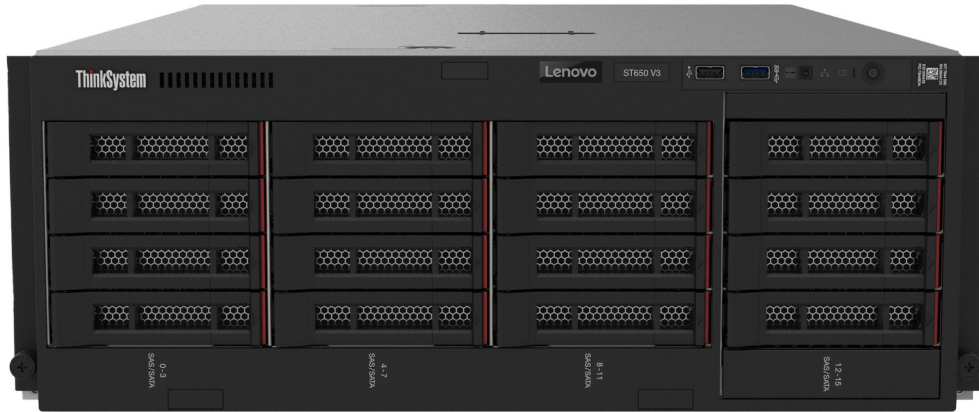


Figure 14. ThinkSystem ST650 V3 with Rack Conversion Kit installed

The part numbers are summarized in the following table.

**No CMA support:** The ST650 V3 does not support the use of a cable management arm.

Table 63. Rack installation options

| Part number | Feature code | Description and contents  |
|-------------|--------------|---|
| 4M27A60835  | BA5Z         | ThinkSystem ST650 V2/V3 Tower to Rack Conversion Kit <ul style="list-style-type: none"> <li>• Tower to Rack Conversion Kit (EIA brackets, labels)</li> <li>• Static Rail</li> <li>• Rail Mylar (affix to rails to reduce friction)</li> </ul> |

The rail kit has the specifications listed in the following table.

Table 64. Rail kit specifications

| Feature                            | ThinkSystem ST650 V2/V3 Static Rail           |
|------------------------------------|---|
| Part number                        | Part of 4M27A60835 (Feature code BA5V)        |
| Rail type                          | Static (fixed, no slide)                      |
| Toolless installation              | Yes   |
| Cable Management Arm (CMA) support | No support                                    |
| In-rack server maintenance         | No  |
| 1U PDU support                     | Yes   |
| 0U PDU support                     | Limited*                                      |
| Rack type                          | Lenovo and IBM 4-post, IEC standard-compliant |
| Mounting holes                     | Square or round                               |
| Mounting flange thickness          | 2 mm - 3.3 mm (0.08 - 0.13 in.)               |
| Supported rack range               | 559 mm - 914 mm (22 - 36 in.)                 |
| Rail length***                     | 600 mm (23.6 in.)                             |

\* For 0U PDU support, the rack must be at least 1100 mm (43.31 in.) deep.

\*\*\* Measured when mounted on the rack, from the front surface of the front mounting flange to the rearmost point of the rail.

Supported rack cabinets are listed in the [Rack cabinets](#) section.

If you configured your server as a rack server, but later wish to convert it to a tower, use the kit in the following table to add the recommended stabilization feet.

Table 65. Stabilization feet for ST650 V3

| Part number | Description   |
|-------------|---|
| 4M27A60833  | ThinkSystem ST650 V2 Rack to Tower Conversion Kit <ul style="list-style-type: none"> <li>• Contains 4 stabilization feet</li> </ul> |

## Operating system support

The server supports the following operating systems:

- Microsoft Windows Server 2019
- Microsoft Windows Server 2022
- Red Hat Enterprise Linux 8.6
- Red Hat Enterprise Linux 8.7
- Red Hat Enterprise Linux 8.8
- Red Hat Enterprise Linux 8.9
- Red Hat Enterprise Linux 9.0
- Red Hat Enterprise Linux 9.1
- Red Hat Enterprise Linux 9.2
- Red Hat Enterprise Linux 9.3
- SUSE Linux Enterprise Server 15 SP4
- SUSE Linux Enterprise Server 15 SP5
- SUSE Linux Enterprise Server 15 Xen SP4
- SUSE Linux Enterprise Server 15 Xen SP5
- Ubuntu 22.04 LTS 64-bit
- VMware ESXi 7.0 U3
- VMware ESXi 8.0 U1
- VMware ESXi 8.0 U2

For a complete list of supported, certified and tested operating systems, plus additional details and links to relevant web sites, see the Operating System Interoperability Guide:

<https://lenovopress.com/osig#servers=st650-v3-7d7b-7d7a>

For configure-to-order configurations, the server can be preloaded with VMware ESXi installed on M.2 cards. Ordering information is listed in the following table.

Table 66. VMware ESXi preload

| Part number | Feature code | Description                            |
|-------------|--------------|--|
| CTO only    | BMEY         | VMware ESXi 7.0 U3 (Factory Installed) |
| CTO only    | BQ8S         | VMware ESXi 8.0 U1 (Factory Installed) |
| CTO only    | BYC7         | VMware ESXi 8.0 U2 (Factory Installed) |

Configuration rule:

- An ESXi preload cannot be selected if the configuration includes an NVIDIA GPU (ESXi preload cannot include the NVIDIA driver)

You can download supported VMware vSphere hypervisor images from the following web page and load it on the M.2 drives drives using the instructions provided:

[https://vmware.lenovo.com/content/custom\\_iso/](https://vmware.lenovo.com/content/custom_iso/)

## Physical and electrical specifications

The ST650 V3 has the following overall physical dimensions, including tower feet, excluding components that extend outside the standard chassis, such as power supply handles:

- Width: 175 mm (6.9 inches)
- Height: 462 mm (18.2 inches)
- Depth: 734 mm (28.9 inches)

The following table lists the detailed dimensions. See the figure below for the definition of each dimension.

Table 67. Detailed dimensions

| Dimension | Description   |
|-----------|---|
| 175 mm    | $X_a$ = Width, using widest features (not including feet)                     |
| 248 mm    | $X_b$ = Width, between the outer edges of the feet                            |
| 462 mm    | $Y_a$ = Height, from bottom of feet to top of chassis body                    |
| 448 mm    | $Y_b$ = Height, from bottom of chassis body to top of chassis body            |
| 713 mm    | $Z_a$ = Depth, from front door to most rearward I/O port surface              |
| 734 mm    | $Z_b$ = Depth, from front door to deepest feature of the chassis body feature |
| 758 mm    | $Z_c$ = Depth, from front door to deepest feature such as power supply handle |
| 23 mm     | $Z_e$ = Depth, front door to front plate of chassis body                      |

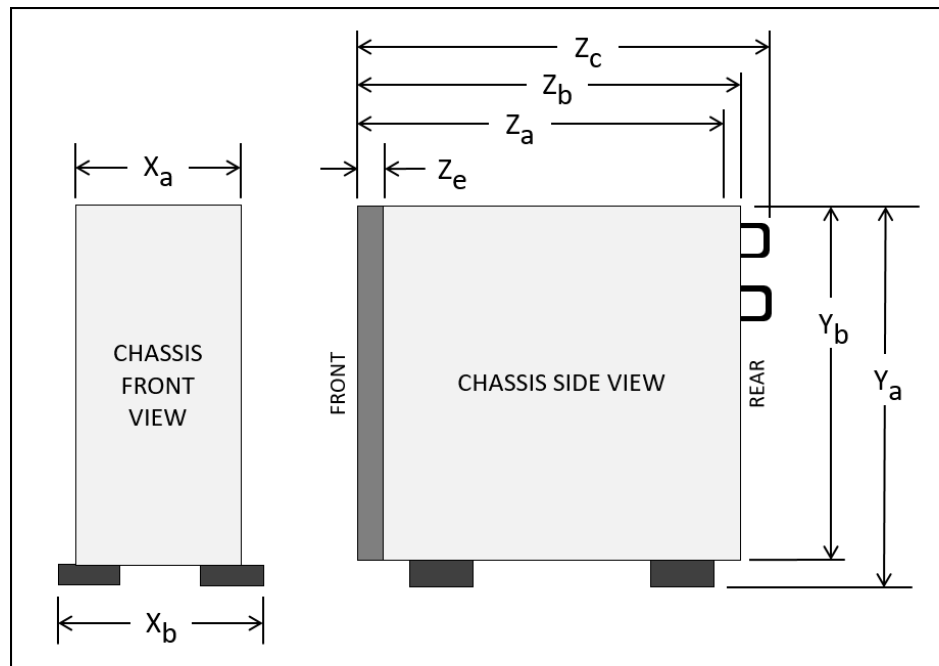


Figure 15. Server dimension

The shipping dimensions (cardboard packaging) of the ST650 V3 are as follows:

- Width: 597 mm (23.5 inches)
- Height: 374 mm (14.7 inches)
- Depth: 996 mm (39.2 inches)

The server has the following weight:

- Maximum weight: 39.1 kg (86.2 lb)

Electrical specifications for AC input power supplies:

- Input voltage:
  - 100 to 127 (nominal) Vac, 50 Hz or 60 Hz
  - 200 to 240 (nominal) Vac, 50 Hz or 60 Hz
  - 180 to 300 Vdc (China only)
- Inlet current: See the following table.

Table 68. Maximum inlet current

| Part number   | Description  | 100V AC    | 200V AC | 220V AC | 240V DC |
|---|--|------------|---------|---------|---------|
| <b>AC input power - 80 PLUS Titanium efficiency</b> |  |            |         |         |         |
| 4P57A72666  | ThinkSystem 1100W 230V Titanium Hot-Swap Gen2 Power Supply         | No support | 5.9A    | 5.3A    | 5A      |
| 4P57A78359  | ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply         | No support | 9.7A    | 8.7A    | 8.3A    |
| 4P57A72667  | ThinkSystem 2600W 230V Titanium Hot-Swap Gen2 Power Supply         | No support | 13.2A   | 13A     | 11.9A   |
| <b>AC input power - 80 PLUS Platinum efficiency</b> |  |            |         |         |         |
| 4P57A72670  | ThinkSystem 750W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3  | 8.4A       | 4.1A    | 3.69A   | 3.5A    |
| 4P57A72671  | ThinkSystem 1100W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3 | 12A        | 6A      | 5.4A    | 5.1A    |
| 4P57A78362  | ThinkSystem 1800W 230V Platinum Hot-Swap Gen2 Power Supply v2      | No support | 10A     | 9.1A    | 9A      |

## Operating environment

The ST650 V3 server complies with ASHRAE Class A2 specifications with most configurations, and depending on the hardware configuration, also complies with ASHRAE Class A3 and Class A4 specifications.

Topics in this section:

- [Temperature and humidity](#)
- [Acoustical noise emissions](#)
- [Shock and vibration](#)
- [Particulate contamination](#)

## Temperature and humidity

The server is supported in the following environment:

- Air temperature:
  - Operating:
    - ASHRAE Class A2: 10°C to 35°C (50°F to 95°F); the maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft).
    - ASHRAE Class A3: 5°C to 40°C (41°F to 104°F); the maximum ambient temperature decreases by 1°C for every 175 m (574 ft) increase in altitude above 900 m (2,953 ft).
    - ASHRAE Class A4: 5°C to 45°C (41°F to 113°F); the maximum ambient temperature decreases by 1°C for every 125 m (410 ft) increase in altitude above 900 m (2,953 ft).
  - Server off: 5°C to 45°C (41°F to 113°F)
  - Shipment/storage: -40°C to 60°C (-40°F to 140°F)
- Maximum altitude: 3,050 m (10,000 ft)
- Relative Humidity (non-condensing):
  - Operating
    - ASHRAE Class A2: 8% to 80%; maximum dew point: 21°C (70°F)
    - ASHRAE Class A3: 8% to 85%; maximum dew point: 24°C (75°F)
    - ASHRAE Class A4: 8% to 90%; maximum dew point: 24°C (75°F)
  - Shipment/storage: 8% to 90%

The following table lists ambient temperature requirements by component type.

Table 69. Ambient temperature requirements

|                                    | Ambient temperature of 25°C or lower |                       | Ambient temperature of 30°C or lower |                       | Ambient temperature of 35°C or lower | Ambient temperature of 40°C or lower  | Ambient temperature of 45°C or lower  |
|------------------------------------|--------------------------------------|-----------------------|--------------------------------------|-----------------------|--------------------------------------|---|---|
| <b>Processor TDP</b>               | All supported                        | All supported         | Max 195W                             | All supported         | Max 195W                             | Max 150W  | Max 125W  |
| <b>Memory</b>                      | 32x DIMMs, each 64 GB or less        | All supported         | 32x DIMMs, each 64 GB or less        | All supported         | 32x DIMMs, each 64 GB or less        | 32x DIMMs, each 32 GB or less   | 32x DIMMs, each 32 GB or less   |
| <b>Drive backplane/drive types</b> | All supported                        | All supported         | All supported                        | All supported         | All supported                        | SATA SSDs/HDDs only; No SAS, NVMe or AnyBay   | SATA SSDs only; No SAS, NVMe or AnyBay, no HDDs   |
| <b>Drive backplane quantities</b>  | All supported                        | 2x backplanes maximum | All supported                        | 2x backplanes maximum | All supported                        | 3.5" drives: 2 backplane (8 drives)<br>2.5" drives: 1 backplane (8 drives)  | 3.5" drives: 2 backplane (8 drives)<br>2.5" drives: 1 backplane (8 drives)  |
| <b>M.2</b>                         | All supported                        | All supported         | All supported                        | All supported         | All supported                        | No M.2 support  | No M.2 support  |
| <b>GPUs</b>                        | SW GPUs only; no DW GPUs             | All supported         | SW GPUs only; no DW GPUs             | All supported         | No GPU support                       | No GPU support  | No GPU support  |
| <b>PCI card</b>                    | All supported                        | All supported         | All supported                        | All supported         | All supported                        | Only support: <ul style="list-style-type: none"> <li>ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter</li> <li>ThinkSystem Intel I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter</li> </ul> | Only support: <ul style="list-style-type: none"> <li>ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter</li> <li>ThinkSystem Intel I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter</li> </ul> |
| <b>LTO tape drive</b>              | All supported                        | All supported         | All supported                        | All supported         | All supported                        | No LTO support  | No LTO support  |

### Acoustical noise emissions

The ST650 V3 server has the following acoustic noise emissions declaration:

- Sound power level ( $L_{WA_d}$ ):
  - Idling: 5.2 Bel (Minimum), 5.8 Bel (Typical), 6.4 Bel (GPU rich), 6.4 Bel (Storage rich)
  - Operating: 5.2 Bel (Minimum), 5.8 Bel (Typical), 7.6 Bel (GPU rich), 7.2 Bel (Storage rich)
- Sound pressure level ( $L_{pAm}$ ):
  - Idling: 37 dBA (Minimum), 41 dBA (Typical), 48 dBA (GPU rich), 48 dBA (Storage rich)
  - Operating: 37 dBA (Minimum), 41 dBA (Typical), 59 dBA (GPU rich), 56 dBA (Storage rich)

Notes:

- These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.
- The declared acoustic sound levels are based on the following configurations, which may change depending on configuration/conditions :
  - Minimum configuration: 1x 125W CPU, 4x 16GB RDIMM, 4x 3.5" SAS HDD, SW RAID, 2x onboard 10GB LAN ports, 1x 750W PSU
  - Typical configuration: 2x 150W CPU, 4x 32GB RDIMM, 8x 3.5" SAS HDD, RAID 940-8i, 2x onboard 10GB LAN ports, 2x 750W PSU
  - GPU rich configuration: 2x 150W CPU, 32x 64GB RDIMM, 8x 3.5" SAS HDD, 1xRAID 940-8i, 2x onboard 10GB LAN ports ,8x NVIDIA A2 GPU, 2x 1800W PSU
  - Storage rich configuration: 2x 195W CPU, 32x 64GB RDIMM, 32x 2.5" SAS HDD, 2x RAID 940-16i, 2x onboard 10GB LAN ports, 2x 1800W PSU
- Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room; the noise levels from other equipment; the room ambient temperature, and employee's location in relation to the equipment. Further, compliance with such government regulations depends on a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. Lenovo recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

## Shock and vibration

The server has the following vibration and shock limits:

- Vibration:
  - Operating: 0.21 G rms at 5 Hz to 500 Hz for 15 minutes across 3 axes
  - Non-operating: 1.04 G rms at 2 Hz to 200 Hz for 15 minutes across 6 surfaces
- Shock:
  - Operating: 15 G for 3 milliseconds in each direction (positive and negative X, Y, and Z axes)
  - Non-operating:
    - Server weight 12 kg - 22 kg: 50 G for 152 in./sec velocity change across 6 surfaces
    - Server weight 23 kg - 31 kg: 35 G for 152 in./sec velocity change across 6 surfaces
    - Server weight 32 kg - 68 kg: 35 G for 136 in./sec velocity change across 6 surfaces

## Particulate contamination

Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might damage the system that might cause the system to malfunction or stop working altogether.

The following specifications indicate the limits of particulates that the system can tolerate:

- Reactive gases:
  - The copper reactivity level shall be less than 200 Angstroms per month (Å/month)
  - The silver reactivity level shall be less than 200 Å/month
- Airborne particulates:
  - The room air should be continuously filtered with MERV 8 filters.
  - Air entering a data center should be filtered with MERV 11 or preferably MERV 13 filters.
  - The deliquescent relative humidity of the particulate contamination should be more than 60% RH
  - Environment must be free of zinc whiskers

For additional information, see the Specifications section of the documentation for the server, available from the Lenovo Documents site, <https://pubs.lenovo.com/>



## Warranty and Support

The ST650 V3 has a 1-year or 3-year warranty based on the machine type of the system:

- 7D7B - 1 year warranty
- 7D7A - 3 year warranty

The standard warranty terms are customer-replaceable unit (CRU) and onsite (for field-replaceable units FRUs only) with standard call center support during normal business hours and 9x5 Next Business Day Parts Delivered.

Lenovo's additional support services provide a sophisticated, unified support structure for your data center, with an experience consistently ranked number one in customer satisfaction worldwide. Available offerings include:

- **Premier Support**

Premier Support provides a Lenovo-owned customer experience and delivers direct access to technicians skilled in hardware, software, and advanced troubleshooting, in addition to the following:

- Direct technician-to-technician access through a dedicated phone line
- 24x7x365 remote support
- Single point of contact service
- End to end case management
- Third-party collaborative software support
- Online case tools and live chat support
- On-demand remote system analysis

- **Warranty Upgrade (Preconfigured Support)**

Services are available to meet the on-site response time targets that match the criticality of your systems.

- 3, 4, or 5 years of service coverage
- 1-year or 2-year post-warranty extensions
- **Foundation Service:** 9x5 service coverage with next business day onsite response. YourDrive YourData is an optional extra (see below).
- **Essential Service:** 24x7 service coverage with 4-hour onsite response or 24-hour committed repair (available only in select markets). Bundled with YourDrive YourData.
- **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select markets). Bundled with YourDrive YourData.

- **Managed Services**

Lenovo Managed Services provides continuous 24x7 remote monitoring (plus 24x7 call center availability) and proactive management of your data center using state-of-the-art tools, systems, and practices by a team of highly skilled and experienced Lenovo services professionals.

Quarterly reviews check error logs, verify firmware & OS device driver levels, and software as needed. We'll also maintain records of latest patches, critical updates, and firmware levels, to ensure you systems are providing business value through optimized performance.

- **Technical Account Management (TAM)**

A Lenovo Technical Account Manager helps you optimize the operation of your data center based on a deep understanding of your business. You gain direct access to your Lenovo TAM, who serves as your single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time. In addition, your TAM will help proactively make service recommendations and manage your service relationship with Lenovo to make certain your needs are met.

- **Enterprise Server Software Support**

Enterprise Software Support is an additional support service providing customers with software support on Microsoft, Red Hat, SUSE, and VMware applications and systems. Around the clock availability for critical problems plus unlimited calls and incidents helps customers address challenges fast, without incremental costs. Support staff can answer troubleshooting and diagnostic questions, address product comparability and interoperability issues, isolate causes of problems, report defects to software vendors, and more.

- **YourDrive YourData**

Lenovo's YourDrive YourData is a multi-drive retention offering that ensures your data is always under your control, regardless of the number of drives that are installed in your Lenovo server. In the unlikely event of a drive failure, you retain possession of your drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. The YourDrive YourData service can be purchased in convenient bundles and is optional with Foundation Service. It is bundled with Essential Service and Advanced Service.

- **Health Check**

Having a trusted partner who can perform regular and detailed health checks is central to maintaining efficiency and ensuring that your systems and business are always running at their best. Health Check supports Lenovo-branded server, storage, and networking devices, as well as select Lenovo-supported products from other vendors that are sold by Lenovo or a Lenovo-Authorized Reseller.

Examples of region-specific warranty terms are second or longer business day parts delivery or parts-only base warranty.

If warranty terms and conditions include onsite labor for repair or replacement of parts, Lenovo will dispatch a service technician to the customer site to perform the replacement. Onsite labor under base warranty is limited to labor for replacement of parts that have been determined to be field-replaceable units (FRUs). Parts that are determined to be customer-replaceable units (CRUs) do not include onsite labor under base warranty.

If warranty terms include parts-only base warranty, Lenovo is responsible for delivering only replacement parts that are under base warranty (including FRUs) that will be sent to a requested location for self-service. Parts-only service does not include a service technician being dispatched onsite. Parts must be changed at customer's own cost and labor and defective parts must be returned following the instructions supplied with the spare parts.

Lenovo Service offerings are region-specific. Not all preconfigured support and upgrade options are available in every region. For information about Lenovo service upgrade offerings that are available in your region, refer to the following resources:

- Service part numbers in Lenovo Data Center Solution Configurator (DCSC):  
<http://dcsc.lenovo.com/#/services>
- Lenovo Services Availability Locator  
<http://lenovolocator.com/>

For service definitions, region-specific details, and service limitations, please refer to the following documents:

- Lenovo Statement of Limited Warranty for Infrastructure Solutions Group (ISG) Servers and System Storage  
<http://pcsupport.lenovo.com/us/en/solutions/ht503310>
- Lenovo Data Center Services Agreement  
<http://support.lenovo.com/us/en/solutions/ht116628>

## Services

Lenovo Services is a dedicated partner to your success. Our goal is to reduce your capital outlays, mitigate your IT risks, and accelerate your time to productivity.

**Note:** Some service options may not be available in all markets or regions. For more information, go to <https://www.lenovo.com/services>. For information about Lenovo service upgrade offerings that are available in your region, contact your local Lenovo sales representative or business partner.

Here's a more in-depth look at what we can do for you:

- **Asset Recovery Services**

Asset Recovery Services (ARS) helps customers recover the maximum value from their end-of-life equipment in a cost-effective and secure way. On top of simplifying the transition from old to new equipment, ARS mitigates environmental and data security risks associated with data center equipment disposal. Lenovo ARS is a cash-back solution for equipment based on its remaining market value, yielding maximum value from aging assets and lowering total cost of ownership for your customers. For more information, see the ARS page, <https://lenovopress.com/lp1266-reduce-e-waste-and-grow-your-bottom-line-with-lenovo-ars>.

- **Assessment Services**

An Assessment helps solve your IT challenges through an onsite, multi-day session with a Lenovo technology expert. We perform a tools-based assessment which provides a comprehensive and thorough review of a company's environment and technology systems. In addition to the technology based functional requirements, the consultant also discusses and records the non-functional business requirements, challenges, and constraints. Assessments help organizations like yours, no matter how large or small, get a better return on your IT investment and overcome challenges in the ever-changing technology landscape.

- **Design Services**

Professional Services consultants perform infrastructure design and implementation planning to support your strategy. The high-level architectures provided by the assessment service are turned into low level designs and wiring diagrams, which are reviewed and approved prior to implementation. The implementation plan will demonstrate an outcome-based proposal to provide business capabilities through infrastructure with a risk-mitigated project plan.

- **Basic Hardware Installation**

Lenovo experts can seamlessly manage the physical installation of your server, storage, or networking hardware. Working at a time convenient for you (business hours or off shift), the technician will unpack and inspect the systems on your site, install options, mount in a rack cabinet, connect to power and network, check and update firmware to the latest levels, verify operation, and dispose of the packaging, allowing your team to focus on other priorities.

- **Deployment Services**

When investing in new IT infrastructures, you need to ensure your business will see quick time to value with little to no disruption. Lenovo deployments are designed by development and engineering teams who know our Products & Solutions better than anyone else, and our technicians own the process from delivery to completion. Lenovo will conduct remote preparation and planning, configure & integrate systems, validate systems, verify and update appliance firmware, train on administrative tasks, and provide post-deployment documentation. Customer's IT teams leverage our skills to enable IT staff to transform with higher level roles and tasks.

- **Integration, Migration, and Expansion Services**

Move existing physical & virtual workloads easily, or determine technical requirements to support increased workloads while maximizing performance. Includes tuning, validation, and documenting ongoing run processes. Leverage migration assessment planning documents to perform necessary migrations.

## Regulatory compliance

The ST650 V3 conforms to the following standards:

- ANSI/UL 62368-1
- IEC 62368-1 (CB Certificate and CB Test Report)
- CSA C22.2 No. 62368-1
- Mexico NOM-019
- India BIS 13252 (Part 1)
- Germany GS
- TUV-GS (EN62368-1, and EK1-ITB2000)
- Brazil INMETRO
- South Africa NRCS LOA
- Ukraine UkrCEPRO
- Morocco CMIM Certification (CM)
- Russia, Belorussia and Kazakhstan, TP EAC 037/2016 (for RoHS)
- Russia, Belorussia and Kazakhstan, EAC: TP TC 004/2011 (for Safety); TP TC 020/2011 (for EMC)
- CE, UKCA Mark (EN55032 Class A, EN62368-1, EN55024, EN55035, EN61000-3-2, EN61000-3-3, (EU) 2019/424, and EN IEC 63000 (RoHS))
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 7, Class A
- CISPR 32, Class A, CISPR 35
- Korea KN32, Class A, KN35
- Japan VCCI, Class A
- Taiwan BSMI CNS15936, Class A; CNS15598-1; Section 5 of CNS15663
- Australia/New Zealand AS/NZS CISPR 32, Class A; AS/NZS 62368.1
- UL Green Guard, UL2819
- [Energy Star 4.0](#)
- EPEAT (NSF/ ANSI 426) Bronze
- Japanese Energy-Saving Act
- EU2019/424 Energy Related Product (ErP Lot9)
- China CCC certificate, GB17625.1; GB4943.1; GB/T9254
- China CECP certificate, CQC3135
- China CELP certificate, HJ 2507-2011

## External drive enclosures

The server supports attachment to external drive enclosures using a RAID controller with external ports or a SAS host bus adapter. Adapters supported by the server are listed in the [SAS adapters for external storage](#) section.

**Note:** Information provided in this section is for ordering reference purposes only. For the operating system and adapter support details, refer to the interoperability matrix for a particular storage enclosure that can be found on the Lenovo Data Center Support web site:

<http://datacentersupport.lenovo.com>

Table 70. External drive enclosures

| Model      | Description  |
|------------|--|
| 4587HC1    | Lenovo Storage D1212 Disk Expansion Enclosure (2U enclosure with 12x LFF drive bays)         |
| 4587HC2    | Lenovo Storage D1224 Disk Expansion Enclosure (2U enclosure with 24x SFF drive bays)         |
| 6413HC1    | Lenovo Storage D3284 High Density Expansion Enclosure (5U enclosure with 84x LFF drive bays) |
| 7DAHCTO1WW | Lenovo ThinkSystem D4390 Direct Attached Storage (4U enclosure with 90x LFF drive bays)      |

For details about supported drives, adapters, and cables, see the following Lenovo Press Product Guides:

- Lenovo Storage D1212 and D1224  
<http://lenovopress.lenovo.com/lp0512>
- Lenovo Storage D3284  
<http://lenovopress.lenovo.com/lp0513>
- Lenovo ThinkSystem D4390  
<https://lenovopress.lenovo.com/lp1681>

## External storage systems

Lenovo offers the ThinkSystem DE Series and ThinkSystem DM Series external storage systems for high-performance storage. See the DE Series and DM Series product guides for specific controller models, expansion enclosures and configuration options:

- ThinkSystem DE Series Storage  
<https://lenovopress.com/storage/thinksystem/de-series#rt=product-guide>
- ThinkSystem DM Series Storage  
<https://lenovopress.com/storage/thinksystem/dm-series#rt=product-guide>
- ThinkSystem DG Series Storage  
<https://lenovopress.com/storage/thinksystem/dg-series#rt=product-guide>

## External backup units

The following table lists the external backup options that are offered by Lenovo.

Table 71. External backup options

| Part number                             | Description                               |
|---|---|
| External RDX USB drives                 |   |
| 4T27A10725                              | ThinkSystem RDX External USB 3.0 Dock     |
| External SAS tape backup drives         |   |
| 6160S7E                                 | IBM TS2270 Tape Drive Model H7S           |
| 6160S8E                                 | IBM TS2280 Tape Drive Model H8S           |
| 6160S9E                                 | IBM TS2290 Tape Drive Model H9S           |
| External SAS tape backup autoloaders    |   |
| 6171S7R                                 | IBM TS2900 Tape Autoloader w/LTO7 HH SAS  |
| 6171S8R                                 | IBM TS2900 Tape Autoloader w/LTO8 HH SAS  |
| 6171S9R                                 | IBM TS2900 Tape Autoloader w/LTO9 HH SAS  |
| External tape backup libraries          |   |
| 6741A1F                                 | IBM TS4300 3U Tape Library-Base Unit      |
| 6741A3F                                 | IBM TS4300 3U Tape Library-Expansion Unit |
| Full High 8 Gb Fibre Channel for TS4300 |   |
| 01KP938                                 | LTO 7 FH Fibre Channel Drive              |
| 01KP954                                 | LTO 8 FH Fibre Channel Drive              |
| 02JH837                                 | LTO 9 FH Fibre Channel Drive              |
| Half High 8 Gb Fibre Channel for TS4300 |   |
| 01KP936                                 | LTO 7 HH Fibre Channel Drive              |
| 01KP952                                 | LTO 8 HH Fibre Channel Drive              |
| 02JH835                                 | LTO 9 HH Fibre Channel Drive              |
| Half High 6 Gb SAS for TS4300           |   |
| 01KP937                                 | LTO 7 HH SAS Drive                        |
| 01KP953                                 | LTO 8 HH SAS Drive                        |
| 02JH836                                 | LTO 9 HH SAS Drive                        |

For more information, see the list of Product Guides in the Backup units category:

<https://lenovopress.com/servers/options/backup>

## Fibre Channel SAN switches

Lenovo offers the ThinkSystem DB Series of Fibre Channel SAN switches for high-performance storage expansion. See the DB Series product guides for models and configuration options:

- ThinkSystem DB Series SAN Switches:  
<https://lenovopress.com/storage/switches/rack#rt=product-guide>

## Uninterruptible power supply units

The following table lists the uninterruptible power supply (UPS) units that are offered by Lenovo.

Table 72. Uninterruptible power supply units

| Part number                     | Description  |
|---------------------------------|--|
| Tower UPS units                 |  |
| 55951AX                         | T1kVA Tower UPS (100-125VAC)   |
| 55951KX                         | T1kVA Tower UPS (200-240VAC)   |
| 55952AX                         | T1.5kVA Tower UPS (100-125VAC)   |
| 55952KX                         | T1.5kVA Tower UPS (200-240VAC)   |
| 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          |  |
| 55943KT†                        | ThinkSystem RT3kVA 2U Standard UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)    |
| 55943LT†                        | ThinkSystem RT3kVA 2U Long Backup UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets) |
| 55946KT†                        | ThinkSystem RT6kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)          |
| 5594XKT†                        | ThinkSystem RT10kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)         |

† Only available in China and the Asia Pacific market.

For more information, see the list of Product Guides in the UPS category:

<https://lenovopress.com/servers/options/ups>



## Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo.

Table 73. Power distribution units

| Part number   | Feature code | Description   | ANZ | ASEAN | Brazil | EET | MEA | RUCIS | WE | HTK | INDIA | JAPAN | LA | NA | PRC |
|---|--------------|---|-----|-------|--------|-----|-----|-------|----|-----|-------|-------|----|----|-----|
| <b>0U Basic PDUs</b>  |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 00YJ776   | ATZY         | 0U 36 C13/6 C19 24A 1 Phase PDU                           | N   | Y     | Y      | N   | N   | N     | N  | N   | N     | Y     | Y  | Y  | N   |
| <b>0U Switched and Monitored PDUs</b>   |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 00YJ783   | AU04         | 0U 12 C13/12 C19 Switched and Monitored 48A 3 Phase PDU   | N   | N     | Y      | N   | N   | N     | Y  | N   | N     | Y     | Y  | Y  | N   |
| 00YJ781   | AU03         | 0U 20 C13/4 C19 Switched and Monitored 24A 1 Phase PDU    | N   | N     | Y      | N   | Y   | N     | Y  | N   | N     | Y     | Y  | Y  | N   |
| <b>1U Switched and Monitored PDUs</b>   |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 4PU7A81117  | BNDV         | 1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - ETL | N   | N     | N      | N   | N   | N     | N  | N   | N     | N     | N  | Y  | N   |
| 4PU7A77467  | BLC4         | 1U 18 C19/C13 Switched and Monitored 80A 3P Delta PDU     | N   | N     | N      | N   | N   | N     | N  | N   | N     | Y     | N  | Y  | N   |
| 4PU7A77469  | BLC6         | 1U 12 C19/C13 switched and monitored 60A 3P Delta PDU     | N   | N     | N      | N   | N   | N     | N  | N   | N     | N     | N  | Y  | N   |
| 4PU7A77468  | BLC5         | 1U 12 C19/C13 switched and monitored 32A 3P WYE PDU       | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | N     | Y  | Y  | Y   |
| 4PU7A81118  | BNDW         | 1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - CE  | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | N     | Y  | N  | Y   |
| <b>1U Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)</b> |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 71763NU   | 6051         | Ultra Density Enterprise C19/C13 PDU 60A/208V/3PH         | N   | N     | Y      | N   | N   | N     | N  | N   | N     | Y     | Y  | Y  | N   |
| 71762NX   | 6091         | Ultra Density Enterprise C19/C13 PDU Module               | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| <b>1U C13 Enterprise PDUs (12x IEC 320 C13 outlets)</b>                           |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 39Y8941   | 6010         | DPI C13 Enterprise PDU Module (WW)                        | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| <b>1U Front-end PDUs (3x IEC 320 C19 outlets)</b>                                 |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 39Y8938   | 6002         | DPI Single-phase 30A/120V Front-end PDU (US)              | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 39Y8939   | 6003         | DPI Single-phase 30A/208V Front-end PDU (US)              | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 39Y8934   | 6005         | DPI Single-phase 32A/230V Front-end PDU (International)   | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 39Y8940   | 6004         | DPI Single-phase 60A/208V Front-end PDU (US)              | Y   | N     | Y      | Y   | Y   | Y     | Y  | N   | N     | Y     | Y  | Y  | N   |
| 39Y8935   | 6006         | DPI Single-phase 63A/230V Front-end PDU (International)   | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| <b>1U NEMA PDUs (6x NEMA 5-15R outlets)</b>                                       |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |
| 39Y8905   | 5900         | DPI 100-127V NEMA PDU                                     | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| <b>Line cords for 1U PDUs that ship without a line cord</b>                       |              |   |     |       |        |     |     |       |    |     |       |       |    |    |     |

| Part number | Feature code | Description   | ANZ | ASEAN | Brazil | EET | MEA | RUCIS | WE | HTK | INDIA | JAPAN | LA | NA | PRC |
|-------------|--------------|---|-----|-------|--------|-----|-----|-------|----|-----|-------|-------|----|----|-----|
| 40K9611     | 6504         | 4.3m, 32A/380-415V, EPDU/IEC 309 3P+N+G 3ph wye (non-US) Line Cord  | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 40K9612     | 6502         | 4.3m, 32A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord            | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 40K9613     | 6503         | 4.3m, 63A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord            | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 40K9614     | 6500         | 4.3m, 30A/208V, EPDU to NEMA L6-30P (US) Line Cord                  | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 40K9615     | 6501         | 4.3m, 60A/208V, EPDU to IEC 309 2P+G (US) Line Cord                 | N   | N     | Y      | N   | N   | N     | Y  | N   | N     | Y     | Y  | Y  | N   |
| 40K9617     | 6505         | 4.3m, 32A/230V, Souriau UTG Female to AS/NZ 3112 (Aus/NZ) Line Cord | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |
| 40K9618     | 6506         | 4.3m, 32A/250V, Souriau UTG Female to KSC 8305 (S. Korea) Line Cord | Y   | Y     | Y      | Y   | Y   | Y     | Y  | Y   | Y     | Y     | Y  | Y  | Y   |

For more information, see the Lenovo Press documents in the PDU category:  
<https://lenovopress.com/servers/options/pdu>

## Rack cabinets

The following table lists the supported rack cabinets.

Table 74. Rack cabinets

| Part number | Description  |
|-------------|--|
| 93072RX     | 25U Standard Rack (1000mm)                                     |
| 93072PX     | 25U Static S2 Standard Rack (1000mm)                           |
| 7D6DA007WW  | ThinkSystem 42U Onyx Primary Heavy Duty Rack Cabinet (1200mm)  |
| 7D6DA008WW  | ThinkSystem 42U Pearl Primary Heavy Duty Rack Cabinet (1200mm) |
| 1410-O42    | Lenovo EveryScale 42U Onyx Heavy Duty Rack Cabinet             |
| 1410-P42    | Lenovo EveryScale 42U Pearl Heavy Duty Rack Cabinet            |
| 93604PX     | 42U 1200mm Deep Dynamic Rack                                   |
| 93614PX     | 42U 1200mm Deep Static Rack                                    |
| 93634PX     | 42U 1100mm Dynamic Rack  |
| 93634EX     | 42U 1100mm Dynamic Expansion Rack                              |
| 93074RX     | 42U Standard Rack (1000mm)                                     |
| 7D6EA009WW  | ThinkSystem 48U Onyx Primary Heavy Duty Rack Cabinet (1200mm)  |
| 7D6EA00AWW  | ThinkSystem 48U Pearl Primary Heavy Duty Rack Cabinet (1200mm) |
| 1410-O48    | Lenovo EveryScale 48U Onyx Heavy Duty Rack Cabinet             |
| 1410-P48    | Lenovo EveryScale 48U Pearl Heavy Duty Rack Cabinet            |

For specifications about these racks, see the Lenovo Rack Cabinet Reference, available from:  
<https://lenovopress.com/lp1287-lenovo-rack-cabinet-reference>

For more information, see the list of Product Guides in the Rack cabinets category:  
<https://lenovopress.com/servers/options/racks>

## KVM console options

The following table lists the supported KVM consoles.

Table 75. KVM console

| Part number | Description  |
|-------------|--|
| 4XF7A84188  | ThinkSystem 18.5" LCD Console (with US English keyboard) |

The following table lists the available KVM switches and the options that are supported with them.

Table 77. KVM switches and options

| Part number                             | Description                                 |
|---|---|
| KVM Console switches                    |   |
| 1754D2X                                 | Global 4x2x32 Console Manager (GCM32)       |
| 1754D1X                                 | Global 2x2x16 Console Manager (GCM16)       |
| 1754A2X                                 | Local 2x16 Console Manager (LCM16)          |
| 1754A1X                                 | Local 1x8 Console Manager (LCM8)            |
| Cables for GCM and LCM Console switches |   |
| 46M5383                                 | Virtual Media Conversion Option Gen2 (VCO2) |
| 46M5382                                 | Serial Conversion Option (SCO)              |

For more information, see the list of Product Guides in the KVM Switches and Consoles category:  
<http://lenovopress.com/servers/options/kvm>

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## Seller training courses

The following sales training courses are offered for employees and partners (login required). Courses are listed in date order.

1. **Lenovo Data Center Product Portfolio**  
2024-04-22 | 20 minutes | Employees and Partners

This course introduces the Lenovo data center portfolio, and covers servers, storage, storage networking, and software-defined infrastructure products. After completing this course about Lenovo data center products, you will be able to identify product types within each data center family, describe Lenovo innovations that this product family or category uses, and recognize when a specific product should be selected.

Published: 2024-04-22

Length: 20 minutes

Employee link: [Grow@Lenovo](mailto:Grow@Lenovo)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1110r7

## 2. **Partner Technical Webinar - ISG Portfolio Update**

2024-04-15 | 60 minutes | Employees and Partners

In this 60-minute replay, Mark Bica, NA ISG Server Product Manager reviewed the Lenovo ISG portfolio. He covered new editions such as the SR680a \ SR685a, dense servers, and options that are strategic for any workload.

Published: 2024-04-15

Length: 60 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: 041224

## 3. **Partner Technical Webinar – StorMagic**

2024-03-19 | 60 minutes | Employees and Partners

March 08, 2024 – In this 60-minute replay, Stuart Campbell and Wes Ganeko of StorMagic joined us and provided an overview of StorMagic on Lenovo. They also demonstrated the interface while sharing some interesting use cases.

Published: 2024-03-19

Length: 60 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: 030824

## 4. **Intel Transparent Supply Chain on Lenovo Servers**

2024-01-29 | 12 minutes | Employees and Partners

This course introduces the Intel Transparent Supply Chain (TSC) program, explains how the program works, and discusses the benefits of the Intel TSC program to customers. Adding the Intel TSC feature to an order is explained.

Course objectives:

- Describe the Intel® Transparent Supply Chain program
- Explain how the Intel® Transparent Supply Chain program works
- Discuss the benefits of the Intel® Transparent Supply Chain program to Lenovo customers
- Explain how to add Intel® Transparent Supply Chain program feature to an order

Published: 2024-01-29

Length: 12 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1230

## 5. **Family Portfolio: Storage Controller Options**

2024-01-23 | 25 minutes | Employees and Partners

This course covers the storage controller options available for use in Lenovo servers. The classes of storage controller are discussed, along with a discussion of where they are used, and which to choose.

After completing this course, you will be able to:

- Describe the classes of storage controllers
- Discuss where each controller class is used
- Describe the available options in each controller class

Published: 2024-01-23

Length: 25 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1111

## 6. **Lenovo-Intel Sustainable Solutions QH**

2024-01-22 | 10 minutes | Employees and Partners

This Quick Hit explains how Lenovo and Intel are committed to sustainability, and introduces the Lenovo-Intel joint sustainability campaign. You will learn how to use this campaign to show customers what that level of commitment entails, how to use the campaign's unsolicited proposal approach, and how to use the campaign as a conversation starter which may lead to increased sales.

Published: 2024-01-22

Length: 10 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2524a

## 7. **Family Introduction: Rack and Tower**

2024-01-19 | 11 minutes | Employees and Partners

This course is designed to give Lenovo sales and partner representatives a foundation on the characteristics of the rack and tower server family. As an introduction to the family, this course also includes positioning, when to use a product, and keywords a client may use when discussing a rack product.

Course Objectives:

- Family Characteristics
- Priority Positioning
- Product Usage
- Keywords and Phrases

Published: 2024-01-19

Length: 11 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1100r3

**8. FY24Q3 Intel Servers Update**

2023-12-11 | 15 minutes | Employees and Partners

This update is designed to help you discuss the features and customer benefits of Lenovo servers that use the 5th Gen Intel® Xeon® processors. Lenovo has also introduced a new server, the ThinkSystem SD650-N V3, which expands the supercomputer server family. Reasons to call your customer and talk about refreshing their infrastructure are also included as a guideline.

Published: 2023-12-11

Length: 15 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2522a

**9. Family Portfolio: Intel Rack and Tower Servers**

2023-12-11 | 15 minutes | Employees and Partners

This course is designed to give Lenovo sales and partner representatives a foundation of the ThinkSystem Intel Rack and Tower server family. After completing this course, you will be able to identify products and features within the ThinkSystem Intel rack and tower server family, describe unique innovations that this product family uses and recognize when a specific product should be selected.

Published: 2023-12-11

Length: 15 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1204r11

**10. Lenovo Data Center Product Portfolio**

2023-07-21 | 15 minutes | Employees and Partners

This course introduces the Lenovo data center portfolio, and covers servers, storage, storage networking, and software-defined infrastructure products. After completing this course about Lenovo data center products, you will be able to identify product types within each data center family, describe Lenovo innovations that this product family or category uses, and recognize when a specific product should be selected.

Published: 2023-07-21

Length: 15 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW1110r6

**11. Partner Technical Webinar - Data Center Limits and ISG TAA Compliance**

2023-05-16 | 60 minutes | Employees and Partners

In this 60-minute replay, we had two topics. First Vinod Kamath, Lenovo Distinguished Engineer for Data Center Cooling presented on the Systems Configuration and Data Center Ambient Limits. Second, Shama Patari, Lenovo Trade Council, and Glenn Johnson, Lenovo Principal Engineer for Supply Chain presented on ISG TAA Compliance.

Published: 2023-05-16

Length: 60 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: 051223



**12. Introduction to the Intel Xeon Scalable Gen4 Processors**

2022-12-30 | 10 minutes | Employees and Partners

When you complete this course, you should be able to define the Gen4 Intel Xeon Scalable processors and the four tiers used in the family. You should also be able to discuss the new features of the Gen4 processors and the family value proposition.

Published: 2022-12-30

Length: 10 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2500

**13. Lenovo Infrastructure Solutions Launch**

2022-09-16 | 8 minutes | Employees and Partners

This Quick Hit introduces a wealth of new products, solutions, and services announced as part of the Lenovo ThinkSystem 30th Anniversary celebration.

Published: 2022-09-16

Length: 8 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: FY23Q2a

**14. Lenovo Sustainable Computing**

2022-09-16 | 4 minutes | Employees and Partners

This Quick Hit describes the Lenovo sustainable computing program, and the many ways in which Lenovo strives to respect and protect the environment.

Published: 2022-09-16

Length: 4 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2504a

**15. Introduction to DDR5 Memory**

2022-08-23 | 10 minutes | Employees and Partners

This course introduces DDR5 memory, describes new features of this memory generation, and discusses the advantages to customers of this new memory generation.

Published: 2022-08-23

Length: 10 minutes

Employee link: [Grow@Lenovo](#)

Partner link: [Lenovo Partner Learning](#)

Course code: SXXW2502

## Related publications and links

For more information, see these resources:

- ThinkSystem ST650 V3 product page:  
<https://www.lenovo.com/us/en/p/servers-storage/servers/towers/thinksystem-st650-v3/len21ts0022>
- ThinkSystem ST650 V3 datasheet  
<https://lenovopress.lenovo.com/ds0144>
- Interactive 3D Tour of the ThinkSystem ST650 V3:  
<https://lenovopress.lenovo.com/lp1624>
- ThinkSystem ST650 V3 drivers and support  
<http://datacentersupport.lenovo.com/products/servers/thinksystem/st650v3/7d7a/downloads>
- ThinkSystem ST650 V3 product publications:  
<https://pubs.lenovo.com/st650-v3/>
  - User Guide, which includes:
    - System Configuration Guide
    - Hardware Maintenance Guide
  - Rack Installation Guides
  - Messages and Codes Reference
  - UEFI Manual for ThinkSystem Servers
- User Guides for options:  
<https://serveroption.lenovo.com>
- ServerProven hardware compatibility:  
<http://serverproven.lenovo.com>

## Related product families

Product families related to this document are the following:

- [2-Socket Tower Servers](#)
- [ThinkSystem ST650 V3 Server](#)

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