IBM High IOPS MLC Adapters

IBM Redbooks Product Guide

The IBM® 365GB, 785GB and 1.2TB MLC Mono and 2.4TB MLC Duo High IOPS Adapters for IBM System x®, IBM BladeCenter®, and IBM Flex System™ are second-generation adapters that come with many of the benefits of standard storage in addition to enterprise-class high performance of more than 900,000 sustained input/output operations per second (IOPS). These adapters are designed primarily for performance-hungry enterprise servers and computing appliances while providing the added benefits of lower power and cooling costs, low management impact, and smaller storage footprints.

Figure 1 shows the IBM 2.4TB High IOPS MLC Duo Adapter.

Figure 1. IBM 2.4TB High IOPS MLC Duo Adapter

Did you know

The IBM High IOPS MLC Adapters use flash memory as their storage medium, contain no moving parts, and do not have the issues associated with vibration, noise, and mechanical failure. The adapters are built as block devices on a PCIe bus with advanced wear-leveling, advanced ECC, and chip-level redundancy, providing exceptional reliability and efficiency.

Providing additional peace of mind, these adapters are covered under IBM warranty. They carry a 1-year limited warranty, or when installed in a System x server, these adapters assume your system's base warranty.

Part number information

Table 1 lists the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
IBM 365GB High IOPS MLC Mono Adapter	46C9078	A3J3
IBM 785GB High IOPS MLC Mono Adapter	46C9081	A3J4
IBM 1.2TB High IOPS MLC Mono Adapter	90Y4377	A3DY
IBM 2.4TB High IOPS MLC Duo Adapter	90Y4397	A3DZ
IBM 8-pin 3 drop 34.7" (95cm) Cable	46C9087	A3EH

Note: IBM 8-pin 3-drop 34.7-inch (95cm) Cable (46C9087) is used to support the 2.4TB High IOPS adapter. This cable supplies AUX power required for the x3650 M4 when four or more of the IBM 2.4 TB High IOPS MLC Duo Adapters are installed.

The part numbers for the adapters include the following items:

- IBM High IOPS MLC Mono or Duo Adapter with 3U bracket attached
- 2U bracket loose
- USB Key with documentation
- Quick Install Guide
- *Important Notices* document
- Warranty Flyer
- Environmental Notices
- IBM Safety Information
- 6-pin 1 drop 16 in. cable (Duo Adapter only)
- 8-pin 3 drop 16 in. cable (Duo Adapter only)
- Solid State Storage Technical Update

Figure 2 shows the IBM High IOPS MLC Mono Adapter (365 GB, 785 GB, or 1.2 TB).

Figure 2. IBM High IOPS MLC Mono Adapter

Features

Based on the standard PCIe architecture coupled with silicon-based NAND clustering storage technology, the High IOPS MLC Adapters are optimized for System x rack servers and can be deployed in blades through the PCIe expansion units. These scalable designs come with 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 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 redundancy providing unparalleled reliability and efficiency.

Typical uses are applications with ultra-high performance I/O needs:

- Data-in-memory applications
- Medium to large databases
- Cache
- Video
- Data warehousing
- Business intelligence and analytics
- Decision support

The IBM High IOPS MLC Adapters have the following features:

Technology features:

- Industry-standard PCIe form factors.
- 24 nm NAND flash.
- Cost-effective MLC technology.
- Functions as a PCIe storage and controller device. The operating system sees a block device.

Performance features:

- Ultra-high performance of more than 700,000 read IOPS and more than 900,000 write IOPS
- Access latency as low as 15 µs
- Up to 3 GBps of sustained sequential throughput
- Integrates with host processor as a memory tier for direct parallel access to flash

Reliability features:

- Enterprise-grade MLC (eMLC)
- 49-bit ECC protection
- End-to-end data integrity
- Adaptive Flashback redundancy for RAID-like chip protection with self-healing capabilities
- Field-upgradable controller hardware to provide performance, reliability, endurance, and feature improvements for the existing deployments

Monitoring and management features:

- Power consumption
- Thermal information
- Flash wear-out

Note: These adapters cannot be used as bootable devices.

Technical specifications

Table 2 presents the technical specifications for the IBM High IOPS MLC Adapters.

Table 2. IBM High IOPS MLC Adapter technical specifications

Specification	365 GB	785 GB	1.2 TB	2.4 TB
Part number	46C9078	46C9081	90Y4377	90Y4397
Interface	PCIe 2.0 x8 (x4-wired)	PCIe 2.0 x8 (x4-wired)	PCIe 2.0 x8 (x4-wired)	PCIe 2.0 x8 (x8-wired)
Form factor	Low profile	Low profile	Low profile	Full height, half length
Capacity	365 GB	785 GB	1.2 TB	2.4 TB
Endurance	Five-year life time expectancy (4 PB TBW)	Five-year life time expectancy (11 PB TBW)	Five-year life time expectancy (17 PB TBW)	Five-year life time expectancy (34 PB TBW)
Data reliability	< 1 in 10^{20} bits read	< 1 in 10^{20} bits read	< 1 in 10^{20} bits read	< 1 in 10^{20} bits read
Sequential read IOPS*	415,000	443,000	445,000	892,000
Sequential write IOPS*	535,000	535,000	535,000	935,000
Random read IOPS*	137,000	141,000	143,000	285,000
Random write IOPS*	535,000	535,000	535,000	725,000
Sequential read rate†	910 MBps	1.5 GBps	1.5 GBps	3.0 GBps
Sequential write rate†	590 MBps	1.1. GBps	1.3 GBps	2.5 GBps
Read access latency	68 µs	68 µs	68 µs	68 µs
Write access latency	15 µs	15 µs	15 µs	15 µs
Power requirements	24 W	24 W	24 W	55 W

* 512 bytes block transfers
† 1 MB block transfers

The TBW value assigned to a solid-state device is the total bytes of written data (based on the number of P/E cycles) that a device can be guaranteed to complete (the percentage of remaining P/E cycles is equal to the percentage of remaining TBW). The IBM warranty for the solid-state storage is limited to devices that have not reached the maximum guaranteed number of program/erase cycles. Solid-state storage that reaches this limit might fail to operate according to its specifications. Because of such behavior by solid-state devices, careful planning must be done to use solid-state storage in the application environments to ensure that the TBW of the device is not exceeded before the end of the required life expectancy.

Supported servers

The IBM High IOPS MLC Adapters can be installed in the System x and IBM iDataPlex® servers identified in Table 3 and the BladeCenter and Flex System servers identified in Table 4.

Table 3. Supported System x and iDataPlex servers (Part 1)

Part number	Feature code	Product description	x3200 M3 (7327, 7328)	x3250 M3 (4251, 4252)	x3400 M3 (7378, 7379)	x3500 M3 (7380)	x3550 M3 (7944)	x3620 M3 (7376)	x3630 M3 (7377)	x3650 M3 (7945)	x3755 M3 (7164)	dx360 M3 (6391)
46C9078	A3J3	IBM 365GB High IOPS MLC Mono Adapter	N	N	N	N	N	N	N	N	N	N
46C9081	A3J4	IBM 785GB High IOPS MLC Mono Adapter	N	N	N	N	N	N	N	N	N	N
90Y4377	A3DY	IBM 1.2TB High IOPS MLC Mono Adapter	N	N	N	N	N	N	N	N	N	N
90Y4397	A3DZ	IBM 2.4TB High IOPS MLC Duo Adapter	N	N	N	N	N	N	N	N	N	N
46C9087	A3EH	IBM 8-pin 3 drop 34.7" (95cm) Cable	N	N	N	N	N	N	N	N	N	N

Table 3. Supported System x and iDataPlex servers (Part 2)

Part number	Feature code	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
46C9078	A3J3	IBM 365GB High IOPS MLC Mono Adapter	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
46C9081	A3J4	IBM 785GB High IOPS MLC Mono Adapter	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
90Y4377	A3DY	IBM 1.2TB High IOPS MLC Mono Adapter	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
90Y4397	A3DZ	IBM 2.4TB High IOPS MLC Duo Adapter	N	N	N	N	N	Y	N	Y	Y	Y	Y	Y
46C9087	A3EH	IBM 8-pin 3 drop 34.7" (95cm) Cable	N	N	N	N	N	N	N	Y	N	N	N	N

Table 4. Supported BladeCenter and Flex System servers

Part number	Feature code	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7873)	x220 (7906)	x240 (8737)	x440 (7917)
46C9078	A3J3	IBM 365GB High IOPS MLC Mono Adapter	N	N	N	Y†	Y†	Y†	Y*	Y*	N
46C9081	A3J4	IBM 785GB High IOPS MLC Mono Adapter	N	N	N	Y†	Y†	Y†	Y*	Y*	N
90Y4377	A3DY	IBM 1.2TB High IOPS MLC Mono Adapter	N	N	N	Y†	Y†	Y†	Y*	Y*	N
90Y4397	A3DZ	IBM 2.4TB High IOPS MLC Duo Adapter	N	N	N	Y†	Y†	Y†	Y*	Y*	N
46C9087	A3EH	IBM 8-pin 3 drop 34.7" (95cm) Cable	N	N	N	Y†	Y†	Y†	Y*	Y*	N

† The HS23, HS23E and HX5 support these adapters with the addition of the IBM BladeCenter PCI Express Gen 2 Expansion Blade II, part number 68Y7484.
* The x220 and x240 support these adapters with the addition of the IBM Flex System PCIe Expansion Node, part number 81Y8983.

See the IBM ServerProven® website for the latest compatibility information for System x, BladeCenter, iDataPlex, and Flex System servers at http://ibm.com/servers/eserver/serverproven/compat/us/.

Supported operating systems

The IBM High IOPS MLC Adapters support the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- SUSE Linux Enterprise Server 11 for AMD64/EM64T
- SUSE Linux Enterprise Server 10 for AMD64/EM64T
- VMware vSphere 5
- VMware ESX 4.1
- VMware ESXi 4.1

See the IBM ServerProven website for the latest information about the specific versions and service packs supported at http://ibm.com/servers/eserver/serverproven/compat/us/. Click **System x servers**, then **Disk controllers** to see the support matrix. Click the check mark that is associated with the System x server in question to see the details of the operating system support.

Warranty

The IBM High IOPS MLC Adapters carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a System x server, these adapters assume your system's base warranty and any IBM ServicePac® upgrade.

Physical specifications

The IBM 365GB, 785GB and 1.2TB High IOPS MLC Mono Adapters have the following physical specifications:

Dimensions and weight (approximate):

- Height: 16 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 168 mm (6.6 in.)
- Weight: 138 g (0.3 lb)

Shipping dimensions and weight (approximate):

- Height: 124 mm (4.9 in.)
- Width: 19 mm (0.8 in.)
- Depth: 178 mm (7.0 in.)
- Weight: 173 g (0.4 lb)

The IBM 2.4TB High IOPS MLC Duo Adapter has the following physical specifications:

Dimensions and weight (approximate):

- Height: 16 mm (0.6 in.)
- Width: 110 mm (4.3 in.)
- Depth: 170 mm (6.7 in.)
- Weight: 279 g (0.6 lb)

Shipping dimensions and weight (approximate):

- Height: 149 mm (5.9 in.)
- Width: 19 mm (0.8 in.)
- Depth: 178 mm (7.0 in.)
- Weight: 312 g (0.7 lb)

Operating environment

The IBM High IOPS MLC Adapters are supported in the following environment:

- Temperature (operational): 0 - 55 °C (32 - 131 °F) at 0 - 3,048 m (0 - 10,000 ft); derated by 1 °C per 1,000 ft elevation above sea level
- Temperature (non-operational): -40 - 70 °C (-40 - 158 °F) at 0 - 9,144 m (0 - 30,000 ft); derated by 1 °C per 1,000 ft elevation above sea level
- Relative humidity: 5 - 95% (non-condensing)
- Maximum altitude (operational): 3,048 m (10,000 ft)

Agency approvals

The IBM High IOPS MLC Adapters have the following agency approvals:

- United States FCC 47, Part 15, Subpart B, Class A
- Canada ICES-003, Class A
- Japan VCCI, Class A
- Australia/New Zealand C-Tick-CISPR 22:2009, Class A
- Taiwan BSMI - CNS 13438, Class A
- CE Mark (EN55022, EN55024, EN61000-3-2, EN61000-3-3)
- Korea KN22, KN24, Class A
- Low Voltage Directive IEC/EN 60950-1:2006

Related publications

For more information, see the following documents:

- IBM US Announcement Letter for IBM 1.2TB and 2.4TB High IOPS MLC Adapters:
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-128
- IBM US Announcement Letter for IBM 365GB and 785GB High IOPS MLC Adapters:
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-187
- *IBM System x Configuration and Options Guide*:
  http://www.ibm.com/support/docview.wss?uid=psg1SCOD-3ZVQ5W
- IBM ServerProven:
  http://ibm.com/servers/eserver/serverproven/compat/us/

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