

Enterprise Value io3 PCIe Flash Adapters

Product Guide

Engineered for application acceleration, the Lenovo Enterprise Value io3 PCIe Flash Adapters can help deliver higher performance than typical solid-state devices at a fraction of the cost and space, which makes them a perfect fit for a broad range of applications, including database and cloud applications, big data analytics, and hyperscale data center workloads.

Delivering high speed, low latency, and high efficiency, this new third-generation line of flash adapters brings scalable and optimized performance to distributed scale-out architectures at low cost. These adapters are designed primarily for servers and computing appliances to maximize compute efficiency while providing the added benefits of lower power and cooling costs, low management impact, and smaller storage footprints.

The Enterprise Value io3 PCIe Flash Adapters are shown in the following figure.



Figure 1. Enterprise Value io3 PCIe Flash Adapters for System x

Did you know?

The Enterprise Value io3 PCIe Flash Adapters use flash memory as their storage medium, which contain no moving parts and do not have the issues that are associated with vibration, noise, and mechanical failure. The adapters are built as block devices on a PCIe bus with advanced wear-leveling, ECC protection and chip-level fault tolerance, which provides exceptional reliability and efficiency.

The Enterprise Value io3 PCIe Flash Adapters can help lower operational expenditure (OPEX) and capital expenditure (CAPEX) for applications that require high storage I/O performance compared to solutions that use a larger number of hard disk drives and solid-state drives to achieve equivalent performance.

Rigorous testing of the Enterprise Value io3 PCIe Flash Adapters by Lenovo through the ServerProven® program ensures a high degree of confidence in storage subsystem compatibility and reliability. Providing extra peace of mind, the adapters are covered under a Lenovo warranty.

Part number information

The following table lists the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
1250GB Enterprise Value io3 Flash Adapter	00AE983	ARYK
1600GB Enterprise Value io3 Flash Adapter	00AE986	ARYL
3200GB Enterprise Value io3 Flash Adapter	00AE989	ARYM
6400GB Enterprise Value io3 Flash Adapter	00AE992	ARYN

The part numbers for the adapters include the following items:

- A PCIe Flash Adapter with full-height (3U) bracket attached
- A low-profile (2U) bracket (1250GB, 1600GB, and 3200GB adapters only)
- USB Key with documentation
- Quick Install Guide
- *Important Notices* document
- Warranty Flyer

Features

Based on the Fusion ioMemory SX300 adapters with silicon-based NAND clustering storage technology, the Enterprise Value io3 PCIe Flash Adapters offer cost-effective Multi-Level Cell (MLC) technology in standard PCIe form factors.

These adapters use NAND flash memory as the basic building block of solid-state storage and contain no moving parts, so they are less sensitive to issues that are associated with vibration, noise, and mechanical failure. These adapters are built as block devices on a PCIe bus with advanced wear-leveling, ECC, and chip-level fault tolerance, which provides exceptional reliability and efficiency.

The Enterprise Value io3 PCIe Flash Adapters can deliver fast and scalable performance for read-intensive workloads at low latency that is required for webscale and cloud environments. The following typical applications require ultra-high I/O performance:

- Large scale transaction processing
- Cloud computing
- Content distribution
- On-demand streaming
- Data warehousing
- Business intelligence and analytics
- Decision support

The Enterprise Value io3 PCIe Flash Adapters have the following features:

- Technology:
 - Up to 6.4 TB of solid-state storage in an industry-standard PCIe form factor.
 - High-density design with cost-effective MLC NAND technology that reduces storage footprint.
 - Functions as a PCIe storage and controller device. The operating system sees a block device.
- Performance:

- High-speed, low latency, consistent, and scalable I/O performance
- Access latency can be as low as 15 μ s
- Up to 2.6 GBps/1.2 GBps of sustained sequential read/write throughput
- Up to 215,000/300,000 random read/write IOPS that uses 4 KB data blocks
- Integrates with host processor as a memory tier for direct parallel access to flash
- Reliability:
 - Advanced wear leveling
 - ECC protection
 - Adaptive Flashback redundancy for RAID-like chip protection with self-healing capabilities
- Monitoring and management:
 - Power consumption
 - Thermal information
 - Flash wear-out

Note: These adapters cannot be used as bootable devices.

Technical specifications

The following table lists the technical specifications for the Enterprise Value io3 PCIe Flash Adapters.

Table 2. Enterprise Value io3 PCIe Flash Adapter technical specifications

Specification	1250 GB	1600 GB	3200 GB	6400 GB
Part number	00AE983	00AE986	00AE989	00AE992
Interface	PCIe 2.0 x8	PCIe 2.0 x8	PCIe 2.0 x8	PCIe 2.0 x8
Form factor	Half height, half length	Half height, half length	Full height, half length	Full height, half length
Capacity	1250 GB	1600 GB	3200 GB	6400 GB
Endurance	4 PB TBW	5.5 PB TBW	11 PB TBW	22 PB TBW
Random read IOPS (4 KB blocks)	195,000	195,000	215,000	180,000
Random write IOPS (4 KB blocks)	285,000	285,000	300,000	285,000
Sequential read throughput	2.6 GBps	2.6 GBps	2.6 GBps	2.6 GBps
Sequential write throughput	1.1 GBps	1.1 GBps	1.2 GBps	1.2 GBps
Read access latency	92 μ s	92 μ s	92 μ s	92 μ s
Write access latency	15 μ s	15 μ s	15 μ s	15 μ s
Power requirements	21 W	21 W	21 W	21 W

Enterprise Value and Enterprise solid-state devices have comparable read and write IOPS and throughput performance, but the key difference between them is their endurance (or lifetime); that is, how long they can perform write operations because solid-state devices have a finite number of program/erase (P/E) cycles. Enterprise Value PCIe Flash Adapters have better cost/IOPS ratio but lower endurance compared to Enterprise PCIe Flash adapters. Because of this fact, the Enterprise Value PCIe Flash Adapters are targeted for read-intensive workloads, and the Enterprise PCIe Flash Adapters are targeted for mixed read- and write-intensive workloads. Solid-state device write endurance often is measured by the number of P/E cycles that the drive incurs over its lifetime, which is listed as the total bytes of written (TBW) data in the device specification.

The TBW value that is assigned to a flash storage adapter is the TBW data (based on the number of P/E cycles) that an adapter can be guaranteed to complete (the percentage of remaining P/E cycles is equal to the percentage of remaining TBW). The Lenovo warranty for the flash storage adapter is limited to devices that have not reached the maximum guaranteed number of P/E cycles. Flash storage adapters that reaches this limit might fail to operate according to its specifications. Because of such behavior, careful planning must be done to use the adapters in the application environments to ensure that the TBW of the adapter is not exceeded before the end of the required life expectancy.

Writes are tracked and reported by the adapter's management utility and might be affected by application writes, data patterns, and maintenance designed to maximize data integrity.

Server support

The following tables list the server compatibility information for the Enterprise Value io3 PCIe Flash Adapters.

Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Table 3. Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Part number	Description	x3250 M6 (3943)	x3250 M6 (3633)	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5-2600 v4)	sd350 (5493)
00AE983	1250GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00AE986	1600GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00AE989	3200GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y	Y*	N
00AE992	6400GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	N

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for System x and dense servers with Intel Xeon v3 processors

Table 4. Support for System x servers with Intel Xeon v3 processors

Part number	Description	x3100 M5 (5457)	x3250 M5 (5458)	x3500 M5 (5464)	x3550 M5 (5463)	x3650 M5 (5462)	x3850 X6/x3950 X6 (6241, E7 v3)	nx360 M5 (5465)
00AE983	1250GB Enterprise Value io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00AE986	1600GB Enterprise Value io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00AE989	3200GB Enterprise Value io3 Flash Adapter	N	N	N	Y*	Y*	Y	Y*
00AE992	6400GB Enterprise Value io3 Flash Adapter	N	N	N	Y*	Y*	Y*	Y*

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for System x and dense servers with Intel Xeon v2 processors

Table 5. Support for System x servers with Intel Xeon v2 processors

Part number	Description	x3500 M4 (7383, E5-2600 v2)	x3530 M4 (7160, E5-2400 v2)	x3550 M4 (7914, E5-2600 v2)	x3630 M4 (7158, E5-2400 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 BD (5466)	x3650 M4 HD (5460)	x3750 M4 (8752)	x3750 M4 (8753)	x3850 X6/x3950 X6 (3837)	x3850 X6/x3950 X6 (6241, E7 v2)	dx360 M4 (E5-2600 v2)	nx360 M4 (5455)
00AE983	1250GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00AE986	1600GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00AE989	3200GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y	N	Y*	Y	Y	N	N
00AE992	6400GB Enterprise Value io3 Flash Adapter	N	N	Y*	Y*	Y*	Y*	Y*	N	N	Y*	Y*	N	N

* This adapter cannot be factory installed; it is supported as a field-installable option only. The server cannot be shipped with this adapter installed.

Support for Flex System compute nodes

Table 6. Support for Flex System servers

Part number	Description	x220 (7906)	x222 (7916)	x240 (8737, E5-2600)	x240 (8737, E5-2600 v2)	x240 (7162)	x240 M5 (9532)	x440 (7917)	x440 (7167)	x880/x480/x280 X6 (7903)	x280/x480/x880 X6 (7196)
00AE983	1250GB Enterprise Value io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00AE986	1600GB Enterprise Value io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00AE989	3200GB Enterprise Value io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N
00AE992	6400GB Enterprise Value io3 Flash Adapter	N	N	Y†	Y†	Y†	Y†	N	N	N	N

† Supported with installed in an attached PCIe Expansion Node

See the following ServerProven website for the latest compatibility information for System x servers:

<http://www.lenovo.com/us/en/serverproven/>

For further information about server compatibility, see this support page:

<https://support.lenovo.com/us/en/documents/serv-io3>

Operating system support

The Enterprise Value io3 PCIe Flash Adapters support the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 7
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 12
- SUSE Linux Enterprise Server 12 with XEN
- VMware vSphere 5.1 (ESXi)
- VMware vSphere 5.5 (ESXi)
- VMware vSphere 6.0 (ESXi)

For more information about the specific supported versions and service packs, see the following ServerProven web page:

<http://www.lenovo.com/us/en/serverproven/xseries/storage/mcmatrix.shtml>

On the ServerProven page, click the check mark that is associated with the server in question to see more information about the operating system support.

Warranty

The Enterprise Value io3 PCIe Flash Adapters carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported Lenovo server, these adapters assume the system's base warranty and any warranty upgrade.

Physical specifications

The 1250GB, 1600GB, and 3200GB Enterprise Value io3 PCIe Flash Adapters have the following physical specifications:

- Dimensions and weight (approximate):
 - Height: 17 mm (0.7 in.)
 - Width: 69 mm (2.7 in.)
 - Depth: 167 mm (6.6 in.)
 - Weight: 152 g (0.3 lb)
- Shipping dimensions and weight (approximate):
 - Height: 65 mm (2.6 in.)
 - Width: 245 mm (9.6 in.)
 - Depth: 225 mm (8.9 in.)
 - Weight: 421 g (0.9 lb)

The 6400GB Enterprise Value io3 PCIe Flash Adapter has the following physical specifications:

- Dimensions and weight (approximate):
 - Height: 17 mm (0.7 in.)
 - Width: 112 mm (4.4 in.)
 - Depth: 167 mm (6.6 in.)
 - Weight: 212 g (0.5 lb)
- Shipping dimensions and weight (approximate):
 - Height: 65 mm (2.6 in.)
 - Width: 245 mm (9.6 in.)
 - Depth: 225 mm (8.9 in.)
 - Weight: 481 g (1.1 lb)

Operating environment

The Enterprise Value io3 PCIe Flash Adapters are supported in the following environment:

- Temperature (operational): 0 - 55 °C (32 - 131 °F) at 0 - 3,048 m (0 - 10,000 ft)
- Relative humidity: 5 - 95% (non-condensing)
- Maximum altitude (operational): 3,048 m (10,000 ft)

Agency approvals

The Enterprise Value io3 PCIe Flash Adapters conform to the following regulations:

- FCC Title 47, Part 15 Subpart B, Class A
- CAN ICES-3 (A) NMB-3 (A)
- EN 55022: 2010
- EN 61000-3-2: 2006 plus A1:2009 and A2:2009
- EN 61000-3-3: 2008
- EN 55024: 2010
- VCCI V-3/2013.04 Class A & EN 55022: 2010 Class A
- ANSI C63.4: 2009
- BSMI CNS 13438: 2006 Class A
- EN 55022 (2006)A1 (2007) Class A
- AS/NZS CISPR 22: 2009 plus A1:2010
- MSIP-REM-FIO-ioScale3
- EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 and IEC 60950-1:2005 A1:2009
- DIRECTIVE 2011/65/EU
- MIL-STD-810

Related publications and links

For more information, see the following web pages and documents:

- io3 Flash Adapter configuration information and requirements
<https://support.lenovo.com/us/en/documents/serv-io3>
- ioMemory VSL 4.1.2 io3 Flash Adapter Hardware Installation Guide (PDF)
<https://support.lenovo.com/us/en/docs/UM104182>
- ioMemory VSL 4.1.2 Release Notes (PDF)
<https://support.lenovo.com/us/en/docs/UM104183>
- ioMemory VSL 4.1.2 User Guide for Linux (PDF)
<https://support.lenovo.com/us/en/docs/UM104184>
- ioMemory VSL 4.1.2 User Guide for Microsoft Windows (PDF)
<https://support.lenovo.com/us/en/docs/UM104185>
- ioMemory VSL 4.1.2 User Guide for VMware ESXi (PDF)
<https://support.lenovo.com/us/en/docs/UM104186>
- Flash Management Console 3.15.0 Installation Guide (PDF)
<https://support.lenovo.com/us/en/docs/UM104178>
- Flash Management Console 3.15.0 Release Notes (PDF)
<https://support.lenovo.com/us/en/docs/UM104179>
- Flash Management Console 3.15.0 Tools Guide (PDF)
<https://support.lenovo.com/us/en/docs/UM104180>
- Flash Management Console 3.15.0 User Guide (PDF)
<https://support.lenovo.com/us/en/docs/UM104181>
- System x Configuration and Options Guide
<https://support.lenovo.com/us/en/documents/SCOD-3ZVQ5W>
- ServerProven
<http://www.lenovo.com/us/en/serverproven/>

Related product families

Product families related to this document are the following:

- [PCIe Flash Adapters](#)

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This document, TIPS1237, was created or updated on June 7, 2016.

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