



# IBM Power Systems feature new I/O enhancements

## Table of contents

<a href="#">1 Overview</a>	<a href="#">14 Publications</a>
<a href="#">2 Key prerequisites</a>	<a href="#">14 Technical information</a>
<a href="#">2 Planned availability date</a>	<a href="#">16 Terms and conditions</a>
<a href="#">2 Description</a>	<a href="#">17 Prices</a>
<a href="#">11 Product number</a>	

## At a glance

- Two new PCIe Gen3 adapters provide higher performance to better support solid-state disks (SSD) on the IBM® Power® 795 server. The following adapters are available:
  - PCIe3 12 GB Cache RAID SAS Adapters (#EJ0L) for maximum performance
  - PCIe3 RAID SAS Adapter (#EJ0J) with zero write cache for cost effectiveness
  - A PCIe Gen3 SAS adapter (#EJ0X) that supports the attachment of SAS LTO-5 and LTO-6 tape drives on the Power 795 server
- Support for the recently announced PCIe Gen2 SAS adapter on more models
- PCIe binary synchronous adapter for IBM i clients

## Overview

Two new PCIe Gen3 SAS adapters introduce the next generation of IBM SAS adapter technology to exploit the SSD flash technology evolution, a 12 GB write cache adapter and a zero write cache adapter. Both support twice as many SSDs as earlier PCIe Gen2 SAS adapters, provide more I/O operations per second (IOPS), and support greater throughput (MB/s).

The PCIe3 12 GB Cache RAID SAS Adapter (#EJ0L) supports up to 48 SSDs and up to 96 hard disk drives (HDDs). The new adapter also effectively offers up to over six times more write cache for greater write performance than the PCIe Gen2 features 5913 and ESA3.

The PCIe3 RAID SAS Adapter (#EJ0J) is a new zero write cache SAS adapter. It uses the same high-performance PCIe Gen3 technology as feature EJ0L but is a lower-cost option than the PCIe3 12 GB Cache RAID SAS Adapter while still providing better performance than delivered by the earlier PCIe Gen2 SAS adapter (#ESA1).

The PCIe3 SAS Tape Adapter (#EJ0X) supports the attachment of SAS LTO-5 and LTO-6 tape drives.

All of these PCIe Gen3 adapters are introduced on the Power 795 server.

Support for the refreshed PCIe Gen2 SAS adapter, which was originally announced for just four Power Systems™ models, is expanding to include more models. The PCIe2 1.8 GB Cache RAID SAS Adapter (#ESA3) is now supported across most of the Power 720, 730, 740, 750, 760, 770, and 780 servers and the PowerLinux™ 7R2 and 7R4 servers. Feature ESA3 offers lower cost and higher energy efficiency than the feature 5913 SAS adapter, with the same performance and function.

Two new PCIe binary synchronous adapters (#EN13/#EN14) are available for clients running IBM i on IBM POWER7® technology-based servers who still need binary

synchronous capability. These adapters can be used instead of features 2893 and 2894, which are being withdrawn from marketing. Non-binary synchronous functions are available for IBM i 7.1 TR5 and TR7 through the lower-cost PCIe async adapter (#5289/#5290).

**Note:** Feature number EN13 is not available in Australia and New Zealand. Feature number EN14 is only available in Australia and New Zealand.

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## Key prerequisites

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None

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## Planned availability date

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- January 31, 2014, for features 0714, 3290, 3293, EJR3, EJS1, EJS2, EJS3, EJS4, EJS5, EJS6, EN13, EN14, and ESA3.
- February 28, 2014, for features ECBB, ECBJ, ECBK, ECBL, ECBT, ECBU, ECBV, ECBW, ECBY, ECBZ, ECC0, ECC2, ECC3, ECC4, EJ0J, EJ0L, EJ0X, EJR1, EJR2, EJR4, EJR5, EJR6, EJR7, EJRA, EJRB, EJRC, EJRD, EJRE, EJRP, EJRS, EJRT, EJRU, EJRW, EJRX, EJRY, and EJRZ.

**Note:** Feature number EN13 is not available in Australia and New Zealand. Feature number EN14 is only available in Australia and New Zealand.

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## Description

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### New high-performance PCIe3 SAS adapters for SSD and HDD

Two PCIe3 SAS adapters are introduced, one with 12 GB write cache (#EJ0L) and one with zero write cache (#EJ0J). Write cache adapters can significantly improve performance of workloads with write activity. Zero cache adapters can offer a lower-cost configuration for applications with very modest write workloads.

#### 12 GB write cache SAS adapter

The PCIe3 12 GB Cache RAID SAS Adapter Quad-port 6 Gb x8 (#EJ0L) is an excellent solution for higher-performance I/O configurations of SFF (2.5-in) SAS SSDs or HDDs. It is a single-wide, full-height, short Gen3 PCIe adapter with four 6 Gb connectors.

The adapter is the next-generation large-write-cache SAS adapter following the PCIe Gen2 (PCIe2) 1.8 GB Cache RAID SAS Adapter (#5913/#ESA3). It offers significantly more performance and a higher maximum number of attached SAS drives. Compared to a pair of PCIe2 adapters (#5913/#ESA3), a pair of PCIe3 adapters (#EJ0L) can deliver more than two times more IOPs. A pair of PCIe3 adapters running RAID 0 SSDs can provide up to 750,000 read IOPS in PCIe Gen1 slots. Early RAID 0 testing indicates more than one million read IOPS in a PCIe Gen2 slot. Early RAID 5 testing indicates over 800,000 read IOPS in a PCIe Gen2 slot. The PCIe3 adapter supports twice as many SSDs and 33% more HDDs than the PCIe2 adapters.

The PCIe3 adapter effectively has up to 12 GB of write cache, which can significantly improve write performance. This is effectively about six times the cache size offered in the PCIe Gen2 adapters. Physically, the PCIe3 adapter has about 3 GB of real cache, but compression built into the adapter effectively delivers about 12 GB cache for typical workloads. Compared to a pair of PCIe2 adapters, a pair of PCIe3 adapters can handle 50% - 100% more RAID 5 writes.

As of January 2014, the PCIe3 adapter is supported only in the Power 795 server and can be placed in the PCIe Gen1 slots of a 12X PCIe I/O drawer (#5803 or #5873). It can control SAS drives located in a 12X PCIe I/O drawer (#5803) or in a EXP24S I/O drawer (#5887). When controlling SAS drives in a 12X PCIe I/O drawer

(#5803), at least one adapter of the 12 GB write cache adapter (#EJ0L) pair must be located in that I/O drawer.

A pair of adapters works together to deliver additional performance, redundancy, and write-cache protection. A single adapter configuration is not supported. A non-paired PCIe SAS RAID indicator (#EJRU) is required by IBM Manufacturing to identify an AIX® high-availability configuration when the 12 GB write cache adapter (#EJ0L) pairing is across two servers.

Each adapter in an adapter pair maintains cross-awareness of the other adapter to protect the write-cache contents. One or two SAS adapter-to-adapter (AA) cables are used to give you the highest possible connectivity. Four cable lengths are available: 0.6 m (#ECC0), 1.5 m (#ECC2), 3 m (#ECC3), and 6 m (#ECC4). The top one or two mini-SAS HD narrow connectors (labeled T3 and T2) on each card are used for this AA cable.

Two AA cables are required when one or two of the bottom ports are attached to I/O drawers. One AA cable is required when the bottom three ports are attached to I/O drawers. An AA cable is not required when all four connectors are needed for controlling I/O drawers. With all connectors attaching I/O drawers, the communication between the adapter pair is performed through the SAS fabric with the I/O drawer and cabling.

Up to four feature EXP24S I/O drawers (#5887) in mode 1 or mode 2 can be controlled by a pair of 12 GB write cache adapters (#EJ0L). A maximum of one 12X PCIe I/O drawer (#5803) in mode 1 or mode 2 can be controlled by a pair of zero write cache SAS adapters (#EJ0J). A maximum of one 12X PCIe I/O drawer and up to three EXP24s drawers can be controlled by a pair of zero write cache SAS adapters (#EJ0J).

The eight ports of an adapter pair are treated as four pairs of ports. The bottom port (labeled T0) of each adapter of an adapter pair is connected to the same I/O drawer or to the same half of an I/O drawer, a specific range of SAS bays. Likewise, the next-to-bottom port (labeled T1) of each adapter pair is connected to one specific range of SAS bays. Similarly, the two ports labeled T2 of each adapter attach to the same range of bays or attach to each other through an AA cable. The top ports labeled T3 are cabled the same way as the T2 ports.

If a feature 5803 drawer or an EXP24S drawer is in mode 2, then not all the SAS bays on the I/O drawer can be accessed by the adapter pair unless a second set of ports is used to access the other half of the drawer. If a second set of adapter ports is used to do this, then the maximum number of drawers per adapter pair is reduced.

If the I/O drawer is in mode 2, then half of its SAS bays can be controlled by one pair of SAS adapters such as a 12 GB write cache adapter pair (#EJ0L) and the other half can be controlled by a different 12 GB write cache adapter pair or by non-feature EJ0L SAS adapters. Note that for simplicity, IBM configurator tools such as eConfig assume that the SAS bays of an individual I/O drawer are controlled by one type of SAS adapter. As a client, you have more flexibility than eConfig understands. For example, an EXP24S drawer in mode 2 could have a pair of feature EJ0L adapters controlling half its SAS bays and a pair of feature 5913 adapters controlling the other half.

The maximum number of HDDs that can be controlled by one adapter pair depends on the number and type of I/O drawers and the drawers' mode setting. For example, the following numbers of HDDs can be controlled as indicated:

- Up to 98 HDDs by using one feature 5803 drawer in mode 1 and three EXP24S drawers in mode 1
- Up to 96 HDDs by using four EXP24S drawers in mode 1
- Up to 48 HDDs by using two or four EXP24S drawers in mode 2
- Up to 85 HDDs by using one feature 5803 drawer in mode 2 (half the bays) and three EXP24S drawers in mode 1

- Up to 72 HDDs by using two EXP24S drawers in mode 2 and two EXP24S drawers in mode 1

All the SFF (2.5-inch) SAS HDDs that are supported in the feature 5803 drawer and in the EXP24S (#5887) drawer are supported by the 12 GB write cache adapter (#EJ0L). The EXP12S (#5886) drawer and its 3.5-inch HDDs are not supported.

SSD configuration options and maximums are different from HDD usage. A 12 GB write cache adapter pair can support a maximum of 48 SSDs. All these SSDs must be attached to the bottom one or two sets of ports (T0 or T1). SSDs and HDDs can be mixed on the same adapter pair; however, SSDs and HDDs cannot be attached to the same set of adapter ports. For example, having SSDs on the T0 ports and HDDs on the T1 and T2 ports is supported, but having SSDs and HDDs on the same T1 port is not. If SSDs are placed in a feature 5803 drawer, the drawer must be in mode 2.

The maximum combined number of SAS drives on an adapter pair is 98 by using 48 SSDs and 50 HDDs (50 = 26 in a #5803 and 24 in an EXP24S). Or the maximum would be 96 using four EXP24S drawers in mode 1 with 48 SSDs in two of the drawers and 48 HDDs in the other two drawers. Pairs of 12 GB write cache adapters support 387 GB and 775 GB SFF (2.5-inch) SSDs. The older 177 GB SFF SSDs are not supported on 12 GB write cache adapter pairs.

A maximum of sixteen 12 GB write cache adapters (eight pairs or 16 halves of pairs or some combination) can be placed in a feature 5803 or feature 5873 12X PCIe I/O drawer. Of these 16 adapters, a maximum of eight adapters can be on each half of the feature 5803 or 5873 drawer. The presence of other high bandwidth adapters affects this maximum. For example, all feature EJ0L, ESA3, and 5913 SAS adapters should be combined into one total per drawer and the maximum of 16 applied.

**Notes:**

- The aggregate bandwidth of the feature 5803 and 5873 drawers and their PCIe Gen1 slots will not be adequate for maximum 12 GB write cache adapter PCIe3 bandwidth, especially configurations with many 12 GB write cache adapters. However, this "over-configuring" may be desirable for configurations with large amounts of redundancy required.
- Typical HDD usage often does not push bandwidth limits.
- IOPS measurements are often not reduced by 12X PCIe I/O drawer (#5803 and #5873) bandwidth.

Specific SAS cables are required to attach to the mini-SAS HD narrow connectors of the 12 GB write cache adapters. These cables are very similar to the mini-SAS HD cables introduced with the PCIe2 feature 5913, ESA1, and ESA2 SAS adapters but are slightly narrower. Narrower cable connectors are required for the PCIe3 SAS adapters because their four ports are located very closely together. The earlier mini-SAS HD non-narrow cables are not supported on the PCIe3 SAS adapters. The new narrow cables are supported on the PCIe2 SAS adapters.

To attach to the SAS drives in a 12X PCIe I/O drawer (#5803), 0.6-meter HD SAS AT cables are used (#ECBB).

**Notes:**

- If only one adapter of an adapter pair is located in the same 12X PCIe I/O drawer (#5803) as the SAS bays it is controlling, then the relatively short AT cable length means the other adapter in the pair has to be located in a nearby feature 5803 or 5873 12X PCIe I/O drawer.
- The IBM Configurator tools assume for simplicity that if controlling SAS bays in the drawer, both adapters of an adapter pair are located in that same feature 5803 12X PCIe I/O drawer.

To attach to an EXP24S I/O Drawer (#5887), HD SAS YO or X cables are used. Four lengths of YO cables with mini-SAS HD narrow connectors are available: 1.5 meter (#ECBT), 3 meter (#ECBU), 6 meter (#ECBV), and 10 meter (#ECBW). Three

lengths of X cables with mini-SAS HD narrow connectors are available: 3 meter (#ECBJ), 6 meter (#ECBK), and 10 meter (#ECBL). All of these cables support 6 Gb throughput.

The 12 GB write cache adapter supports a full set of protection options for its SAS drives. For AIX, Linux™, and VIOS, this includes RAID 0, 5, 6, and 10, as well as operating system mirroring. For IBM i, this includes RAID 5 and 6 or operating system mirroring. Hot spare is also supported for AIX, IBM i, Linux, and VIOS. RAID sets with up to a maximum of 32 devices can be configured, depending on the environment.

For additional performance, pairs of 12 GB write cache adapters support Active/Active protocols. This means that as long as there are at least two arrays configured per pair of adapters, additional I/O performance is gained by using the bandwidth of both adapters in the pair.

The 12 GB write cache adapter is supported by:

- AIX 6.1, or later
- IBM i 6.1, or later
- Red Hat Enterprise Linux 6.4, or later
- SUSE Linux Enterprise Server 11 Service Pack 3, or later
- VIOS

Refer to the feature EJ0L adapter description in the Sales Manual for the appropriate machine type-model for additional information such as Technology Level and Service Pack levels.

The SAS drives attached to a pair of 12 GB write cache adapters must use 528-byte sector formatting. The 512-byte sector (JBOD) formatted drives are not supported except when initially formatting to 528 bytes under AIX or Linux. Thus, any AIX, Linux, and VIOS drives that are not already formatted to 528-byte sectors need to be reformatted to 528 bytes before being added to a 12 GB write cache adapter RAID array.

Additional protection capabilities called *T10 Data Integrity Function* (DIF) are designed into Power Systems PCIe3 or PCIe2 SAS adapters. As a result, the formatting of HDD/SSD arrays on PCIe3/PCIe2 SAS adapters differs slightly compared to the formatting on the older PCIe Gen1 SAS adapters such as the feature 5904, 5906, 5908, 5805, or 5903 adapters.

Like the PCIe2 SAS adapters (#5913 or #ESA3) and unlike PCIe1 SAS adapters with write caches, batteries are not used in the PCIe3 SAS adapters to protect cache contents in case of a power failure. Built-in flash memory protection with capacitors is used instead. This avoids the need to change batteries as they age.

The 528-byte formatted SAS drives or arrays can usually be easily moved off of older PCIe1 SAS adapters to the PCIe3 or PCIe2 SAS adapter and will automatically be converted by the PCIe2 or PCIe3 SAS adapter. The word "usually" is used because AIX, Linux, and VIOS drives that were placed in an array that did not use the default 256,000 stripe size or that were individually included into an existing array will require reformatting before being moved to the PCIe3 or PCIe2 adapter.

**Note:** Moving drives off the PCIe3 or PCIe2 adapter and onto older PCIe1 or PCI-X SAS adapters requires the HDDs or SSDs to be reformatted before being placed on the older adapters.

One no-charge specify code is used with each EXP24S (#5887) to communicate to IBM configurator tools and to IBM Manufacturing which mode setting, adapter, and SAS cable are needed. With this specify code, no hardware is shipped. The physical adapters, controllers, and cables must be ordered with their own chargeable feature numbers. There are more technically supported configurations than represented by these specify codes. IBM Manufacturing and IBM configurator tools such as eConfig only understand and support EXP24S configurations represented by these specify codes.

EXP24S I/O Drawer (#5887) specify codes used with the 12 GB write cache adapter (#EJ0L) include:

- #EJRP Mode 1 and two #EJ0L and two YO cables for AIX/IBM i/Linux/VIOS
- #EJRS Mode 2 and four #EJ0L and two X cables (assumes the adapter pair running all SAS bays) for AIX/Linux/VIOS
- #EJRT Mode 2 and two #EJ0L and one X cable (the adapter pair only running half the SAS bays for future growth) for AIX/Linux/VIOS

There are also two specify features to assist IBM Manufacturing in determining how to cable a feature 5803 12X PCIe I/O drawer in mode 2 without customer-specified placement information. Specify code EJRW indicates an 12 GB write cache adapter pair connection to the left side of the 12X PCIe drawer. Specify code EJRX indicates the right half.

### **Zero write cache PCIe3 SAS adapter**

The PCIe3 RAID SAS Adapter Quad-port 6 Gb x8 (#EJ0J) is a very cost-effective solution for higher-performance I/O configurations of SFF (2.5 inch) SAS SSDs or HDDs with small or modest write workloads. The 12 GB write cache adapter (#EJ0L) is a single-wide, full-height, short Gen3 PCIe adapter with four 6 Gb connectors.

The PCIe3 RAID SAS Adapter Quad-port 6 Gb x8 adapter is the next generation of zero write cache SAS adapters, following the feature ESA1 PCIe Gen2 (PCIe2) RAID SAS Adapter. It offers more performance and a higher maximum of attached SAS drives. The new adapter can offer over twice as many IOPS as the previous adapter and supports twice as many SSDs. The new adapter also supports HDDs and SSDs while the previous adapter supports only SSDs.

The new adapter has no write cache. For workloads that have limited writes, it is more cost effective than a pair of 12 GB write cache adapters (#EJ0L). The zero write cache adapter is less expensive than an adapter with write cache. In addition, you can use a single zero write cache adapter instead of the required pair for adapters with cache. This can save a PCIe slot. A pair of zero write cache adapters offers redundancy and can boost performance using Active/Active, but is optional.

The zero write cache adapter is a PCIe Gen3 6 Gb adapter with four ports and can also be compared to the PCIe Gen1 3 Gb adapter (#5901) with two ports. Both adapters have zero write cache. Where throughput is an important factor, the zero write cache adapter is a clear winner with 6 Gb ports versus the 3 Gb ports of the feature 5901 adapter. In addition, zero write cache adapter has twice as many ports.

As of January 2014, the zero write cache adapter is supported only in the Power 795 server and can be placed in a 12X PCIe I/O drawer (#5803 or #5873). It can control SAS drives located in a 12X PCIe I/O drawer (#5803) or in an EXP24S I/O drawer (#5887). When a pair of zero write cache adapters controls SAS drives in a feature 5803 12X PCIe I/O drawer, at least one of the adapters must be located in that I/O drawer. When a single (non-paired) zero write cache adapter controls SAS drives in a feature 5803 12X PCIe I/O drawer, it must be located in that I/O drawer.

Each adapter in a zero write cache adapter pair maintains cross-awareness of the other adapter through the SAS cabling to the I/O drawers. SAS AA cables are not used.

Up to four EXP24S I/O drawers in mode 1 or mode 2 can be controlled by a zero write cache adapter or adapter pair. If there are four EXP24S in mode 2, then only half of their bays can be controlled. A maximum of one EXP24S drawer in mode 4 can be controlled. A maximum of one feature 5803 12X PCIe I/O drawer in mode 2 or mode 4 can be controlled by a zero write cache adapter or pair of adapters. A feature 5803 12X PCIe I/O drawer in mode 1 is not supported. EXP24S drawers and feature 5803 drawers cannot be controlled by the same zero write cache adapters or pair of adapters.

If configured as an adapter pair, the eight ports of the adapter pair are treated as four pairs of ports. The bottom port (labeled T0) of each adapter of an adapter

pair is connected to the same I/O drawer or to the same half of an I/O drawer -- a specific range of SAS bays. Likewise, the next-to-bottom port (labeled T1) of each adapter pair is connected to one specific range of SAS bays. Similarly, the two ports labeled T2 of each adapter attach to the same I/O drawer and the top ports labeled T3 are each attached to a specific range of SAS bays.

If an I/O drawer is in mode 2, then half of its SAS bays can be controlled by one zero write cache adapter or pair of adapters and the other half can be controlled by different SAS adapters. Note that for configurator simplicity, IBM configurator tools such as eConfig assume the SAS bays of an individual I/O drawer are controlled by one type of SAS adapter. As a client, you have more flexibility than eConfig understands. For example, technically, an EXP24S drawer in mode 2 could have a zero write cache adapter controlling half its SAS bays and a 12 GB write cache adapter pair controlling the other half.

If an I/O drawer is in mode 4 and controlled by a zero write cache adapter or pair of adapters, IBM does not support any mixing of other adapters or adapter types on the drawer. This is both a technical statement and a configurator statement.

The maximum number of HDDs that can be controlled by one adapter or adapter pair depends on the number and type of I/O drawer and the drawer's mode setting. For example, the following numbers of HDDs can be controlled as indicated:

- Up to 26 HDDs by using one feature 5803 drawer in mode 2 or mode 4
- Up to 96 HDDs by using four EXP24S drawers in mode 1
- Up to 48 HDDs by using two or four EXP24S drawers in mode 2
- Up to 24 HDDs by using one EXP24S drawer in mode 4
- Up to 70 HDDs by using two EXP24S drawers in mode 1 and one EXP24S drawer in mode 2

All the SFF (2.5-inch) SAS HDDs that are supported in the feature 5803 12X PCIe I/O drawer and in the feature 5887 EXP24S I/O drawer are supported by the zero write cache adapter. The feature 5886 EXP12S drawer and its 3.5-inch HDDs are not supported.

SSD configuration options and maximums are different from HDD usage. A zero write cache adapter or adapter pair can support a maximum of 48 SSDs. All these SSDs must be attached to the bottom one or two sets of ports (T0 or T1). SSDs and HDDs can be mixed on the same adapter or adapter pair; however, SSDs and HDDs cannot be attached to the same adapter port. For example, SSDs on the T0 ports and HDDs on the T1 and T2 ports is supported, but having SSDs and HDDs on the same T1 port is not. If SSDs are placed in a feature 5803 12X PCIe I/O drawer, the drawer must be in mode 2.

The maximum combined number of SAS drives on an adapter pair is 96 by using 48 SSDs and 48 HDDs in an EXP24S drawer in mode 1.

The zero write cache adapter supports 387 GB and 775 GB SFF (2.5-inch) SSDs. The older 177 GB SFF SSDs are not supported on the adapter.

A maximum of 20 zero write cache adapters can be placed in a feature 5803 or 5873 12X PCIe I/O drawer.

**Notes:**

- The aggregate bandwidth of the feature 5803 and 5873 12X PCIe I/O drawer and their PCIe Gen1 slots will not be adequate for maximum zero write cache adapter PCIe3 bandwidth, especially configurations with many zero write cache adapters. However, this "over-configuring" may be desirable for configurations with large amounts of redundancy required.
- Typical HDD usage often does not push bandwidth limits.
- IOPS measurements are often not reduced by feature 5803 and 5873 bandwidth.

Specific SAS cables are required to attach to the mini-SAS HD narrow connectors of the zero write cache adapters. These cables are very similar to the mini-SAS HD cables introduced with the PCIe2 feature 5913, ESA1, and ESA2 SAS adapters but are slightly narrower. Narrower cable connectors are required for the PCIe3 SAS adapters because their four ports are located very closely together. The earlier mini-SAS HD non-narrow cables are not supported on the PCIe3 SAS adapters. The new narrow cables are supported on the PCIe2 SAS adapters.

To attach to the SAS drives in a feature 5803 12X PCIe I/O drawer, 0.6-meter HD SAS AT cables are used (#ECBB).

**Notes:**

- If only one of an adapter pair is located in the same feature 5803 12X PCIe I/O drawer as the SAS bays it is controlling, then the relatively short AT cable length means the other half on an adapter pair has to be located in a nearby feature 5803 or 5873 12X PCIe I/O drawer.
- The IBM Configurator tools assume for configurator simplicity that if controlling SAS bays in the drawer, both adapters of an adapter pair are located in that same 12X PCIe I/O drawer.

To attach to a EXP24S I/O Drawer, HD SAS YO or X cables are used. Four lengths of YO cables with mini-SAS HD narrow connectors are available: 1.5 meter (#ECBT), 3 meter (#ECBU), 6 meter (#ECBV), and 10 meter (#ECBW). Three lengths of X cables with mini-SAS HD narrow connectors are available: 3 meter (#ECBJ), 6 meter (#ECBK), and 10 meter (#ECBL). All of these support 6 Gb throughput.

The zero write cache adapter supports a full set of protection options for its SAS drives. For AIX, Linux, and VIOS, this includes RAID 0, 5, 6, and 10, as well as operating system mirroring. For IBM i, this includes RAID 5 and 6 or operating system mirroring. Hot spare is also supported for AIX, IBM i, Linux, and VIOS. RAID sets with up to a maximum of 32 devices can be configured, depending on the environment.

For additional performance, pairs of zero write cache adapters support Active/Active protocols. This means that as long as there are at least two arrays configured per pair of adapters, additional I/O performance is gained by using the bandwidth of both adapters in the pair.

The zero write cache adapter is supported by:

- AIX 6.1, or later
- IBM i 6.1, or later
- Red Hat Enterprise Linux 6.4, or later
- SUSE Linux Enterprise Server 11 Service Pack 3, or later
- VIOS

Refer to the feature E0J adapter description in the Sales Manual for the appropriate machine type-model for additional information such as Technology Level and Service Pack levels.

The SAS drives attached to a zero write cache adapter must use 528-byte sector formatting. The 512-byte sector (JBOD) formatted drives are not supported except when initially formatting to 528 bytes under AIX or Linux. Thus, any AIX, Linux, and VIOS drives that are not already formatted to 528-byte sectors will need to be reformatted to 528 bytes before being added to a zero write cache adapter RAID array.

Additional protection capabilities called *T10 Data Integrity Function (DIF)* are designed into Power Systems PCIe3 or PCIe2 SAS adapters. As a result, the formatting of HDD or SSD arrays on PCIe3 or PCIe2 SAS adapters differs slightly compared to the formatting on the older PCIe Gen1 SAS adapters such as the feature 5904, 5906, 5908, 5805, or 5903 adapters.



The 528-byte formatted SAS drives or arrays can usually be easily moved off of older PCIe1 SAS adapters to the PCIe3 or PCIe2 SAS adapter and will automatically be converted by the PCIe2 or PCIe3 SAS adapter. The word "usually" is used because AIX, Linux, and VIOS drives that were placed in an array that did not use the default 256,000 stripe size or that were individually included into an existing array will require reformatting before being moved to the PCIe3 or PCIe2 adapter.

**Note:** Moving drives off the PCIe3 or PCIe2 adapter and onto older PCIe1 or PCI-X SAS adapters requires the HDDs or SSDs to be reformatted before being placed on the older adapters.

One no-charge specify code is used with each EXP24S I/O Drawer (#5887) to communicate to IBM configurator tools and to IBM Manufacturing which mode setting, adapter, and SAS cable are needed. With this specify code, no hardware is shipped. The physical adapters, controllers, and cables must be ordered with their own chargeable feature numbers. There are more technically supported configurations than represented by these specify codes. IBM Manufacturing and IBM configurator tools such as eConfig only understand and support EXP24S configurations represented by these specify codes.

EXP24S I/O Drawer (#5887) specify codes used with the zero write cache adapter (#EJ0J) include:

- #EJR1 Mode 1 and one #EJ0J and one YO cable for AIX/IBM i/Linux/VIOS
- #EJR2 Mode 1 and two #EJ0J (paired) and two YO cables for AIX/IBM i/Linux/VIOS
- #EJR3 Mode 2 and two #EJ0J (paired) and two X cables for AIX/Linux/VIOS
- #EJR4 Mode 2 and four #EJ0J (two pair) and two X cables for AIX/Linux/VIOS
- #EJR5 Mode 4 and four #EJ0J (non paired) and two X cables for AIX/Linux/VIOS
- #EJR6 Mode 2 and one #EJ0J and two YO cables for AIX/Linux/VIOS
- #EJR7 Mode 2 and two #EJ0J (non paired) and two YO cables for AIX/Linux/VIOS

All of the above EXP24S specify codes assume the adapter or adapter pair is controlling all of the SAS bays in the drawer. But to communicate a need for a partial configuration where the adapter or adapter pair is running a portion of the SAS bays, leaving the option for future growth, the following specify codes are used:

- #EJRA Mode 2 and one #EJ0J (paired) and one YO cable (half of #EJR3)
- #EJRB Mode 2 and two #EJ0J (paired) and one X cable (half of #EJR4)
- #EJRC Mode 4 and one #EJ0J and one X cable (1/4 of #EJR5)
- #EJRD Mode 4 and two #EJ0J and one X cable (1/2 of #EJR5)
- #EJRE Mode 4 and three #EJ0J and two X cable (3/4 of #EJR5)

There are also two specify features to assist IBM Manufacturing in determining how to cable a feature 5803 12X PCIe I/O drawer in mode 2 without customer-specified placement information. Specify code EJRY indicates a zero write cache adapter pair connection to the left side of the 12X PCIe drawer. Specify code EJRZ indicates the right half.

### **SAS LTO™ enhancement: PCIe3 6Gb Adapter**

The PCIe3 SAS Tape Adapter Quad-port 6Gb (#EJ0X) supports the attachment of SAS LTO-5 and LTO-6 tape drives. The 6Gb ports offer twice the bandwidth of the existing PCIe1 SAS adapter's (#5901) 3 Gb ports. This allows the PCIe3 SAS adapter to better match the performance bandwidth capabilities of the newer LTO SAS drives. Plus, the new PCIe3 adapter has four ports, whereas the previous PCIe1 adapter has two ports, giving a fourfold bandwidth advantage to the PCIe3 adapter.

The new PCIe3 adapter also has a fourfold attachability advantage: it can use either YE1 SAS cables or AE1 SAS cables. One SAS drive can be attached using a AE1 cable. One or two SAS tape drives can be attached using a YE1 cable. Thus, using

four YE1 SAS cables, the new PCIe3 adapter supports up to eight LTO-5/6 SAS tape drives, whereas the previous PCIe1 adapter supports up to two tape drives.

Feature EJ0X requires Mini-SAS HD Narrow cables. The AE1 cable (#ECBY) is a 4-meter cable. The YE1 cable (#ECBZ) is a 3-meter cable. Physically identical AE1 and YE1 SAS cables can also be ordered with the IBM SAS LTO tape drive enclosures using feature number 5507 (AE1) or feature number 5509 (YE1). Note that these identical AE1 or YE1 SAS cables can alternatively be ordered with the LTO drive in a 7226-1U3 Multi-Media Enclosure and if ordered there will use feature code #9850, #5507 (AE1) or #5509 (YE1).

The PCIe3 12 GB Cache RAID SAS Adapter (#EJ0L) is supported in the Power 795 server and can be placed in the PCIe Gen1 slots of a 12X PCIe I/O drawer (#5803 or #5873). It can control IBM SAS LTO-5/6 tape drives located in IBM enclosures such as the 3580-H5S (TS2250), 3580-H6S (TS2260), 3580-S63 (TS2260/TS2360), and 7226-1U3 (Removable Media Drawer).

The PCIe3 SAS Tape Adapter Quad-port 6Gb (#EJ0X) is supported by:

- IBM AIX 6.1, or later
- IBM i 6.1, or later
- Red Hat Enterprise Linux 6.4, or later
- SUSE Linux Enterprise Server 11 Service Pack 3, or later

Refer to the feature EJ0X adapter description in the Sales Manual for the appropriate machine type-model for additional information such as Technology Level and Service Pack levels.

Physically and electronically, this adapter is identical to the zero write cache adapter (#EJ0J), which was discussed earlier in this announcement letter. It uses the same 57B4 CCIN. It has a different feature number so that IBM configuration tools understand the intended usage. Attaching both HDDs or SSDs and tape to this adapter is not supported. Clients may re-purpose their zero write cache adapter to attach tape or re-purpose their PCIe3 SAS Tape Adapter Quad-port 6Gb to attach SSDs or HDDs; however, IBM configuration tools are not aware of this flexibility.

As a tape controller, the PCIe3 SAS Tape Adapter Quad-port 6Gb is always configured as a single card and never used as a pair of cards.

Only LTO-5 and LTO-6 tape drives are supported on the PCIe3 SAS Tape Adapter Quad-port 6Gb. Earlier generations of SAS LTO tape drives and other SAS or SATA tape drives or optical drives are not supported.

### **Expanded support of PCIe Gen2 SAS adapter**

Support for the refreshed PCIe Gen2 SAS adapter (#ESA3) is expanded to include more models. The feature ESA3 adapter is now supported on the:

- Power 720, 740, 770, 780 "C" models (8202-E4C, 8205-E6C, 9117-MMC, 9179-MHC)
- Power 750/760 "D" models (8408-E8D, 9109-RMD)
- Power 730 "C and D" model (8231-E2C, 8231-E2D) in a 12X-attached PCIe I/O drawer
- PowerLinux 7R2 (8246-L2S, 8246-L2T) in a 12X-attached PCIe I/O drawer
- PowerLinux 7R4 (8248-L4T)
- Power ESE (8412-EAD)

The PCIe2 1.8 GB Cache RAID SAS Adapter (#ESA3) was originally announced October 7, 2013, for just four Power Systems models. Refer to Hardware Announcement [113-171](#), dated October 07, 2013, for configuration usage details.

The feature ESA3 adapter has a lower cost and is more energy efficient than the feature 5913 SAS adapter, yet it has the same performance and function.

## Binary asynchronous adapters (#EN13/#EN14)

Although the use of binary synchronous, a synchronous communications protocol, has greatly decreased, some IBM i clients still have applications that need to be migrated to newer servers without replacing the existing binary synchronous communications infrastructure. The feature EN13 and EN14 adapters can accommodate these needs on POWER7 and POWER7+™ technology-based servers. The PCIe binary synchronous adapters provide binary synchronous functionality identical to the PCIe 2-Line WAN with Modem features 2893 and 2894, which will be withdrawn from marketing in the future.

The new adapters are full-high PCIe adapters with one RVX communication port that can be used for binary synchronous communication using an external, client-provided modem. Feature EN14 is used in Australia and New Zealand and complies to CIM standards. Feature EN13 is used in other countries.

The PCIe 2-Line WAN with Modem features (#2893/#2894) being withdrawn also support non-binary synchronous (async) communications for IBM i. The full-high and low-profile PCIe 2-port Async Adapter, features 5289 and 5290 respectively, can provide a lower-cost solution to IBM i clients. IBM i 7.1 TR 5 supports async and fax capability. IBM i 7.1 TR7 adds supports for async PPP capability.

**Note:** Feature number EN13 is not available in Australia and New Zealand. Feature number EN14 is only available in Australia and New Zealand.

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## Product number

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The following are newly announced features on the specific models of the IBM Power Systems 7316, 8202, 8205, 8231, 8233, 8246, 8248, 8408, 8412, 9109, 9117, 9119, and 9179 machine types:

### ***New features available January 31, 2014***

Description	Machine type	Model	Feature number
Purescale Application Indicator	7316	TF3	0714
10 meter Quad Data Rate InfiniBand Optical Cable, QSFP/QSFP	9119	FHB	3290
30 meter Quad Data Rate InfiniBand Optical Cable, QSFP/QSFP	9119	FHB	3293
Specify Mode-2 & (2)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR3
Non-paired Indicator ESA3 PCIe SAS RAID Adapter	8231	E2C	EJS1
	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
	8202	E4C	
	8205	E6C	
	9117	MMC	
	9179	MHC	
Specify Mode-2 & (2)ESA3 for EXP24S (#5887/#EL1S)	8231	E2C	EJS2
	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
	8202	E4C	
	8205	E6C	
	9117	MMC	
	9179	MHC	
Specify Mode-1 & (2)ESA3 for EXP24S (#5887/#EL1S)	8231	E2C	EJS3

	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
	8202	E4C	
	8205	E6C	
	9117	MMC	
	9179	MHC	
Specify Mode-2 & (4)ESA3 for EXP24S (#5887/#EL1S)	8231	E2C	EJS4
	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
	8202	E4C	
	8205	E6C	
	9117	MMC	
	9179	MHC	
Specify Left Half 12X I/O Drawer to PCIe2 1.8GB RAID SAS Adapter	8202	E4C	EJS5
	8205	E6C	
	9117	MMC	
	9179	MHC	
	8231	E2C	
	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
Specify Right Half 12X I/O Drawer to PCIe2 1.8GB RAID SAS Adapter	8202	E4C	EJS6
	8205	E6C	
	9117	MMC	
	9179	MHC	
	8231	E2C	
	8231	E2D	
	8246	L2S	
	8246	L2T	
	8248	L4T	
	8408	E8D	
	8412	EAD	
	9109	RMD	
PCIe 1-port Bisync Adapter	8202	E4B	EN13
	8202	E4C	
	8202	E4D	
	8205	E6B	
	8205	E6C	
	8205	E6D	
	8231	E2C	
	8231	E2D	
	8233	E8B	
	8408	E8D	
	9109	RMD	
	9117	MMB	
	9117	MMC	
	9117	MMD	
	9119	FHB	
	9179	MHB	
	9179	MHC	
	9179	MHD	
PCIe2 1.8GB Cache RAID SAS Adapter Tri-port 6Gb CR	8202	E4C	ESA3
	8205	E6C	
	9117	MMC	
	9179	MHC	
	8231	E2C	

8231	E2D
8246	L2S
8246	L2T
8248	L4T
8408	E8D
8412	EAD
9109	RMD

**Note:** Feature number EN13 is not available in Australia and New Zealand. Feature number EN14 is only available in Australia and New Zealand.

The following are newly announced features on the specific models of the IBM Power Systems 7316, 8202, 8205, 8231, 8233, 8246, 8248, 8408, 8412, 9109, 9117, 9119, and 9179 machine types:

***New features available February 28, 2014***

Description	Machine type	Model	Feature number
SAS AT Cable 0.6m - HD Narrow 6Gb Adapter to 12X Enclosure (AT)	9119	FHB	ECBB
SAS X Cable 3m - HD Narrow 6Gb 2-Adapters to Enclosure	9119	FHB	ECBJ
SAS X Cable 6m - HD Narrow 6Gb 2-Adapters to Enclosure	9119	FHB	ECBK
SAS X Cable 10m - HD Narrow 6Gb 2-Adapters to Enclosure	9119	FHB	ECBL
SAS YO Cable 1.5m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBT
SAS YO Cable 3m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBU
SAS YO Cable 6m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBV
SAS YO Cable 10m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBW
SAS AE1 Cable 4m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBY
SAS YE1 Cable 3m - HD Narrow 6Gb Adapter to Enclosure	9119	FHB	ECBZ
SAS AA Cable 0.6m - HD Narrow 6Gb Adapter to Adapter	9119	FHB	ECC0
SAS AA Cable 1.5m - HD Narrow 6Gb Adapter to Adapter	9119	FHB	ECC2
SAS AA Cable 3m - HD Narrow 6Gb Adapter to Adapter	9119	FHB	ECC3
SAS AA Cable 6m - HD Narrow 6Gb Adapter to Adapter	9119	FHB	ECC4
PCIe3 RAID SAS Adapter Quad-port 6Gb x8	9119	FHB	EJ0J
PCIe3 12GB Cache RAID SAS Adapter Quad-port 6Gb x8	9119	FHB	EJ0L
PCIe3 SAS Tape Adapter Quad-port 6Gb x8	9119	FHB	EJ0X
Specify Mode-1 & (1)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR1
Specify Mode-1 & (2)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR2
Specify Mode-2 & (4)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR4
Specify Mode-4 & (4)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR5
Specify Mode-2 & (1)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR6
Specify Mode-2 & (2)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJR7
Specify Mode-2 & (1)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJRA
Specify Mode-2 & (2)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJRB
Specify Mode-4 & (1)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJRC
Specify Mode-4 & (2)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJRD
Specify Mode-4 & (3)EJ0J for EXP24S (#5887/EL1S)	9119	FHB	EJRE
Specify Mode-1 & (2)EJ0L for EXP24S (#5887/EL1S)	9119	FHB	EJRP
Specify Mode-2 & (2)EJ0L for EXP24S (#5887/EL1S)	9119	FHB	EJRS
Specify Mode-2 & (2)EJ0L for EXP24S (#5887/EL1S)	9119	FHB	EJRT
Non-paired Indicator EJ0L PCIe SAS RAID Adapter	9119	FHB	EJRU
Specify Left Half 12X I/O Drawer to PCIe3 12GB RAID SAS Adapter	9119	FHB	EJRW
Specify Right Half 12X I/O Drawer to PCIe3 12GB RAID SAS Adapter	9119	FHB	EJRX
Specify Left Half 12X I/O Drawer to PCIe3 RAID			

SAS Adapter	9119	FHB	EJRY
Specify Right Half 12X I/O Drawer to PCIe3 RAID			
SAS Adapter	9119	FHB	EJRZ

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## Business Partner information

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If you are a Direct Reseller - System Reseller acquiring products from IBM, you may link directly to Business Partner information for this announcement. A PartnerWorld® ID and password are required (use IBM ID).

<https://www.ibm.com/partnerworld/mem/sla.jsp?num=114-010>

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## Publications

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No publications are shipped with these features.

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## Services

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### Global Technology Services®

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IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an On Demand Business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or visit

<http://www.ibm.com/services/>

For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or visit

<http://www.ibm.com/services/continuity>

For details on education offerings related to specific products, visit

<http://www.ibm.com/services/learning/index.html>

Select your country, and then select the product as the category.

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## Technical information

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### Specified operating environment

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#### *Physical specifications*

For physical specifications, refer to the Sales Manual.

#### Planning information

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#### *Cable orders*

No cables required.

## Security, auditability, and control

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The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

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## IBM Electronic Services

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Electronic Service Agent™ and the IBM Electronic Support web portal are dedicated to providing fast, exceptional support to IBM Systems customers. The IBM Electronic Service Agent tool is a no-additional-charge tool that proactively monitors and reports hardware events, such as system errors, performance issues, and inventory. The Electronic Service Agent tool can help you stay focused on your company's strategic business initiatives, save time, and spend less effort managing day-to-day IT maintenance issues. Servers enabled with this tool can be monitored remotely around the clock by IBM Support all at no additional cost to you.

Now integrated into the base operating system of AIX 5.3, AIX 6.1, and AIX 7.1, Electronic Service Agent is designed to automatically and electronically report system failures and utilization issues to IBM, which can result in faster problem resolution and increased availability. System configuration and inventory information collected by the Electronic Service Agent tool also can be viewed on the secure Electronic Support web portal, and used to improve problem determination and resolution by you and the IBM support team. To access the tool main menu, simply type "smitty esa\_main", and select "Configure Electronic Service Agent." In addition, ESA now includes a powerful Web user interface, giving the administrator easy access to status, tool settings, problem information, and filters. For more information and documentation on how to configure and use Electronic Service Agent, refer to

<http://www.ibm.com/support/electronic>

The IBM Electronic Support portal is a single Internet entry point that replaces the multiple entry points traditionally used to access IBM Internet services and support. This portal enables you to gain easier access to IBM resources for assistance in resolving technical problems. The My Systems and Premium Search functions make it even easier for Electronic Service Agent tool-enabled customers to track system inventory and find pertinent fixes.

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## Benefits

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**Increased uptime:** The Electronic Service Agent tool is designed to enhance the Warranty or Maintenance Agreement by providing faster hardware error reporting and uploading system information to IBM Support. This can translate to less wasted time monitoring the "symptoms," diagnosing the error, and manually calling IBM Support to open a problem record. Its 24x7 monitoring and reporting mean no more dependence on human intervention or off-hours customer personnel when errors are encountered in the middle of the night.

**Security:** The Electronic Service Agent tool is designed to be secure in monitoring, reporting, and storing the data at IBM. The Electronic Service Agent tool securely transmits either via the Internet (HTTPS or VPN) or modem, and can be configured to communicate securely through gateways to provide customers a single point of exit from their site. Communication is one way. Activating Electronic Service Agent does not enable IBM to call into a customer's system. System inventory information is stored in a secure database, which is protected behind IBM firewalls. It is viewable only by the customer and IBM. The customer's business applications or business data is never transmitted to IBM.

**More accurate reporting:** Since system information and error logs are automatically uploaded to the IBM Support center in conjunction with the service request, customers are not required to find and send system information, decreasing

the risk of misreported or misdiagnosed errors. Once inside IBM, problem error data is run through a data knowledge management system and knowledge articles are appended to the problem record.

**Customized support:** Using the IBM ID entered during activation, customers can view system and support information in the "My Systems" and "Premium Search" sections of the Electronic Support website at

<http://www.ibm.com/support/electronic>

My Systems provides valuable reports of installed hardware and software using information collected from the systems by Electronic Service Agent. Reports are available for any system associated with the customer's IBM ID. Premium Search combines the function of search and the value of Electronic Service Agent information, providing advanced search of the technical support knowledgebase. Using Premium Search and the Electronic Service Agent information that has been collected from your system, customers are able to see search results that apply specifically to their systems.

For more information on how to utilize the power of IBM Electronic Services, contact your IBM Systems Services Representative, or visit

<http://www.ibm.com/support/electronic>

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## Terms and conditions

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### **Terms and conditions features section**

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#### ***MES discount applicable***

Yes. Equal to the volume commitment discount

#### ***Field-installable feature***

Yes

#### ***Warranty period***

These features assume the same warranty or maintenance terms as the machine in which they are installed for the full warranty or maintenance period announced for such machine.

#### ***Customer setup***

Yes.

#### ***Machine code***

Same license terms and conditions as base machine



## Prices

For additional information and current prices, contact your local IBM representative.

The following are newly announced features on the specific models of the IBM Power Systems 7316, 8202, 8205, 8231, 8233, 8246, 8248, 8408, 8412, 9109, 9117, 9119, and 9179 machine types:

Description	Model number	Feature number	Purchase price	Minimum Monthly Maint. Charge	Initial/MES/Both/Support	RP CSU	MES
Purescale Application Ind	TF3	0714			Initial	N/A	No

Description	Model number	Feature number	Purchase price	Minimum Monthly Maint. Charge	Initial/MES/Both/Support	RP CSU	MES
PCIe 1-port Bisync Adapter	E4B	EN13			MES	Yes	No
	E4C				MES	Yes	No
	E4D				Both	Yes	No

Description	Model number	Feature number	Purchase price	Minimum Monthly Maint. Charge	Initial/MES/Both/Support	RP CSU	MES
PCIe 1-port Bisync Adapter	E6B	EN13			MES	Yes	No
	E6C				MES	Yes	No
	E6D				Both	Yes	No

Description	Model number	Feature number	Purchase price	Minimum Monthly Maint. Charge	Initial/MES/Both/Support	RP CSU	MES
Non-paired Indicator	ESA3	PCIe					
	E2C	EJS1			MES	Yes	No
	E2D				Both	Yes	No
Specify Mode2 & (2)ESA3-EXP24S	E2C	EJS2			MES	Yes	No
	E2D				Both	Yes	No
Specify Mode1 & (2)ESA3-EXP24S	E2C	EJS3			MES	Yes	No
	E2D				Both	Yes	No
Specify Mode2 & (4)ESA3-EXP24S	E2C	EJS4			MES	Yes	No
	E2D				Both	Yes	No
Specify Left Half 12X I/O Draw	E2C	EJS5			MES	Yes	No
	E2D				Both	Yes	No
Specify Right Half 12X I/O Drw	E2C	EJS6			Both	Yes	No
	E2D				Both	Yes	No
PCIe 1-port Bisync Adapter	E2C	EN13			MES	Yes	No
	E2D				Both	Yes	No
PCIe2 1.8GB Cache RAID SAS Ada	E2C	ESA3			MES	Yes	No
	E2D				Both	Yes	No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Maint.	Both/	MES
				Charge	Support	
PCIe 1-port Bisync Adapter	E8B	EN13			MES	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Maint.	Both/	MES
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	L2S	EJS1			MES	Yes No
	L2T				Both	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	L2S	EJS2			MES	Yes No
	L2T				Both	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	L2S	EJS3			MES	Yes No
	L2T				Both	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	L2S	EJS4			MES	Yes No
	L2T				Both	Yes No
Specify Left Half 12X	I/O Draw					
	L2S	EJS5			MES	Yes No
	L2T				Both	Yes No
Specify Right Half 12X	I/O Drw					
	L2S	EJS6			MES	Yes No
	L2T				Both	Yes No
PCIe2 1.8GB Cache RAID	SAS Ada					
	L2S	ESA3			MES	Yes No
	L2T				Both	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Maint.	Both/	MES
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	L4T	EJS1			Both	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	L4T	EJS2			Both	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	L4T	EJS3			Both	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	L4T	EJS4			Both	Yes No
Specify Left Half 12X	I/O Draw					
	L4T	EJS5			Both	Yes No
Specify Right Half 12X	I/O Drw					
	L4T	EJS6			Both	Yes No
PCIe2 1.8GB Cache RAID	SAS Ada					
	L4T	ESA3			Both	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Maint.	Both/	MES
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	E8D	EJS1			Both	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	E8D	EJS2			Both	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	E8D	EJS3			Both	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	E8D	EJS4			Both	Yes No
Specify Left Half 12X	I/O Draw					
	E8D	EJS5			Both	Yes No

Specify Right Half 12X I/O Drw	E8D	EJS6		Both	Yes	No
PCIe 1-port Bisync Adapter	E8D	EN13		Both	Yes	No
PCIe2 1.8GB Cache RAID SAS Ada	E8D	ESA3		Both	Yes	No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Charge	Both/	MES
					Support	
Non-paired Indicator	ESA3	PCIe				
	EAD	EJS1			Both	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	EAD	EJS2			Both	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	EAD	EJS3			Both	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	EAD	EJS4			Both	Yes No
Specify Left Half 12X I/O Draw	EAD	EJS5			Both	Yes No
Specify Right Half 12X I/O Drw	EAD	EJS6			Both	Yes No
PCIe2 1.8GB Cache RAID SAS Ada	EAD	ESA3			Both	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Charge	Both/	MES
					Support	
Non-paired Indicator	ESA3	PCIe				
	RMD	EJS1			Both	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	RMD	EJS2			Both	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	RMD	EJS3			Both	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	RMD	EJS4			Both	Yes No
Specify Left Half 12X I/O Draw	RMD	EJS5			Both	Yes No
Specify Right Half 12X I/O Drw	RMD	EJS6			Both	Yes No
PCIe 1-port Bisync Adapter	RMD	EN13			Both	Yes No
PCIe2 1.8GB Cache RAID SAS Ada	RMD	ESA3			Both	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Charge	Both/	MES
					Support	
PCIe 1-port Bisync Adapter	MMB	EN13			MES	Yes No
	MMC				Both	Yes No
	MMD				Both	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU
				Charge	Both/	MES
					Support	
10m QDR IB Optic Cable	FHB	3290			Both	Yes No
30m QDR IB Optic Cable	FHB	3293			Both	Yes No
SAS AT Cable 0.6m - HD Narrow	FHB	ECBB			Both	Yes No
SAS X Cable 3m - HD Narrow						

SAS X Cable 6m - HD Narrow	FHB	ECBJ	Both	Yes	No
SAS X Cable 10m - HD Narrow	FHB	ECBK	Both	Yes	No
SAS YO Cable 1.5m - HD Narrow	FHB	ECBL	Both	Yes	No
SAS YO Cable 3m - HD Narrow	FHB	ECBT	Both	Yes	No
SAS YO Cable 6m - HD Narrow	FHB	ECBU	Both	Yes	No
SAS YO Cable 10m - HD Narrow	FHB	ECBV	Both	Yes	No
SAS AE1 Cable 4m - HD Narrow	FHB	ECBW	Both	Yes	No
SAS YE1 Cable 3m - HD Narrow	FHB	ECBY	Both	Yes	No
SAS AA Cable 0.6m - HD Narrow	FHB	ECBZ	Both	No	No
SAS AA Cable 1.5m - HD Narrow	FHB	ECC0	Both	Yes	No
SAS AA Cable 3m - HD Narrow	FHB	ECC2	Both	Yes	No
SAS AA Cable 6m - HD Narrow	FHB	ECC3	Both	Yes	No
PCIe3 RAID SAS Adapter 4-port	FHB	ECC4	Both	Yes	No
PCIe3 12GB Cache RAID SAS Adap	FHB	EJ0J	Both	No	No
PCIe3 SAS Tape Adapter 4-port	FHB	EJ0L	Both	No	No
Specify Mode1 & (1)EJ0J-EXP24S	FHB	EJ0X	Both	No	No
Specify Mode1 & (2)EJ0J-EXP24S	FHB	EJR1	Both	No	No
Specify Mode1 & (2)EJ0J-EXP24S	FHB	EJR2	Both	No	No
Specify Mode2 & (4)EJ0J-EXP24S	FHB	EJR3	Both	Yes	No
Specify Mode4 & (4)EJ0J-EXP24S	FHB	EJR4	Both	No	No
Specify Mode2 & (1)EJ0J-EXP24S	FHB	EJR5	Both	No	No
Specify Mode2 & (2)EJ0J-EXP24S	FHB	EJR6	Both	No	No
Specify Mode2 & (1)EJ0J-EXP24S	FHB	EJR7	Both	No	No
Specify Mode2 & (2)EJ0J-EXP24S	FHB	EJRA	Both	No	No
Specify-Mode4 & (1)EJ0J-EXP24S	FHB	EJRB	Both	No	No
Specify-Mode4 & (2)EJ0J-EXP24S	FHB	EJRC	Both	No	No
Specify-Mode4 & (3)EJ0J-EXP24S	FHB	EJRD	Both	Yes	No
Specify Mode1 & (2)EJ0L-EXP24S	FHB	EJRE	Both	No	No
Specify Mode2 & (2)EJ0L-EXP24S	FHB	EJRP	Both	No	No
Specify Mode2 & (2)EJ0L-EXP24S	FHB	EJRS	Both	No	No
Non-paired Indicator EJ0L PCIe	FHB	EJRT	Both	No	No
Specify Left Half 12X I/O Drwr	FHB	EJRU	Both	Yes	No
Specify Right Half 12X I/O Drw	FHB	EJRW	Both	Yes	No
Specify Left Half 12X I/O Drwr	FHB	EJRX	Both	Yes	No
Specify Right Half 12X I/O Drw	FHB	EJRY	Both	Yes	No
PCIe 1-port Bisync Adapter	FHB	EJRZ	Both	Yes	No
	FHB	EN13	Both	Yes	No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU MES
				Maint.	Both/	
				Charge	Support	
PCIe 1-port Bisync Adapter						
	MHB	EN13			MES	Yes No
	MHC				Both	Yes No
	MHD				Both	Yes No

The following are features already announced for the IBM Power Systems 8202, 8205, 9117, 9179 machine type:

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU MES
				Maint.	Both/	
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	E4C	EJS1			MES	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	E4C	EJS2			MES	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	E4C	EJS3			MES	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	E4C	EJS4			MES	Yes No
Specify Left Half 12X	I/O Draw					
	E4C	EJS5			MES	Yes No
Specify Right Half 12X	I/O Drw					
	E4C	EJS6			MES	Yes No
PCIe2 1.8GB Cache RAID	SAS Ada					
	E4C	ESA3			MES	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU MES
				Maint.	Both/	
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	E6C	EJS1			MES	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	E6C	EJS2			MES	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	E6C	EJS3			MES	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	E6C	EJS4			MES	Yes No
Specify Left Half 12X	I/O Draw					
	E6C	EJS5			MES	Yes No
Specify Right Half 12X	I/O Drw					
	E6C	EJS6			MES	Yes No
PCIe2 1.8GB Cache RAID	SAS Ada					
	E6C	ESA3			MES	Yes No

Description	Model	Feature	Purchase	Minimum	Initial/	RP
Machine type	number	number	price	Monthly	MES/	CSU MES
				Maint.	Both/	
				Charge	Support	
Non-paired Indicator	ESA3	PCIe				
	MMC	EJS1			MES	Yes No
Specify Mode2 & (2)	ESA3-EXP24S					
	MMC	EJS2			MES	Yes No
Specify Mode1 & (2)	ESA3-EXP24S					
	MMC	EJS3			MES	Yes No
Specify Mode2 & (4)	ESA3-EXP24S					
	MMC	EJS4			MES	Yes No
Specify Left Half 12X	I/O Draw					
	MMC	EJS5			MES	Yes No
Specify Right Half 12X	I/O Drw					

Description	Machine type	Model number	Feature number	Purchase price	Minimum Monthly Maint. Charge	Initial/MES/Both/Support	RP CSU MES
		MMC	EJS6			MES	Yes No
	PCIe2 1.8GB Cache RAID	SAS	Ada			MES	Yes No
		MMC	ESA3			MES	Yes No
Non-paired Indicator		ESA3	PCIe				
Specify Mode2 & (2)		MHC	EJS1			Both	Yes No
		ESA3-EXP24S					
Specify Mode1 & (2)		MHC	EJS2			Both	Yes No
		ESA3-EXP24S					
Specify Mode2 & (4)		MHC	EJS3			Both	Yes No
		ESA3-EXP24S					
Specify Left Half 12X		MHC	EJS4			Both	Yes No
	I/O Draw						
Specify Right Half 12X		MHC	EJS5			Both	Yes No
	I/O Drw						
PCIe2 1.8GB Cache RAID		MHC	EJS6			Both	Yes No
	SAS	Ada					
		MMC	ESA3			Both	Yes No

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