

# ServeRAID M5115 SAS/SATA Controller for IBM Flex System

## IBM Redbooks Product Guide

The ServeRAID M5115 SAS/SATA Controller is a high-performance offering for IBM Flex System™ compute nodes. It enables a high-performance RAID solution composed of combinations of SAS or SATA drives or high-throughput solid-state drives (SSDs). The offering is designed around a base RAID adapter with a set of upgrades that are rich with features, designed to minimize parts-on-the-floor, optimized for storage performance, and consistent with existing industry-leading ServeRAID products.

The ServeRAID M5115 SAS/SATA Controller for IBM Flex System is capable of delivering several focused solutions depending on business needs, offering two-drive HDD connectivity or support for up to eight 1.8-inch SSDs or combinations of HDDs and SSDs. Software upgrades include SSD performance features or an extra layer of redundancy with RAID 6. These solutions are realized by pairing M5115 with one or more available hardware kits and Feature-on-Demand license upgrades.

The following figure shows a design drawing of the ServeRAID M5115 controller.

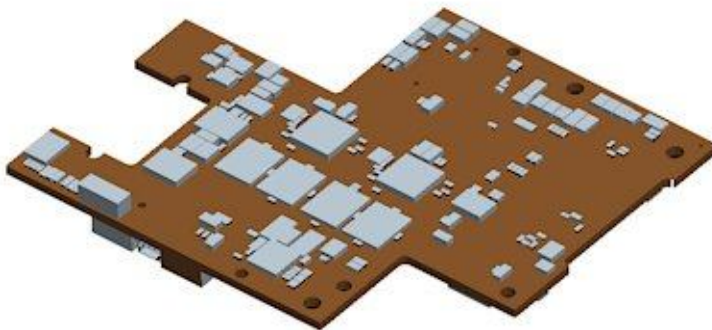


Figure 1. ServeRAID M5115 SAS/SATA Controller

### Did you know?

The ServeRAID M5115 SAS/SATA controller is optimized for high-performance, internal data storage that integrates a dual-core chip architecture, DDR3 1333 MHz cache memory, and PCIe 3.0 host interface. Upgrade features, such as support for RAID 6/60, performance optimization, and caching with SSDs, no longer require a hardware key, as they are implemented through Features-on-Demand (FoD) software licenses.

## Part number information

The following table provides the ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Part number	Feature code	Description
90Y4390	A2XW	ServeRAID M5115 SAS/SATA Controller for IBM Flex System
<b>Hardware enablement kits - IBM Flex System x220 Compute Node</b>		
90Y4424	A35L	ServeRAID M5100 Series Enablement Kit for IBM Flex System x220
90Y4425	A35M	ServeRAID M5100 Series IBM Flex System Flash Kit for x220
90Y4426	A35N	ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x220
<b>Hardware enablement kits - IBM Flex System x240 Compute Node</b>		
90Y4342	A2XX	ServeRAID M5100 Series Enablement Kit for IBM Flex System x240
90Y4341	A2XY	ServeRAID M5100 Series IBM Flex System Flash Kit for x240
90Y4391	A2XZ	ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x240
<b>Hardware enablement kits - IBM Flex System x440 Compute Node</b>		
46C9030	A3DS	ServeRAID M5100 Series Enablement Kit for IBM Flex System x440
46C9031	A3DT	ServeRAID M5100 Series IBM Flex System Flash Kit for x440
46C9032	A3DU	ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x440
<b>Feature on demand licenses (for all three compute nodes)</b>		
90Y4410	A2Y1	ServeRAID M5100 Series RAID 6 Upgrade for IBM Flex System
90Y4412	A2Y2	ServeRAID M5100 Series Performance Upgrade for IBM Flex System
90Y4447	A36G	ServeRAID M5100 Series SSD Caching Enabler for IBM Flex System

## Supported servers

The following table lists the IBM Flex System compute nodes that support the ServeRAID M5115 SAS/SATA Controller.

Table 2. Supported servers

Part number	Feature code	Description	x220	x240	x440	p24L	p260	p460
90Y4390	A2XW	ServeRAID M5115 SAS/SATA Controller	Yes	Yes	Yes	No	No	No

See IBM ServerProven® at the following web address for the latest information about the expansion cards that are supported by each blade server type:

<http://ibm.com/servers/eserver/serverproven/compat/us/>

## Supported configurations

With the ServeRAID M5115, the compute node can support contain up to eight 1.8-inch solid-state drives. The M5115 attaches to the I/O adapter 1 connector and can be attached even if the Compute Node Fabric Connector is installed (used to route the embedded Ethernet controller to chassis bays 1 and 2). The ServeRAID M5115 cannot be installed if an adapter is installed in I/O adapter slot 1.

The following figure shows where the ServeRAID M5115 is installed in an IBM Flex System compute node (x240 is shown as an example).

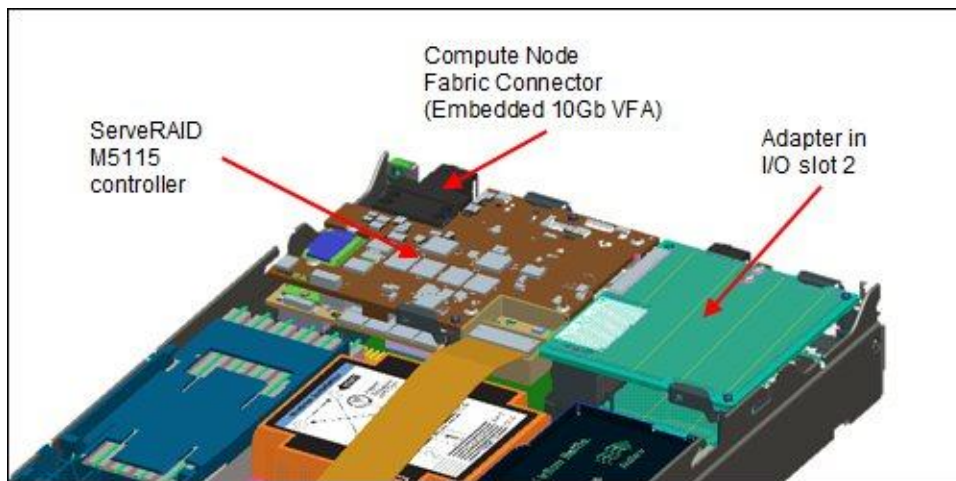


Figure 2. ServeRAID M5115 installed in the x240 Compute Node

The ServeRAID M5115 supports combinations of 2.5-inch drives and 1.8-inch solid state drives:

- Up to two 2.5-inch drives only
- Up to four 1.8-inch drives only
- Up to two 2.5-inch drives, plus up to four 1.8-inch solid state drives
- Up to eight 1.8-inch solid state drives

The ServeRAID M5115 provides an advanced RAID controller supporting RAID 0, 1, 10, 5, 50, and, optionally, 6 and 60. It includes 1 GB of cache, which can be backed up to flash memory when attached to the supercapacitor included with the optional ServeRAID M5100 Series Enablement Kit (90Y4342).

At least one hardware kit is required with the ServeRAID M5115 controller, and there are three hardware kits that are supported that enable specific drive support:

- **ServeRAID M5100 Series Enablement Kit for IBM Flex System x240 (90Y4342) or IBM Flex System x220 (90Y4424) or IBM Flex System x440 (46C9030)** enables support for up to two 2.5-inch HDDs or SSDs in the hot-swap bays in the front of the server. It includes a CacheVault unit, which enables MegaRAID CacheVault flash cache protection. This enablement kit replaces the standard two-bay backplane (which is attached through the planar to an onboard controller) with a new backplane that attaches to an included flex cable to the M5115 controller. It also includes an air baffle, which also serves as an attachment for the CacheVault unit.

MegaRAID CacheVault flash cache protection uses NAND flash memory powered by a supercapacitor to protect data stored in the controller cache. This module eliminates the need for a lithium-ion battery commonly used to protect DRAM cache memory on PCI RAID controllers. To avoid the possibility of data loss or corruption during a power or server failure, CacheVault technology transfers the contents of the DRAM cache to NAND flash memory using power from the supercapacitor. After the power is restored to the RAID controller, the saved data is transferred from the NAND flash back to the DRAM cache, which can then be flushed to disk.

**Tip:** The Enablement Kit is only required if 2.5-inch drives are used. If you plan to install four or eight 1.8-inch SSDs only, then this kit is not required.

- **ServeRAID M5100 Series IBM Flex System Flash Kit for x240 (90Y4341) or IBM Flex System x220 (90Y4425) or IBM Flex System x440 (46C9031)** enables support for up to four 1.8-inch SSDs. This kit replaces the standard two-bay backplane with a four-bay SSD backplane that attaches to an included flex cable to the M5115 controller. Because only SSDs are supported, a CacheVault unit is not required, and therefore this kit does not have a supercap.
- **ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x240 (90Y4391) or IBM Flex System x220 (90Y4426) or IBM Flex System x440 (46C9032)** enables support for up to four internal 1.8-inch SSDs. This kit includes two air baffles which can attach two 1.8-inch SSD attachment locations and Flex cables for attachment to up to four 1.8-inch SSDs.

The following table shows the kits required for each combination of drives. For example, if you plan to install eight 1.8-inch SSDs, then you need the M5115 controller, the Flash kit, and the SSD Expansion kit.

Table 3. ServeRAID M5115 hardware kits

Desired drive support			Components required			
Maximum number of 2.5-inch drives	Maximum number of 1.8-inch SSDs		ServeRAID M5115 90Y4390	Enablement Kit 90Y4342 (x240) 90Y4424 (x220) 46C9030 (x440)	Flash Kit 90Y4341 (x240) 90Y4425 (x220) 46C9031 (x440)	SSD Expansion Kit 90Y4391 (x240) 90Y4426 (x220) 46C9032 (x440)
2	0	=>	Required	Required		
0	4 (front)	=>	Required		Required	
2	4 (internal)	=>	Required	Required		Required
0	8 (both)	=>	Required		Required	Required

The following figure shows how the ServeRAID M5115 and the Enablement Kit are installed in the x240 to support two 2.5-inch drives with MegaRAID CacheVault flash cache protection (row 1 of the preceding table). The configuration is the same for the x220.

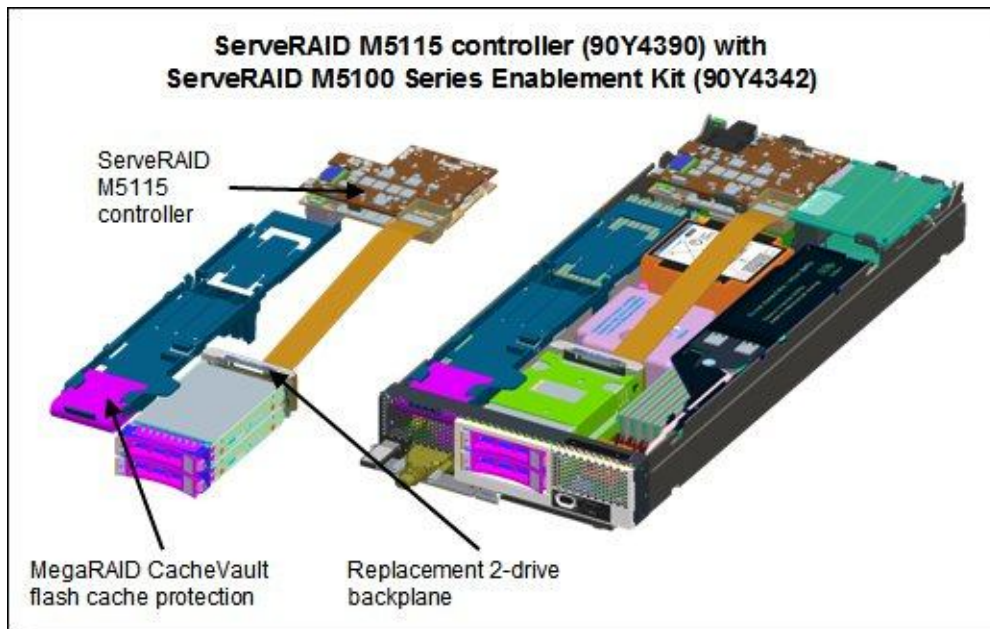


Figure 3. The ServeRAID M5115 and the Enablement Kit installed (x240)

The following figure shows how the ServeRAID M5115 and Flash and SSD Expansion Kits are installed in the x240 to support eight 1.8-inch solid-state drives (row 4 of the preceding table). The configuration is the same for the x220.

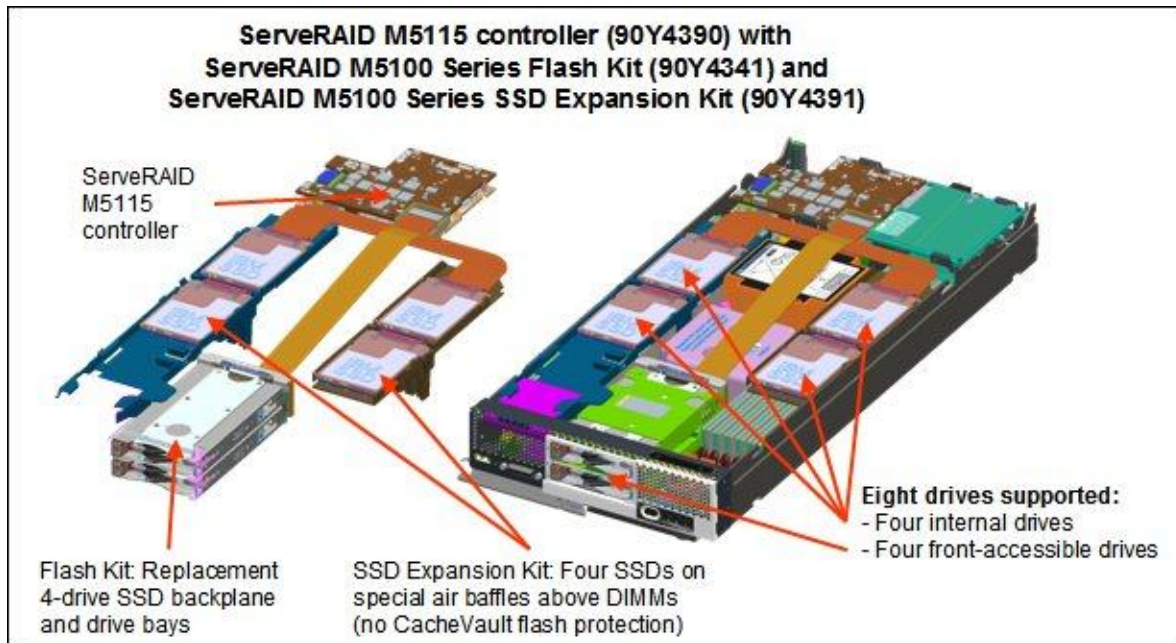


Figure 4. ServeRAID M5115 with Flash Kit and SSD Expansion Kits installed (x240)

The eight SSDs are installed in the following locations:

- Four in the front of the system in place of the two 2.5-inch drive bays
- Two in a tray above one the memory banks for processor 1
- Two in a tray above one the memory banks for processor 2

The following figure shows how the ServeRAID M5115 and Flash and SSD Expansion Kits are installed in the x440 to support eight 1.8-inch solid-state drives.

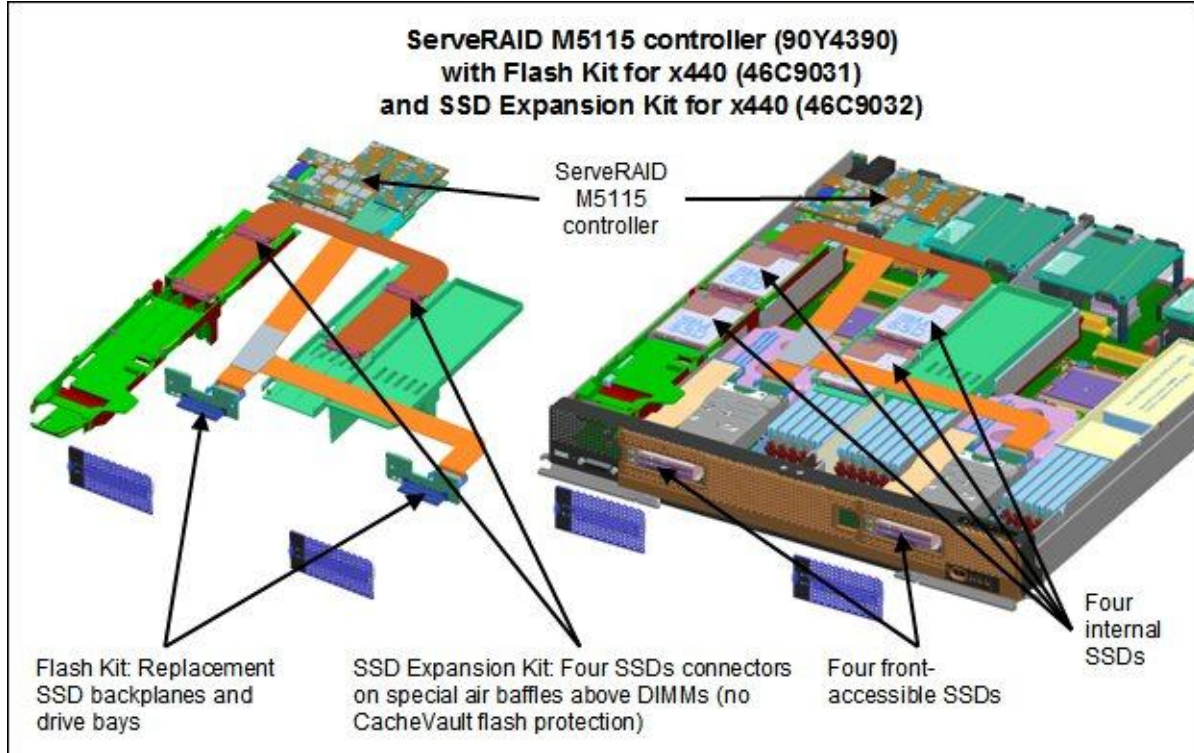


Figure 5. ServeRAID M5115 with Flash and SSD Expansion Kits installed (x440)

## Components shipped with each option

The ServeRAID M5115 SAS/SATA Controller for IBM Flex System part number includes the following items:

- ServeRAID M5115 controller
- Warranty Information
- ServeRAID M Documentation CD
- *IBM Important Notices* flyer

The ServeRAID M5100 Series Enablement Kit part number (90Y4342 or 90Y4424 or 46C9030) includes the following items:

- Air baffle to replace the standard air baffle (over the memory DIMMs) to hold the Power Module
- 2.5-inch backplane for the installation of up to two 2.5-inch SAS HDDs, SATA HDDs, or SSDs
- Power Module
- Power Module cable
- Flex cable
- *IBM Important Notices* flyer
- Warranty Information
- ServeRAID M Documentation CD

The ServeRAID M5100 Series IBM Flex System Flash Kit part number (90Y4341 or 90Y4425 or 46C9031) includes the following items:

- 1.8-inch backplane for the installation of up to four SSDs
- Flex cable
- Drive caddies for four SSDs
- Bezel
- *IBM Important Notices* flyer
- Warranty Information
- ServeRAID M Documentation CD

The ServeRAID M5100 Series SSD Expansion Kit part number (90Y4391 or 90Y4426 or 46C9032) includes the following items:

- Two air baffles where up to four SSDs are mounted
- Flex cable
- *IBM Important Notices* flyer
- Warranty Information
- ServeRAID M Documentation CD

The following part numbers come in form of a flyer with the M5100 Series upgrade activation key and instructions:

- ServeRAID M5100 Series RAID 6 Upgrade for IBM Flex System (90Y4410)
- ServeRAID M5100 Series Performance Upgrade for IBM Flex System (90Y4412)
- ServeRAID M5100 Series SSD Caching Enabler for IBM Flex System (90Y4447)

## Specifications

The ServeRAID M5115 controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- PCI Express 3.0 x8 host interface
- 6 Gbps throughput per port
- 800 MHz dual-core IBM PowerPC® processor with LSI SAS2208 6 Gbps RAID on Chip (ROC) controller
- Support for RAID levels 0, 1, 10, 5, 50 standard; support for RAID 6 and 60 with optional upgrade using 90Y4411
- Optional onboard 1 GB data cache (DDR3 running at 1333 MHz) with optional flash backup (MegaRAID CacheVault technology) as part of the Enablement Kit 90Y4342
- Support for SAS and SATA HDDs and SSDs
- Support for intermixing SAS and SATA HDDs and SSDs; mixing different types of drives in the same array (drive group) is not recommended
- Support for self-encrypting drives (SEDs) with MegaRAID SafeStore
- Optional support for SSD performance acceleration with MegaRAID FastPath and SSD caching with MegaRAID CacheCade Pro 2.0 (90Y4447)
- Support for up to 64 virtual drives, up to 128 drive groups, up to 16 virtual drives per one drive group, and up to 32 physical drives per one drive group
- Support for logical unit number (LUN) sizes up to 64 TB
- Configurable stripe size up to 1 MB
- Compliant with Disk Data Format (DDF) configuration on disk (COD)
- S.M.A.R.T. support
- MegaRAID Storage Manager management software

Optional add-ons to the ServeRAID M5115 controller are RAID 6 support, SSD performance accelerator, and SSD caching enabler. The feature upgrades are as listed in the following table. These are all Feature on Demand (FoD) activations.

Table 4. Supported upgrade features

Part number	Feature code	Description
90Y4410	A2Y1	ServeRAID M5100 Series RAID 6 Upgrade for IBM Flex System
90Y4412	A2Y2	ServeRAID M5100 Series Performance Upgrade for IBM Flex System (MegaRAID FastPath)
90Y4447	A36G	ServeRAID M5100 Series SSD Caching Enabler for IBM Flex System (MegaRAID CacheCade Pro 2.0)



These features are described as follows:

- **RAID 6 Upgrade (90Y4410)**  
Adds support for RAID 6 and RAID 60. This is a Feature on Demand license.
- **Performance Upgrade (90Y4412)**  
The Performance Upgrade for IBM Flex System (implemented using the LSI MegaRAID FastPath software) provides high-performance I/O acceleration for SSD-based virtual drives by using an extremely low-latency I/O path to increase the maximum I/O per second (IOPS) capability of the controller. This feature boosts the performance of applications with a highly random data storage access pattern, such as transactional databases. Part number 90Y4412 is a Feature on Demand license.
- **SSD Caching Enabler for traditional hard drives (90Y4447)**  
The SSD Caching Enabler for IBM Flex System (implemented using the LSI MegaRAID CacheCade Pro 2.0) is designed to accelerate the performance of hard disk drive (HDD) arrays with only an incremental investment in solid-state drive (SSD) technology. The feature enables the SSDs to be configured as a dedicated cache to help maximize the I/O performance for transaction-intensive applications, such as databases and web serving. The feature tracks data storage access patterns and identifies the most frequently accessed data. The hot data is then automatically stored on the SSDs that are assigned as a dedicated cache pool on the ServeRAID controller. Part number 90Y4447 is a Feature on Demand license. This feature requires at least one SSD drive be installed.

## Supported HDDs and SSDs

The 1.8-inch solid-state drives supported with the Flash Kit (90Y4341 or 90Y4425 or 46C9031) and SSD Expansion Kit (90Y4391 or 90Y4426 or 46C9032) are listed in the following table.

Table 5. Supported 1.8-inch solid-state drives

Part number	Feature code	Description	x220	x240	x440	Maximum supported
43W7746	5420	IBM 200GB SATA 1.8" MLC SSD	Yes	Yes	Yes	8
43W7726	5428	IBM 50GB SATA 1.8" MLC SSD	Yes	Yes	Yes	8
49Y5993	A3AR	IBM 512GB SATA 1.8" MLC Enterprise Value SSD	No	No	No	None
49Y5834	A3AQ	IBM 64GB SATA 1.8" MLC Enterprise Value SSD	No	No	No	None
00W1120	A3HQ	IBM 100GB SATA 1.8" MLC Enterprise SSD	No	No	No	None
49Y6119	A3AN	IBM 200GB SATA 1.8" MLC Enterprise SSD	No	No	No	None

The 2.5-inch drive bays in the Enablement Kit (90Y4342 or 90Y4424 or 46C9030) support SAS or SATA hard disk drives (HDDs) or SATA solid state drives (SSDs). The following table lists the supported 2.5-inch drive options.

Table 6. 2.5-inch drive options for internal disk storage in the IBM Flex System compute nodes

Part number	Feature code	Description	x220	x240	x440	Maximum supported
<b>10K SAS hard disk drives</b>						
44W2264	5413	IBM 300GB 10K 6Gbps SAS 2.5" SFF Slim-HS SED*	No	No	Yes	2
42D0637	5599	IBM 300GB 10K 6Gbps SAS 2.5" SFF Slim-HS HDD	Yes	Yes	Yes	2
49Y2003	5433	IBM 600GB 10K 6Gbps SAS 2.5" SFF Slim-HS HDD	Yes	Yes	Yes	2
81Y9650	A282	IBM 900GB 10K 6Gbps SAS 2.5" SFF HS HDD	Yes	Yes	Yes	2
<b>15K SAS hard disk drives</b>						
42D0677	5536	IBM 146GB 15K 6Gbps SAS 2.5" SFF Slim-HS HDD	Yes	Yes	Yes	2
81Y9670	A283	IBM 300GB 15K 6Gbps SAS 2.5" SFF HS HDD	Yes	Yes	Yes	2
<b>NL SATA</b>						
81Y9722	A1NX	IBM 250GB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	Yes	Yes	Yes	2
81Y9726	A1NZ	IBM 500GB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	Yes	Yes	Yes	2
81Y9730	A1AV	IBM 1TB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	Yes	Yes	Yes	2
<b>NL SAS</b>						
42D0707	5409	IBM 500GB 7200 6Gbps NL SAS 2.5" SFF Slim-HS HDD	Yes	Yes	Yes	2
81Y9690	A1P3	IBM 1TB 7.2K 6Gbps NL SAS 2.5" SFF HS HDD	Yes	Yes	Yes	2
<b>Solid-state drives</b>						
43W7718	A2FN	IBM 200GB SATA 2.5" MLC HS SSD	Yes	Yes	Yes	2
90Y8643	A2U3	IBM 256GB SATA 2.5" MLC HS Enterprise Value SSD	Yes	Yes	Yes	2
90Y8648	A2U4	IBM 128GB SATA 2.5" MLC HS Enterprise Value SSD	Yes	Yes	Yes	2
49Y5844	A3AU	IBM 512GB SATA 2.5" MLC HS Enterprise Value SSD	Yes	Yes	No	2
49Y5839	A3AS	IBM 64GB SATA 2.5" MLC HS Enterprise Value SSD	Yes	Yes	No	2

\* Supports self-encrypting drive (SED) technology. For more information, see Self-Encrypting Drives for IBM System x at <http://www.redbooks.ibm.com/abstracts/tips0761.html?Open>.

## Supported operating systems

The ServeRAID M5115 SAS/SATA Controller support the following operating systems:

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

See the IBM ServerProven® website for the latest information about the specific versions and service levels supported and any other prerequisites:

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

## Physical specifications

The ServeRAID M5115 SAS/SATA Controller has the following physical specifications:

Dimensions (approximate):

- Height: 38 mm (1.5 in.)
- Width: 96 mm (3.75 in.)
- Depth: 120 mm (4.75 in.)
- Weight: 142 g (0.36 lb)

Shipping dimensions (approximate):

- Height: 128 mm (5.0 in.)
- Width: 128 mm (5.0 in.)
- Depth: 128 mm (5.0 in.)
- Weight: 908 g (2.0 lb)

## Operating environment

The ServeRAID M5115 SAS/SATA Controller is supported in the following environment:

- Temperature:
  - 10 - 35 degrees C (50 - 95 F) at 0 - 914 m (0 - 3,000 ft.)
  - 10 - 32 degrees C (50 - 90 F) at 914 - 2,133 m (3,000 - 7,000 ft.)
- Relative humidity: 20% - 80% (noncondensing)
- Maximum altitude: 2,133 m (7,000 ft.)

## Warranty

The adapter has a 1-year limited warranty. When installed on an IBM Flex System Compute Node, the adapter assumes the system's base warranty and any IBM ServicePac® upgrades.

## Agency approvals

The adapter conforms to the following standards:

- EN55022
- EN55024
- EN60950 / CE
- EN 61000-3-2
- EN 61000-3-3
- IEC 950 CB Scheme
- FCC Part 15 Class A, and Class B
- UL 1950
- CSA C22.2 950-95
- VCCI
- NZ AS3548 / C-tick
- RRL for MIC (KCC)
- BSMI
- UL 94-/V

## Related publications

For more information, see the following documents:

- *ServeRAID M5115 SAS/SATA Controller Installation and User Guide*  
<http://www.ibm.com/support>
- IBM Flex System Information Center  
<http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>
- *IBM Flex System x240 Compute Node Product Guide*  
<http://www.redbooks.ibm.com/abstracts/tips0860.html>
- *IBM Flex System x220 Compute Node Product Guide*  
<http://www.redbooks.ibm.com/abstracts/tips0885.html>
- *IBM Flex System x440 Compute Node Product Guide*  
<http://www.redbooks.ibm.com/abstracts/tips0886.html>
- *IBM Flex System Interoperability Guide*  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=sa&subtype=wh&htmlfid=WZL12345USEN>
- *IBM PureFlex System and Flex System Products & Technology*, SG24-7984  
<http://www.redbooks.ibm.com/abstracts/sg247984.html>
- System x RAID products home page:  
[http://www.ibm.com/systems/storage/product/systemx/scsi\\_raid.html](http://www.ibm.com/systems/storage/product/systemx/scsi_raid.html)
- IBM ServeRAID software matrix:  
<http://www.ibm.com/support/entry/portal/docdisplay?Indocid=SERV-RAID>
- IBM System x Configuration and Options Guide:  
<http://ibm.com/systems/xbc/cog/>
- IBM Redbooks® Product Guides for IBM Flex System servers and options  
<http://www.redbooks.ibm.com/portals/puresystems>

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