# IBM Power Systems servers: New I/O features available

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IBM® introduces several I/O enhancements:

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- Refreshed RDX removable media docking stations and DVD drives
- New 900 GB/856 GB 10k RPM hard disk drives (HDD)
- Improved IBM PowerLinux™ big data price/performance options
- Additional RDMA over Converged Ethernet (RoCE) adapter options

## Overview

IBM Power Systems™ introduces a number of I/O-related enhancements, offering improved functionality, performance, price/performance, and density across the Power product line.

The enhanced EXP30 Ultra SSD I/O Drawer (#EDR1) provides the IBM Power 770+ and IBM Power 780+ up to 30 solid-state drives (SSD) in just 1U of rack space without any PCIe slots. The drawer provides up to 480,000 IOPS and up to 11.6 TB of capacity for AIX® or Linux™ clients. Plus up to 48 additional HDDs can be directly attached to the Ultra Drawer (still without using any PCIe slots), providing up to 43.2 TB additional capacity in only 4U additional rack space for AIX clients. This ultra-dense SSD option is very similar to the Ultra Drawer (#5888), which remains available to the Power 710, 720, 730, and 740.

Two new GX++ adapters provide PCIe Gen2 functionality and performance in extremely dense and efficient packaging for the Power 795. The new GX++ adapters eliminate the need for a GX++ 12X adapter, 12X cables, a 12X-attached PCIe I/O drawer, and a PCIe adapter. In some cases, they may even alleviate the need for an expansion rack. Plus they also offer slightly lower latency compared to similar PCIe adapters as they are attached directly to the GX++ port. The two adapters are a 2-port 16Gb Fibre Channel adapter (#EN23) and a 2-port 10Gb Fibre Channel over Ethernet (FCoE) or Converged Network Adapter (#EN22).

IBM i 7.1 adds support for RDX Removable Media Devices. RDX docking stations and drives can provide a more reliable, higher performance, and lower cost option to traditional entry tape options such as DAT160 and older QIC and LTO-2 tape drives. IBM i 7.1 supports USB RDX Removable Disk on newer servers and supports the new

SATA RDX Removable Disk (#EU07) on many earlier servers. In addition, IBM i 7.1 adds support for the USB-attached DAT160 tape drive.

IBM i 7.1 also adds support for a significantly lower priced 2-port asynchronous communications adapter (#5289 and #5290). Compared to the existing IBM i supported 2-port adapter (#2893 and #2894), the new adapter is half the price (less a modem) and is available as either a low-profile (#5289) or full-high (#5290) adapter, improving configuration flexibility.

RDX docking stations are refreshed with slightly newer technology (#EU03, #EU04, and #EU23) replacing the existing docking stations (#1103, #1104, and #1123) in most proposals. Similarly, the slimline DVD drive that is placed in Power 710 through Power 780 system units is refreshed and is now ordered as feature 5771 instead of the current feature 5762.

The 900 GB/856 GB 10k RPM SAS HDD (#1737, #1738, #1751, and #1752) offers lower cost per gigabyte and better storage density compared to smaller HDDs. Four feature numbers are used to identify if the drive is SFF-1 or SFF-2 and if shipped formatted with 528-byte sectors for RAID arrays (ordered for IBM i environments) or JBOD formatted with 512-byte sectors (ordered for AIX/Linux/VIOS environments).

PowerLinux™ servers improve their big data capabilities with new SSD features offering more attractive pricing (#ELQK (177 GB) and #ELQL (387 GB)) for the highest performance needs. Plus for lower performance but better cost per gigabyte, support is provided for the new 900 GB 10k RPM HDD.

The PCIe Gen2 RoCE Adapter capabilities are enhanced with expanded configuration options and expanded support. A new RoCE adapter (#EC29/#EC30) provides an SR fiber optical cabling option in addition to the existing adapter with copper cabling (#EC27/#EC28). RoCE support is expanded to include the Power 795.

## Key prerequisites

For the required operating system level support, refer to the specific I/O feature description section in the individual server sales manuals.

## Planned availability date

October 19, 2012, for features 0712, 0729, 0879, 0880, 1121, 1737, 1738, 1751, 1752, 1887, 1958, 5771, EC29, EC30, EDT1, EDT2, EDT3, EL1R, EL35, ELQK, ELQL; ELQR, EQ37, EQ38, EQ51, EQ52, EU03, EU04, EU07, EU23, and EU27.

November 6, 2012, for feature EUC7.

November 16, 2012, for features 4651, 4652, 4653, 4654, 4655, 4656, 4657, 4658, 4659, 4660, 4661, 4662, 4663, 4664, 4665, 4666, EB2T, ECB9, EN22, and EN23.

## Description

### EXP30 Ultra SSD I/O Drawer (#EDR1)

A summary feature EDR1 description and the specific feature numbers and ordering structures are listed in the Power 770 and Power 780 announcement letters of October 3, 2012. A detailed description follows in this announcement letter.

Solid-state drive (SSD) or flash technology can provide a much larger number of input/output operations per second (IOPS) compared to spinning disk drive (HDD) technology, and can therefore slash I/O-bound batch window times, improve interactive or query response time, and even make previously performance-impractical applications work well. Depending on the workload, it can range from

66X to 250X more IOPs with an SSD versus a HDD. (Pre-2012 SSD comparisons ranged from 33X to 125X.)

Additionally, a small set of SSDs can offer energy, cooling, and footprint savings by replacing a much larger set of HDDs. By combining SSDs and HDDs in the same partition or application, you can leverage the performance capability of SSD technology on the hot data or files and leverage the HDD technology's lower cost per gigabyte on the cold data or files. Hot SSD plus cold HDD usage can often provide the best overall system price/performance.

The EXP30 Ultra SSD I/O Drawer provides ultra-dense packaging and ultra-high performance for up to 30 SSDs without requiring a PCI slot. The Ultra Drawer requires only 1U (1 EIA) of standard 19-inch rack space, while providing up to 11.6 TB of capacity using 387 GB SSDs. This ultra-dense packaging is more than twice the density of the feature 5887 EXP24S Drawer, which offers 24 drives in 2U of space plus needs space for prerequisite feature 5887 SAS controllers/adapters.

Also, up to 48 additional HDDs located in up to two downstream EXP24S Disk Drawers (#5887) can be directly attached to the Ultra Drawer. This provides up to 43.2 TB additional capacity using 900 GB HDD in only 4U additional rack space (2U per EXP24S drawer). Thus in just 5U space (one EXP30 Ultra Drawer and two EXP24S drawers), up to 54.8 TB capacity can be provided.

The EXP30 Ultra SSD I/O Drawer (#EDR1) has incredible specifications. It provides up to 480,000 IOPS (read only) or up to 410,000 IOPS (60% read/40% write) or up to 325,000 IOPS (100% write). It provides up to 4.5 GBps bandwidth from the SSD. All of this is possible in just 1U of space -- ultra performance in an ultra-dense package. Compared to an SFF 15k rpm HDD, which will typically provide 200 to maybe 400 IOPS and need space in a 2U form factor, the EXP30 Ultra SSD I/O Drawer is far advanced. The EXP30 Ultra Drawer announced earlier in 2012 for the Power 710, 720, 730, and 740 and still offered for the Power 710, 720, 730, and 740 has specifications of 400,000 and 340,000 and 270,000 respectively.

The EXP30 Ultra SSD I/O Drawer is attached directly to the Power 770 (9117-MMD) and Power 780 (9179-MHD) GX++ slot for higher bandwidth.

Integrated into each EXP30 Ultra SSD I/O Drawer are two powerful IBM-designed SAS controllers with very large 3.1 GB write cache. These Ultra controllers work as a pair, providing redundancy and protection of the write cache contents. The controllers leverage the latest and most powerful IBM SAS adapter technology and employ high-performance hardware and firmware technology. Use of IBM's active/active SAS technology allows each controller to be the optimized controller for one or more RAID arrays and provides higher aggregate performance.

The 387 GB SSD (#ES02) used in the EXP30 Ultra SSD I/O Drawer has the latest eMLC technology. It provides twice the capacity and performance of the 2011 SSD technology and up to twice the previous SSD performance levels. These SSDs are packaged as 1.8-inch SAS drives, which can be added to or removed concurrently while the drawer is in use. The drives are formatted to 528 byte sectors, which allows SCSI T10 standardized data integrity fields to exist on every block of data. JBOD mode (512 byte sectors) is not supported.

The SSDs can be protected using RAID 0, RAID 5, RAID 6, or RAID 10 by operating system mirroring (LVM). RAID 1 functionally is provided by creating RAID 10 with two drives. Hot spare is also supported with RAID 5 or RAID 6. RAID 5 arrays of up to 30 drives can be configured, but to utilize the higher performance of active/active functionality, an even number of RAID arrays is recommended.

When configuring an EXP30 Ultra SSD I/O Drawer, a minimum of six SSDs is required per drawer. The SSD can be used like any SAS drive, including boot drives.

*eMLC technology* stands for "Enterprise Multi-Level Cell" flash memory technology. IBM was the first server vendor to provide this SSD technology option, which blends enterprise-class performance and reliability characteristics with the more cost-effective characteristics of MLC flash storage. The new feature ES02 387 GB SSD builds upon this base. It uses advances in both the SSD device controller flash

memory management and in eMLC technology itself to provide an even better value proposition. Like IBM's earlier eMLC SSD, the drives are designed to provide greater sustained performance levels and extended endurance or reliability. For example, the new IBM eMLC SSD modules were designed to provide 24 x 7 x 365 usage even when running write-intensive levels for at least five years. Typical client usage is expected to be much lower, especially regarding the average percentage of writes, and thus drive life span can be much longer.

The EXP30 Ultra SSD I/O Drawer (#EDR1) requires the latest firmware level, 7.6, planned for fourth quarter 2012.

The following environments support the EXP30 Ultra SSD Drawer:

- AIX Version 7.1 with the 7100-02 Technology Level, or later
- AIX Version 7.1 with the 7100-01 Technology Level and Service Pack 6, or later (planned availability December 19, 2012)
- AIX Version 7.1 with the 7100-00 Technology Level and Service Pack 8, or later (planned availability December 19, 2012)
- AIX Version 6.1 with the 6100-08 Technology Level, or later
- AIX Version 6.1 with the 6100-07 Technology Level and Service Pack 6, or later (planned availability December 19, 2012)
- AIX Version 6.1 with the 6100-06 Technology Level and Service Pack 10, or later (planned availability December 19, 2012)
- Red Hat Enterprise Linux 6.3 for POWER® , or later
- Red Hat Enterprise Linux 5.7 for POWER , or later
- SUSE Linux Enterprise Server 11 Service Pack 2, or later, with current maintenance updates available from SUSE to enable all planned functionality
- VIOS V2.2.2.0
- VIOS V2.2.1.5 (planned availability December 19, 2012)

IBM i support is not offered at this time even through VIOS. However, note the statement of direction regarding native IBM i support for feature EDR1.

You can find the required driver update for Linux at

http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html

Each of the two integrated SAS controllers in the EXP30 Ultra SSD I/O Drawer requires a connection to a GX++ PCIe2 x8 Adapter located in the Power server GX ++ slot. The Power 770 (9117-MMD) and Power 780 (9179-MHD) use a dual-port GX++ PCIe2 Adapter (#1914), and thus one GX++ PCIe2 Adapter can support one EXP30 Ultra SSD I/O Drawer. If a GX++ PCIe2 Adapter is used in the GX++ slot, the GX++ slot cannot be used for an I/O loop.

The connection between the GX++ PCIe adapter in the server's GX++ slot and the EXP30 Ultra SSD I/O Drawer's integrated SAS controller is through a PCIe cable, 1.5 meter (#EN05), 3 meter (#EN07), or 8 meter (#EN08). Two cables are required, one for each integrated SAS controller.

For redundancy, one Ultra Drawer can attach to two different GX++ PCIe Adapters, using just one port on each GX++ PCIe Adapter.

For high-availability configurations, an Ultra Drawer can be attached to two different GX++ PCIe Adapters located on two different servers. For example, one Ultra Drawer can be attached to one port of a feature 1914 GX++ Adapter on a Power 770 and to one port of a feature 1914 GX++ Adapter on a Power 780. Typically, this would be done under control of AIX PowerHA® software in the same way a SAS adapter pair such as a pair of feature 5913 or a pair of feature 5805 can be attached. In this scenario, if one server fails, the other server can access all the SAS drives controlled by the Ultra Drawer's integrated SAS controllers. To assist IBM configurator tools in recognizing this scenario, two specify feature numbers are used

for each EXP30 Ultra SSD I/O Drawer shared across two servers, feature 5925 and feature 5927.

The SAS SSD bays are always physically one set of drives, even though there may be multiple RAID arrays in this one set. With two or more RAID arrays, each RAID array can be optimized to either of the integrated SAS controllers to take advantage of active/active performance improvements through the read/write bandwidth of both adapters.

In all the above scenarios, the two integrated Ultra SAS controllers work as a pair to provide protection of the write cache contents. If there is a failure to one of the controllers or a failure to that controller's PCI cable or its GX++ PCIe2 Adapter, the write cache contents are written out to the SAS SSD drives and caching is disabled. The remaining SAS adapter is designed to continue working without using the write cache. This helps ensure that write cache contents do not become a possible single point of failure and data loss. Full access to all the devices and RAID protection is maintained through the remaining integrated Ultra SAS controller. When the pairing is re-established, write cache usage resumes. Note that the SAS controller's performance for many workloads can be noticeably reduced if the write cache is not being used. To help alert the operations staff of the problem, multiple error messages are posted, advising of the missing pairing for write cache.

The write cache contents are also protected against power failures. Super capacitors in the integrated SAS controllers provide power to write out cache content to integrated nonvolatile flash memory in the integrated SAS controllers if power is lost. Batteries are not used and thus there is no battery maintenance required.

Four SAS ports on the rear of the EXP30 Ultra Drawer (#EDR1) allow up to two EXP24S Disk Drawers (#5887) to be attached, supporting up to 48 SAS bays. Two ports are labeled T1 and two are labeled T2. Two EX SAS cables (#5926 (1.5 m), #3675 (3 m), or #3680 (6 m)) attach the Ultra Drawer (#EDR1) and each EXP24S Disk Drawer (#5887). These two cables provide two connections to each EXP24S Drawer for redundancy and performance. One EXP24S Drawer (#5887) is attached to the T1 ports. A second EXP24S is attached to the T2 ports. The integrated SAS controllers drive both the SSD in the Ultra Drawer and the HHD in the EXP24S (#5887). SSDs are not supported in the EXP24S in this configuration. The EXP24S must be in mode 1. One EXP24S cannot be attached to two different Ultra Drawers.

No-charge specify feature 9388 has been created to communicate to IBM Manufacturing that a feature 5887 EXP24S will be attached to the SSD Ultra Drawer.

The EXP30 Ultra Drawer (#5888) remains the EXP30 option for the Power 710/730 (8231-E1C/E2C) or Power 720 (8202-E4C) or Power 740 (8205-E6C), which do not support firmware level 7.6. As of fourth quarter 2012, the EXP30 Ultra Drawer (#EDR1) is not supported on the PCIe Gen2 capable Power 770 (9117-MMC) or Power 780 (9179-MHC). EXP30 Ultra Drawer attachment to other Power models is not announced.

The EXP30 Ultra Drawer has extensive redundancy and concurrent maintenance capability. It provides redundant fans, redundant power supplies, and redundant integrated SAS controllers. Concurrent maintenance is supported for fans, power supplies, SAS controllers, and SSD SAS bays. PCI cables between the system unit and Ultra Drawer can also be disconnected and reconnected, but will require the associated GX slot and the imbedded SAS controller to be reset as part of the reconnect procedure. The 770/780 GX++ PCI adapters initially do not have concurrent maintenance support, but this CHARM support is planned for first half 2013. There are redundant SAS paths all the way from the GX++ adapter to the SAS.

EXP24S Disk Drawers (#5887) can be attached, detached, or replaced concurrently downstream of the EXP30 Ultra Drawer but both imbedded SAS controllers must be taken offline. Thus unless redundant EXP30 Ultra Drawers have been implemented or unless the temporary loss of EXP30 access is insignificant to the configuration, scheduled downtime should be expected.

**Power 795 PCIe Gen2 GX++ Adapters**

Two specialized GX++ PCIe Adapters provide PCIe Gen2 performance and capability in an extremely small physical footprint for the Power 795. Like the 795 GX adapter for 12X loops (#1816), these PCIe Gen2 adapters plug into the Power 795 processor book. But instead of connecting through 12X cables to a 4U 12X I/O drawer (#5803/5873) that has PCIe Gen1 adapter slots holding PCI adapters, these adapters directly provide two I/O ports. Two adapters are announced, an FCoE (CNA) adapter and a Fibre Channel (FC) adapter.

The adapter's two ports can leverage the full 20 GBps bandwidth of the GX++ slot. Also, because the adapters are attached directly to the GX++ slot/bus, they have slightly lower latency than a PCI adapter located in an I/O drawer.

Each 795 processor book has four GX++ slots. A maximum of three GX++ PCIe Adapters can be plugged into one 795 processor book. Thus a maximum of 24 GX++ PCIe Adapters can be plugged into an 8 processor book 795. Any of an individual processor book's four GX++ slots can be used for GX++ PCIe Adapters. Use of a GX++ PCIe Adapter does not impact the ability to use a 12X GX++ Adapter (#1816) in other GX++ slots.

A key advantage of the GX++ PCIe Adapters is their small footprint and cost effectiveness compared to using a 12X GX adapter plus GX cables plus a 12X I/O drawer plus a PCIe adapter. It may even avoid the need for an expansion rack if there is no more room in the existing rack for an additional 12X PCIe I/O Drawer (#5803/5873). This can be quite significant as it may provide savings in price, floor space, 3-phase wiring, maintenance, and cooling. However, a PCIe I/O Drawer (#5803/#5873) provides 20 PCIe Gen1 slots, which can support a lot of Ethernet, Fibre Channel, and FCoE ports. The GX++ PCIe Adapter provides just two ports in order to stay within a small physical space.

**GX++ 2-port 10Gb FCoE CNA SR Optical Adapter (#EN22)**

The GX++ 2-port 10Gb FCoE CNA SR Optical Adapter (#EN22) provides two 10Gb ports running Fibre Channel over Ethernet (FCoE), also known as CNA (Converged Network Adapters). Both Ethernet NIC (Network Interface Card) and Fibre Channel traffic are supported. Refer to the Power 795 (9119-FHB) sales manual under feature number EN22 for additional information such as operating system level support, cabling, and CCIN. AIX supports the adapter directly while IBM i and Linux leverage VIOS V2.2.1.5, or later, for support. IBM i supports using the Ethernet NIC data stream. N_Port ID Virtualization (NPIV) capability is supported through VIOS. Attachment is supported to FCoE switches (full function) or to Ethernet switches (NIC only function). Direct attachment to a device without a switch has not been tested and is not supported.

**GX++ 2-port 16Gb Fibre Channel Adapter (#EN23)**

The GX++ 2-port 16Gb Fibre Channel Adapter provides two Fibre Channel 16 Gb ports. Each port can automatically negotiate to run at 16 GB, 8 Gb, or 4 Gb. Refer to the Power 795 (9119-FHB) sales manual under feature number EN23 for additional information such as operating system level support, cabling, and CCIN. AIX supports the adapter directly while Linux leverages VIOS V2.2.1.5, or later, for support. IBM i support is not announced. N_Port ID Virtualization (NPIV) capability is supported through VIOS. Attachment is supported to FC switches. Direct attachment to a device without a switch is not supported.

**Refreshed RDX Docking Stations**

New USB-3 attached docking stations (#EU23, #EU03, and #EU04) replace the existing USB-2 attached docking stations (#1123, #1103, and #1103) in most proposals. The newer docking stations use USB-3 interfaces, which allow additional capabilities to be implemented, but have very minimal performance difference between the USB-2 and USB-3 sets of docking stations.

The feature EU23 exactly matches the product structure and configuration rules of feature 1123. The feature EU23 can be placed in the half-high bay of a Power

710/730 (8231-E2B/E1C/E2C). It is also supported on the PowerLinux 8246-L1C/L2C/L1S/L2S.

Feature EU03 exactly matches the product structure and configuration rules of feature 1103. The feature EU03 can be placed in the half-high bay of a Power 720 (8202-E4B/E4C), 740 (8205-E6B/E6C), or 750 (8233-E8B) or 755 (8236-E8C).

Feature EU04 exactly matches the product structure and configuration rules of the feature 1104, which is attached externally through a USB cable to the server. Feature EU04 can be attached to the Power 710 through 780 (8231-E2B/E1C/E2C, 8202-E4B/E4C, 8205-E6B/E6C, 8233-E8B, 8236-E8C, 9117-MMB/MMC/MMD, and 9179-MHB/MHC/MHD). A USB cable and power supply/cord is included with the feature.

RDX technology is an excellent entry save/restore media option offering many advantages over tape drives such as the DAT 80/160, or QIC, or VXA or even LTO-2. Advantages include:

- Equivalent throughput to DAT160 or VXA.
- Much faster access, save 30 seconds or more on start/finish of each job.
- Direct access to files saves a lot of time when accessing a single file on a multiple file cartridge.
- Capacity: Up to 1 TB uncompressed capacity per cartridge.
- Media durability: Drives/cartridges can last for many years, up to 50 times more loads/unloads.
- Cleaner: No cleaning operations or cleaning drives. Save time, money and avoid save/restore problems.
- Environmentally tough: Ability to work well even in "office-dirty" environments such as a typical back office or store room.
- Rugged: Tougher than most tape cartridges, designed to withstand drops from table top heights.
- Inexpensive docking stations.
- Natural fit for applications such as data logging.
- Can move to larger capacity RDX drives from smaller capacity RDX drives without changing docking stations.
- Combining the ability for quickly accessing different files on the cartridge and a large 1 TB capacity, can more easily use one cartridge to do daily backups without operator involvement.

**IBM i RDX support added**

In addition to refreshing the USB-attached RDX docking stations, two other Power Systems RDX enhancements are announced. IBM i support of RDX drives and a new SATA RDX Docking Station (#EU07) for IBM i on selected POWER6® and POWER7® servers.

The USB-3 attached feature EU04 is supported with IBM i 7.1 with TR5. The feature 1104 USB-2 RDX docking station is not supported by IBM i. Attachment to the Power 710 through 780 (8231-E2B/E1C/E2C, 8202-E4B/E4C, 8205-E6B/E6C, 8233-E8B, 9117-MMB/MMC/MMD, and 9179-MHB/MHC/MHD) is supported.

The RDX SATA Internal Docking station (#EU07) is supported with IBM i 6.1 with machine code 6.1.1, or later, in the high-high bay of the system unit of the Power 520 (8203-E4A, 9407-M15, 9408-M25), Power 550 (8204-E8A, 9409-M50), Power 720 (8202-E4B), Power 740 (8205-E6B), and Power 750 (8233-E8B). It is run by the integrated SAS controller, which also handles the SAS disk/SSD bays in the system unit. IBM i 7.1 support is planned for October 2012 and IBM i 6.1 support is planned for November 2012.

The feature EU07 SATA RDX support on selected POWER6 servers and POWER7 servers combined with USB RDX support the newest POWER7+ servers and provide a wide base of systems with potential RDX support for IBM i clients. As of October

2012, the externally attached 7226-1U3 IBM Storage Enclosure only offers the USB-2 RDX drives, which IBM i does not support.

**IBM i USB DAT160 support added**

Support of the 80 GB/160 GB DAT160 USB Tape Drive (#EU16) is expanded. IBM i already supports SAS/SATA attached DATA160 tape drives and AIX/Linux already supports the USB-attached feature EU16. This enhancement provides IBM i 7.1 clients additional configuration flexibility and potentially additional performance.

Using the USB attached DAT160 (#EU16) instead of the SAS/SATA attached DAT160 (#5619) can separate running the tape drive from running disk or SSD. The feature 5619 is run by the same integrated SAS controller that runs the disk/SSD in the Power 720/740/750 system unit. The USB controller is separate, and the USB DAT160 helps avoid possible tape/disk bandwidth contention.

Feature EU16 is offered on the Power 720 (8202-E4B/E4C), Power 740 (8205-E6B/E6C), and Power 750 (8233-E8B). IBM i support is only through the integrated USB system ports. IBM i does not support the use of the USB PCIe adapter (#2728). USB DAT160 tape drives located in the 7226-1U3 IBM Storage Enclosure are also supported. TR5 for IBM i 7.1 is required.

**IBM i support of PCIe 2-Port Async EIA-323 Adapter**

The existing 2-port asynchronous communications adapter (#5289 and #5290), which is already used in AIX and Linux partitions, is provided additional operating system support for IBM i 7.1 with TR5. Support is announced for POWER7 servers. POWER6 servers were not tested and are not supported.

The PCIe 2-Port Async EIA-323 Adapter (#5289/#5290) can lower the cost of an async connection for IBM i partition. The feature 5289 or 5290 (CCIN 57D4) 2-port adapter is half the price of the currently available IBM i 2-port communications adapter (#2893/#2894 and CCIN 576C). Plus feature 5289 is a low-profile adapter, which provides IBM i clients additional configuration flexibility. The existing features 2893 and 2894, like the feature 5290, are available only for full-high PCIe slots.

The more expensive IBM i 2-port communications adapter (#2893/#2894) remains available and provides function not available with the PCIe 2-Port Async EIA-323 Adapter (#5289/#5290). These additional functions include PPP or Bisync protocols and an integrated modem on one of the two ports on the adapter.

Typical async (non PPP) usages for which this adapter is probably a good solution include connecting with async terminals, workstations, printers, manufacturing devices, time clocks, and pagers.

Examples of typical PPP applications that are not supported as of 2012 for IBM i include IBM Electronic Customer Support (ECS), IBM Electronic Service Agent™ (ESA), and IBM iGSC Remote support tool.

The popular IBM Facsimile Support for i (5798-FAX), which is sometimes called Fax/400 is supported using the lower-cost feature 5289 or 5290 async adapter. Proper modem selection for this application with the feature 5289 or 5290 adapter is important. The Multi-Tech Systems MultiModem ZBA V.92 Data/Fax World Modem (MT9234ZBA-IEC) has been tested and found to work using Multi-Tech 923ZBA firmware later than the 1.02j level. Note that the modem default profile setting DSR (Data Set Ready) 'HIGH' must be changed to follow 'CD' (Carrier Detect).

Note that communication ports are not virtualized by IBM i. IBM i 7.1 does not virtualize the adapter for other IBM i partitions. Nor does VIOS virtualize async ports for other partitions.

**900 GB/856 GB 10k RPM SAS HDD (#1737, #1738, #1751, #1752)**

900 GB/856 GB drives provide 50% more capacity than the currently available 10k RPM 600 GB/571 GB drives. Higher-density HDD lowers the cost per gigabyte and can improve floor space density compared to smaller HDDs.

Four feature numbers are used to identify if the drive is in a Gen1 or Gen2 SFF carrier and if the drive is for AIX/Linux/VIOS or IBM i.

- 856 GB SFF-1 for IBM i (#1737): 528-byte sectors for RAID arrays and a Gen1 SFF carrier used in system units and 12X-attached PCIe I/O drawers (#5802/ #5803)
- 856 GB SFF-2 for IBM i (#1738): 528-byte sectors for RAID arrays and a Gen2 SFF carrier used in the #5887 EXP24S I/O Drawer
- 900 GB SFF-1 for AIX/Linux/VIOS (#1751): 512-byte sectors for JBOD and a Gen1 SFF carrier used in system units and 12X-attached PCIe I/O drawers (#5802/#5803)
- 900 GB SFF-2 for AIX/Linux/VIOS (#1752): 512-byte sectors for JBOD and a Gen2 SFF carrier used in the EXP24S I/O Drawer (#5887)

SAS SFF drives can be reformatted from 528-byte to 512-byte sectors or vice versa at the client location. In order to support detailed eConfig ordering logic and IBM Manufacturing testing, AIX/Linux/VIOS partitions are always shipped with JBOD formatted HDD. IBM i only supports RAID formatted HDD. A conversion from SFF-1 to SFF-2 or vice versa is not offered.

These 900 GB/856 GB drives are supported on the Power 710 through Power 795 servers. The SFF-1 drives are supported on the Power 710 (8231-E1C), 720 (8202-E4C), 730 (8231-E2C), 740 (8231-E6C), 750 (8233-E8B), 770 (9117-MMC/MMD), 780 (9179-MHC/MHD), and 795 (9119-FHB). The SFF-2 drives are supported on all POWER7 models of the SSF-1 and also supported on the 710/730 (8231-E2B), 720 (8202-E4B), 740 (8205-E6B), 770 (9117-MMB), and 780 (9179-MHB).

They are supported by AIX 5.3, or later, and IBM i 7.1, or later, and SUSE Linux Enterprise Server 10, or later, or Red Hat Enterprise Linux 5.7, or later. Refer to the sales manual for more specifics.

There are also four quantity 150 features for each of the four features EQ37, EQ38, EQ51, and EQ52. Plus there are PowerLinux specific features EL1R and EL35 for ordering the 900 GB drives.

**RoCE Capable 10Gb SR Ethernet Adapter (#EC29/#EC30)**

The PCIe Gen2 RoCE Adapter (#EC29/#EC30) provides a different cabling option to the existing feature EC27/EC28 RoCE Adapter. Feature EC29/EC30 provides SR (short range) fiber optic cabling, which provides a 300 meter maximum versus the 7 meter maximum of copper twinax (#EC27/#EC28). The adapter provides two 10 Gb Ethernet ports. The feature EC27/EC28 RoCE PCIe adapter and feature EC29/EC30 are identical adapters except they differ in the cabling option.

The PCIe Gen2 adapter supports the IBTA RoCE standard. IBTA stands for InfiniBand Trade Association. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. This protocol is a more efficient mechanism for transferring data for applications that support its usage. Typical usage might be in clusters of servers. The adapter can support significantly greater bandwidth with low latency than typical Ethernet protocols. Instead of the typically more expensive InfiniBand switches, it can leverage the typically lower cost Ethernet infrastructure. RoCE can minimize CPU overhead by more efficiently using memory access than many other protocols. This offloads the CPU from I/O networking tasks, potentially improving server performance, scalability, and licensing costs.

The full-high feature EC30 is supported in PCIe Gen2 slots of the Power 720 (8202-E4C), Power 740 (8205-E6C), Power 770 (9117-MMC/MMD), and Power 780 (9179-MHC/MHD). Feature EC30 is also supported in the feature 5803/5877 12X-attached PCIe I/O drawer of the Power 795 (9119-FHB). The low-profile feature EC29 is supported in PCIe Gen2 slots of the Power 710 (8231-E1C) and Power 730 (8231-E2C) and in the PCIe Gen2 Riser Card (#5685) of the Power 720/740 (model E4C/ E6C).

The Existing full-high copper twinax feature EC28 is enhanced with support on the POWER7+ Model 770/780 and on the Power 795.

## Statement of general direction

IBM plans to provide IBM i native support for the EXP30 Ultra SSD I/O Drawer (#EDR1), requiring IBM i 7, or later.

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

## Reference information

Refer to Hardware Announcement 109-305, dated April 28, 2009

Refer to Hardware Announcement 111-065, dated April 12, 2011

Refer to Hardware Announcement 111-132, dated July 12, 2011

## Product number

The following are newly announced features on the specific models of the IBM Power Systems 1455, 1611, 7042, 8202, 8203, 8204, 8205, 8231, 8233, 8236, 8246, 9117, 9119, 9179, 9407, 9408, and 9409 machine type:

### New features available October 19, 2012

| Description | Machine type | Model | Feature number |
|---|---|---|---|
| Manufacturing Routing Code for CSC | 9117 | MMC | 0712 |
| Specify EXP30 Load Source placement | 9117 | MMC | 0729 |
| | 9179 | MHC | |
| #1737 Load Source Specify (856GB SFF-1 disk) | 8202 | E4C | 0879 |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 9117 | MMC | |
| | 9179 | MHC | |
| #1738 Load Source Specify (856GB SFF-2 disk) | 8202 | E4B | 0880 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2B | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| CAT5E Ethernet Cable, 25M YELLOW | 9117 | MMC | 1121 |
| 856GB 10k RPM SAS SFF Disk Drive (IBM i) | 8202 | E4C | 1737 |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2C | |
| | 8233 | E8B | |

| | | | |
|---|---|---|---|
| | 9117 | MMC | |
| | 9179 | MHC | |
| 856GB 10k RPM SAS SFF-2 Disk Drive (IBM i) | 8202 | E4B | 1738 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2B | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| 900GB 10K RPM SAS SFF Disk Drive (AIX/Linux) | 8202 | E4C | 1751 |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| | 9117 | MMC | |
| | 9179 | MHC | |
| 900GB 10k RPM SAS SFF-2 Disk Drive (AIX/Linux) | 8202 | E4B | 1752 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2B | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| Quantity 150 of #1793 | 8231 | E2C | 1887 |
| Quantity 150 of #1794 | 8231 | E2C | 1958 |
| SATA Slimline DVD-RAM Drive | 8202 | E4C | 5771 |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| | 8246 | L1C | |
| | 8246 | L1S | |
| | 8246 | L2C | |
| | 8246 | L2S | |
| | 9117 | MMC | |
| | 9179 | MHC | |
| PCIe2 LP 2-Port 10GbE RoCE SR Adapter | 8202 | E4C | EC29 |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2C | |
| | 8246 | L1C | |
| | 8246 | L1S | |
| | 8246 | L2C | |
| | 8246 | L2S | |
| PCIe2 2-Port 10GbE RoCE SR Adapter | 8202 | E4C | EC30 |
| | 8205 | E6C | |
| | 9117 | MMC | |
| | 9179 | MHC | |
| 900GB 10k RPM SAS SFF-2 Disk Drive (Linux) | 8246 | L1S | EL1R |
| | 8246 | L2S | |
| 900GB 10K RPM SAS SFF Disk Drive (Linux) | 8246 | L1C | EL35 |
| | 8246 | L1S | |
| | 8246 | L2C | |
| | 8246 | L2S | |
| Quantity 150 of #EL1K | 8246 | L2S | ELQK |
| Quantity 150 of #EL1L | 8246 | L2S | ELQL |
| Quantity 150 of #EL1R | 8246 | L2S | ELQR |
| Quantity 150 of #1737 (856GB SFF-1 disk) | 9117 | MMC | EQ37 |
| | 9179 | MHC | |
| Quantity 150 of #1738 (856GB SFF-2 disk) | 8202 | E4B | EQ38 |
| | 8202 | E4C | |

| | | | |
|---|---|---|---|
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8233 | E8B | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| Quantity 150 of #1751 (900GB SFF-1 disk) | 9117 | MMC | EQ51 |
| | 9179 | MHC | |
| Quantity 150 of #1752 (900GB SFF-2 disk) | 8202 | E4B | EQ52 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| RDX USB Internal Docking Station for Removable Disk Cartridge | 8202 | E4B | EU03 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| RDX USB External Docking Station for Removable Disk Cartridge | 8202 | E4B | EU04 |
| | 8202 | E4C | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8231 | E1C | |
| | 8231 | E2B | |
| | 8231 | E2C | |
| | 8233 | E8B | |
| | 8236 | E8C | |
| | 8246 | L2C | |
| | 8246 | L2S | |
| | 9117 | MMB | |
| | 9117 | MMC | |
| | 9179 | MHB | |
| | 9179 | MHC | |
| RDX SATA Internal Docking Station for Removable Disk Cartridge | 8202 | E4B | EU07 |
| | 8202 | E4C | |
| | 8203 | E4A | |
| | 8204 | E8A | |
| | 8205 | E6B | |
| | 8205 | E6C | |
| | 8233 | E8B | |
| | 9407 | M15 | |
| | 9408 | M25 | |
| | 9409 | M50 | |
| RDX USB Internal Docking Station for Removable Disk Cartridge | 8231 | E1C | EU23 |
| | 8231 | E2B | |
| | 8231 | E2C | |
| | 8246 | L1C | |
| | 8246 | L1S | |
| | 8246 | L2C | |
| | 8246 | L2S | |

The following are newly announced features on the specific models of the IBM Power Systems 1455, 1611, 7042, 8202, 8203, 8204, 8205, 8231, 8233, 8236, 8246, 9117, 9119, 9179, 9407, 9408, and 9409 machine type:

**New features available November 6, 2012**

| Description | Machine type | Model | Feature number |
|---|---|---|---|
| Core Use HW Feature 10X | 8202 | E4C | EUC7 |

| | | |
|---|---|---|
| 8205 | E6C | |
| 9117 | MMC | |

The following are newly announced features on the specific models of the IBM Power Systems 1455, 1611, 7042, 8202, 8203, 8204, 8205, 8231, 8233, 8236, 8246, 9117, 9119, 9179, 9407, 9408, and 9409 machine type:

**New features available November 16, 2012**

| Description | Machine type | Model | Feature number |
|---|---|---|---|
| #1737 Load Source Specify (856GB SFF-1 disk) | 9119 | FHB | 0879 |
| #1738 Load Source Specify (856GB SFF-2 disk) | 9119 | FHB | 0880 |
| 856GB 10k RPM SAS SFF Disk Drive (IBM i) | 9119 | FHB | 1737 |
| 856GB 10k RPM SAS SFF-2 Disk Drive (IBM i) | 9119 | FHB | 1738 |
| 900GB 10K RPM SAS SFF Disk Drive (AIX/Linux) | 9119 | FHB | 1751 |
| 900GB 10k RPM SAS SFF-2 Disk Drive (AIX/Linux) | 9119 | FHB | 1752 |
| One and only one rack indicator feature is required on all orders (#4650 to #4666). | | | |
| Rack Indicator- Not Factory Integrated | 1455 | 24E | 4650 |
| One and only one rack indicator feature is required on all orders (#4650 to #4666). | | | |
| | 1455 | 48E | |
| One and only one rack indicator feature is required on all orders (#4650 to #4666). | | | |
| | 1455 | 64C | |
| One and only one rack indicator feature is required on all orders (#4650 to #4666). | | | |
| | 1611 | 16E | |
| Rack Indicator, Rack #1 | 1455 | 24E | 4651 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #2 | 1455 | 24E | 4652 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #3 | 1455 | 24E | 4653 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #4 | 1455 | 24E | 4654 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #5 | 1455 | 24E | 4655 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #6 | 1455 | 24E | 4656 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #7 | 1455 | 24E | 4657 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #8 | 1455 | 24E | 4658 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #9 | 1455 | 24E | 4659 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #10 | 1455 | 24E | 4660 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #11 | 1455 | 24E | 4661 |
| | 1455 | 48E | |

| | | | |
|---|---|---|---|
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #12 | 1455 | 24E | 4662 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #13 | 1455 | 24E | 4663 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #14 | 1455 | 24E | 4664 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #15 | 1455 | 24E | 4665 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| Rack Indicator, Rack #16 | 1455 | 24E | 4666 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |
| SATA Slimline DVD-RAM Drive | 9119 | FHB | 5771 |
| RAID1 Enabled | 7042 | CR6 | EB2T |
| PCIe2 2-Port 10GbE RoCE SR Adapter | 9119 | FHB | EC30 |
| IBM SFP+ LR Fiber Transceiver | 1455 | 24E | ECB9 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| 1U Air Duct Long | 1455 | 24E | EDT1 |
| 1U AIR DUCT MED | 1455 | 48E | EDT2 |
| 1U AIR DUCT Short | 1455 | 64C | EDT3 |
| | 1611 | 16E | |
| GX++ 2-port 10Gb FCoE CNA SR Optical Adapter | 9119 | FHB | EN22 |
| GX++ 2-port 16Gb Fibre Channel Adapter | 9119 | FHB | EN23 |
| Quantity 150 of #1737 (856GB SFF-1 disk) | 9119 | FHB | EQ37 |
| Quantity 150 of #1738 (856GB SFF-2 disk) | 9119 | FHB | EQ38 |
| Quantity 150 of #1751 (900GB SFF-1 disk) | 9119 | FHB | EQ51 |
| Quantity 150 of #1752 (900GB SFF-2 disk) | 9119 | FHB | EQ52 |
| 1U Duct Rail Kit | 1455 | 24E | EU27 |
| | 1455 | 48E | |
| | 1455 | 64C | |
| | 1611 | 16E | |

## Business Partner information

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=112-180

## Reliability, Availability, and Serviceability (RAS)

The reliability of the IBM Power Systems starts with components, devices, and subsystems that are designed to be fault-tolerant. POWER7 uses lower-voltage technology in the processor SCMs that improves reliability stacked latches to reduce soft error (SER) susceptibility. During the design and development process, subsystems go through rigorous verification and integration testing processes. During system manufacturing, systems go through a thorough testing process to help ensure high product quality levels.

The processor and memory subsystem contains a number of features designed to avoid or correct environmentally induced, single-bit, intermittent failures as well as handle solid faults in components, including selective redundancy to tolerate certain faults without requiring an outage or parts replacement.

## Publications

No publications are shipped with the announced products.

The IBM Systems Information Center provides you with a single information center where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access. The IBM Systems Information Center is at

http://publib14.boulder.ibm.com/infocenter/systems

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## Services

### Global Technology Services

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.

## Technical information

### Specified operating environment

#### *Software requirements*

Refer to the specific I/O feature description for the required operating system level support.

### Planning information

#### *Cable orders*

No cables are required.

### Security, auditability, and control

This product uses the security and auditability features of host hardware, host software, and application software.

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

## Terms and conditions

#### *MES discount applicable*

Equal to the volume commitment discount

#### *Field-installable feature*

Yes

#### *Warranty period*

An IBM part or feature installed during the initial installation of an IBM machine is subject to a full warranty effective on the date of installation of the machine. An IBM part or feature that replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty effective on its date of installation. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature is the same as the machine it is installed in.

#### *Customer setup*

Yes, except for feature number EC30 under machine type 9119

#### *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 1455, 1611, 7042, 8202, 8203, 8204, 8205, 8231, 8233, 8236, 8246, 9117, 9119, 9179, 9407, 9408, and 9409 machine type:

| Description<br>Machine type 1455 | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| One and only one rack indicator feature is required on all orders (#4650 to #4666). No Factory Integration Ind. | 24E | 4650 | | | Initial | N/A | No |
| | 48E | | | | Initial | N/A | No |

| | | | | | |
|---|---|---|---|---|---|
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 1 | | | | | |
| | 24E | 4651 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 2 | | | | | |
| | 24E | 4652 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 3 | | | | | |
| | 24E | 4653 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 4 | | | | | |
| | 24E | 4654 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 5 | | | | | |
| | 24E | 4655 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 6 | | | | | |
| | 24E | 4656 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 7 | | | | | |
| | 24E | 4657 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 8 | | | | | |
| | 24E | 4658 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 9 | | | | | |
| | 24E | 4659 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 10 | | | | | |
| | 24E | 4660 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 11 | | | | | |
| | 24E | 4661 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 12 | | | | | |
| | 24E | 4662 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 13 | | | | | |
| | 24E | 4663 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 14 | | | | | |
| | 24E | 4664 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 15 | | | | | |
| | 24E | 4665 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| Rack Indicator, Rack 16 | | | | | |
| | 24E | 4666 | Initial | N/A | No |
| | 48E | | Initial | N/A | No |
| | 64C | | Initial | N/A | No |
| IBM SFP+ LR Fiber Transceiver | | | | | |
| | 24E | ECB9 | Both | Yes | No |
| | 48E | | Both | Yes | No |
| | 64C | | Both | Yes | No |
| 1U Air Duct Long | | | | | |
| | 24E | EDT1 | Both | Yes | No |
| 1U AIR DUCT MED | | | | | |
| | 48E | EDT2 | Both | Yes | No |
| 1U AIR DUCT Short | | | | | |

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                        64C     EDT3                    Both     Yes No
1U Duct Rail Kit
                        24E     EU27                    Both     Yes No
                        48E                             Both     Yes No
                        64C                             Both     Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase    Maint.  Both/        RP
Machine type 1611    number number  price       Charge  Support  CSU MES

One and only one rack indicator feature is required on
all orders (#4650 to #4666).
No Factory Integration Ind.
                        16E     4650                    Initial  N/A No
Rack Indicator, Rack 1
                        16E     4651                    Initial  N/A No
Rack Indicator, Rack 2
                        16E     4652                    Initial  N/A No
Rack Indicator, Rack 3
                        16E     4653                    Initial  N/A No
Rack Indicator, Rack 4
                        16E     4654                    Initial  N/A No
Rack Indicator, Rack 5
                        16E     4655                    Initial  N/A No
Rack Indicator, Rack 6
                        16E     4656                    Initial  N/A No
Rack Indicator, Rack 7
                        16E     4657                    Initial  N/A No
Rack Indicator, Rack 8
                        16E     4658                    Initial  N/A No
Rack Indicator, Rack 9
                        16E     4659                    Initial  N/A No
Rack Indicator, Rack 10
                        16E     4660                    Initial  N/A No
Rack Indicator, Rack 11
                        16E     4661                    Initial  N/A No
Rack Indicator, Rack 12
                        16E     4662                    Initial  N/A No
Rack Indicator, Rack 13
                        16E     4663                    Initial  N/A No
Rack Indicator, Rack 14
                        16E     4664                    Initial  N/A No
Rack Indicator, Rack 15
                        16E     4665                    Initial  N/A No
Rack Indicator, Rack 16
                        16E     4666                    Initial  N/A No
1U AIR DUCT Short
                        16E     EDT3                    Both     Yes No
1U Duct Rail Kit
                        16E     EU27                    Both     Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase    Maint.  Both/        RP
Machine type 7042    number number  price       Charge  Support  CSU MES

RAID 1 Enabled
                        CR6     EB2T                    MES      Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase    Maint.  Both/        RP
Machine type 8202    number number  price       Charge  Support  CSU MES

#1737 Load Source Specify(856G
                        E4C     0879                    Both     Yes No
#1738 Load Source Specify SFF2
                        E4B     0880                    Both     Yes No
                        E4C                             Both     Yes No
856GB 10k RPM SAS SFF Disk
                        E4C     1737                    Both     Yes No
856GB 10k RPM SAS SFF-2 Disk
                        E4B     1738                    Both     Yes No
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                      E4C                              Both     Yes No
900GB 10k RPM SAS SFF Disk
                      E4C     1751                     Both     Yes No
900GB 10k RPM SAS SFF-2 Disk
                      E4B     1752                     Both     Yes No
                      E4C                              Both     Yes No
SATA Slimline DVD-RAM Drive
                      E4C     5771                     Both     Yes No
PCIe2 LP 2-Port 10GbE RoCE SR
                      E4C     EC29                     Both     Yes No
PCIe2 2-Port 10GbE RoCE SR Ada
                      E4C     EC30                     Both     Yes No
Quantity 150 of #1738
                      E4B     EQ38                     Both     Yes No
                      E4C                              Both     Yes No
Quantity 150 of #1752
                      E4B     EQ52                     Both     Yes No
                      E4C                              Both     Yes No
RDX USB Internal Docking
                      E4B     EU03                     Both     Yes No
                      E4C                              Both     Yes No
RDX USB External Docking
                      E4B     EU04                     Both     Yes No
                      E4C                              Both     Yes No
RDX SATA Internal Docking
                      E4B     EU07                     Both     Yes No
                      E4C                              Both     Yes No
Core Use HW Feature 10
                      E4C     EUC7                     MES      Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase Maint.  Both/        RP
Machine type 8203    number number  price    Charge  Support  CSU MES

RDX SATA Internal Docking
                      E4A     EU07                     Both     Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase Maint.  Both/        RP
Machine type 8204    number number  price    Charge  Support  CSU MES

RDX SATA Internal Docking
                      E8A     EU07                     Both     Yes No

                                                 Minimum Initial/
                                                 Monthly MES/
Description          Model  Feature Purchase Maint.  Both/        RP
Machine type 8205    number number  price    Charge  Support  CSU MES

#1737 Load Source Specify(856G
                      E6C     0879                     Both     Yes No
#1738 Load Source Specify SFF2
                      E6B     0880                     Both     Yes No
                      E6C                              Both     Yes No
856GB 10k RPM SAS SFF Disk
                      E6C     1737                     Both     Yes No
856GB 10k RPM SAS SFF-2 Disk
                      E6B     1738                     Both     Yes No
                      E6C                              Both     Yes No
900GB 10k RPM SAS SFF Disk
                      E6C     1751                     Both     Yes No
900GB 10k RPM SAS SFF-2 Disk
                      E6B     1752                     Both     Yes No
                      E6C                              Both     Yes No
SATA Slimline DVD-RAM Drive
                      E6C     5771                     Both     Yes No
PCIe2 LP 2-Port 10GbE RoCE SR
                      E6C     EC29                     Both     Yes No
PCIe2 2-Port 10GbE RoCE SR Ada
                      E6C     EC30                     Both     Yes No
Quantity 150 of #1738
                      E6B     EQ38                     Both     Yes No
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | E6C | | | | Both | Yes | No |
| Quantity 150 of #1752 | | | | | | | |
| | E6B | EQ52 | | | Both | Yes | No |
| | E6C | | | | Both | Yes | No |
| RDX USB Internal Docking | | | | | | | |
| | E6B | EU03 | | | Both | Yes | No |
| | E6C | | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | E6B | EU04 | | | Both | Yes | No |
| | E6C | | | | Both | Yes | No |
| RDX SATA Internal Docking | | | | | | | |
| | E6B | EU07 | | | Both | Yes | No |
| | E6C | | | | Both | Yes | No |
| Core Use HW Feature 10 | | | | | | | |
| | E6C | EUC7 | | | MES | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 8231 | | | | | | | |
| #1737 Load Source Specify(856G | | | | | | | |
| | E1C | 0879 | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| #1738 Load Source Specify SFF2 | | | | | | | |
| | E1C | 0880 | | | Both | Yes | No |
| | E2B | | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF Disk | | | | | | | |
| | E1C | 1737 | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | E1C | 1738 | | | Both | Yes | No |
| | E2B | | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | E1C | 1751 | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | E1C | 1752 | | | Both | Yes | No |
| | E2B | | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| Quantity 150 of #1793 | | | | | | | |
| | E2C | 1887 | | | Both | Yes | No |
| Quantity 150 of #1794 | | | | | | | |
| | E2C | 1958 | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | E1C | 5771 | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| PCIe2 LP 2-Port 10GbE RoCE SR | | | | | | | |
| | E1C | EC29 | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | E1C | EU04 | | | Initial | N/A | No |
| | E2B | | | | Initial | N/A | No |
| | E2C | | | | Initial | N/A | No |
| RDX USB Internal Docking | | | | | | | |
| | E1C | EU23 | | | Both | Yes | No |
| | E2B | | | | Both | Yes | No |
| | E2C | | | | Both | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 8233 | | | | | | | |
| #1737 Load Source Specify(856G | | | | | | | |
| | E8B | 0879 | | | Both | Yes | No |
| #1738 Load Source Specify SFF2 | | | | | | | |
| | E8B | 0880 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF Disk | | | | | | | |
| | E8B | 1737 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | E8B | 1738 | | | Both | Yes | No |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | E8B | 1751 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | E8B | 1752 | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | E8B | 5771 | | | Both | Yes | No |
| Quantity 150 of #1738 | | | | | | | |
| | E8B | EQ38 | | | Both | Yes | No |
| Quantity 150 of #1752 | | | | | | | |
| | E8B | EQ52 | | | Both | Yes | No |
| RDX USB Internal Docking | | | | | | | |
| | E8B | EU03 | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | E8B | EU04 | | | Both | Yes | No |
| RDX SATA Internal Docking | | | | | | | |
| | E8B | EU07 | | | Both | Yes | No |

| Description<br>Machine type 8236 | Model<br>number | Feature<br>number | Purchase<br>price | Minimum Monthly Maint.<br>Charge | Initial/ MES/ Both/<br>Support | CSU | RP<br>MES |
|---|---|---|---|---|---|---|---|
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | E8C | 1751 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | E8C | 1752 | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | E8C | 5771 | | | Both | Yes | No |
| Quantity 150 of #1752 | | | | | | | |
| | E8C | EQ52 | | | Both | Yes | No |
| RDX USB Internal Docking | | | | | | | |
| | E8C | EU03 | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | E8C | EU04 | | | Initial | N/A | No |

| Description<br>Machine type 8246 | Model<br>number | Feature<br>number | Purchase<br>price | Minimum Monthly Maint.<br>Charge | Initial/ MES/ Both/<br>Support | CSU | RP<br>MES |
|---|---|---|---|---|---|---|---|
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | L1C | 5771 | | | Both | Yes | No |
| | L1S | | | | Both | Yes | No |
| | L2C | | | | Both | Yes | No |
| | L2S | | | | Both | Yes | No |
| PCIe2 LP 2-Port 10GbE RoCE SR | | | | | | | |
| | L1C | EC29 | | | Both | Yes | No |
| | L1S | | | | Both | Yes | No |
| | L2C | | | | Both | Yes | No |
| | L2S | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | L1S | EL1R | | | Both | Yes | No |
| | L2S | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | L1C | EL35 | | | Both | Yes | No |
| | L1S | | | | Both | Yes | No |
| | L2C | | | | Both | Yes | No |
| | L2S | | | | Both | Yes | No |
| Quantity 150 of #EL1K | | | | | | | |
| | L2S | ELQK | | | Both | Yes | No |
| Quantity 150 of #EL1L | | | | | | | |
| | L2S | ELQL | | | Both | Yes | No |
| Quantity 150 of #EL1R | | | | | | | |
| | L2S | ELQR | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | L2C | EU04 | | | Initial | N/A | No |
| | L2S | | | | Initial | N/A | No |
| RDX USB Internal Docking | | | | | | | |
| | L1C | EU23 | | | Both | Yes | No |
| | L1S | | | | Both | Yes | No |
| | L2C | | | | Both | Yes | No |
| | L2S | | | | Both | Yes | No |

| Description<br>Machine type 9117 | Model<br>number | Feature<br>number | Purchase<br>price | Minimum Monthly Maint.<br>Charge | Initial/ MES/ Both/<br>Support | CSU | RP<br>MES |
|---|---|---|---|---|---|---|---|
| EXP30 Load Source Specify | | | | | | | |
| | MMC | 0729 | | | Both | Yes | No |
| #1737 Load Source Specify(856G | | | | | | | |
| | MMC | 0879 | | | Both | Yes | No |
| #1738 Load Source Specify SFF2 | | | | | | | |
| | MMB | 0880 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF Disk | | | | | | | |
| | MMC | 1737 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | MMB | 1738 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | MMC | 1751 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | MMB | 1752 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | MMC | 5771 | | | Both | Yes | No |
| PCIe2 2-Port 10GbE RoCE SR Ada | | | | | | | |
| | MMC | EC30 | | | Both | Yes | No |
| Quantity 150 of #1737 | | | | | | | |
| | MMC | EQ37 | | | Both | Yes | No |
| Quantity 150 of #1738 | | | | | | | |
| | MMB | EQ38 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| Quantity 150 of #1751 | | | | | | | |
| | MMC | EQ51 | | | Both | Yes | No |
| Quantity 150 of #1752 | | | | | | | |
| | MMB | EQ52 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | MMB | EU04 | | | Both | Yes | No |
| | MMC | | | | Both | Yes | No |
| Core Use HW Feature 10 | | | | | | | |
| | MMC | EUC7 | | | MES | Yes | No |

| Description<br>Machine type 9119 | Model<br>number | Feature<br>number | Purchase<br>price | Minimum Monthly Maint.<br>Charge | Initial/ MES/ Both/<br>Support | CSU | RP<br>MES |
|---|---|---|---|---|---|---|---|
| #1737 Load Source Specify(856G | | | | | | | |
| | FHB | 0879 | | | Both | Yes | No |
| #1738 Load Source Specify SFF2 | | | | | | | |
| | FHB | 0880 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF Disk | | | | | | | |
| | FHB | 1737 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | FHB | 1738 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | FHB | 1751 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | FHB | 1752 | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | FHB | 5771 | | | Both | Yes | No |
| PCIe2 2-Port 10GbE RoCE SR Ada | | | | | | | |
| | FHB | EC30 | | | Both | No | No |
| GX++ 2-port 10GB FCOE CNA SR O | | | | | | | |
| | FHB | EN22 | | | Both | No | No |
| GX++ 2-port 16Gb Fibre Channel | | | | | | | |
| | FHB | EN23 | | | Both | No | No |
| Quantity 150 of #1737 | | | | | | | |
| | FHB | EQ37 | | | Both | Yes | No |
| Quantity 150 of #1738 | | | | | | | |
| | FHB | EQ38 | | | Both | Yes | No |
| Quantity 150 of #1751 | | | | | | | |
| | FHB | EQ51 | | | Both | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Quantity 150 of #1752 | | | | | | | |
| | FHB | EQ52 | | | Both | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 9179 | | | | | | | |
| EXP30 Load Source Specify | | | | | | | |
| | MHC | 0729 | | | Both | Yes | No |
| #1737 Load Source Specify(856G | | | | | | | |
| | MHC | 0879 | | | Both | Yes | No |
| #1738 Load Source Specify SFF2 | | | | | | | |
| | MHB | 0880 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF Disk | | | | | | | |
| | MHC | 1737 | | | Both | Yes | No |
| 856GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | MHB | 1738 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF Disk | | | | | | | |
| | MHC | 1751 | | | Both | Yes | No |
| 900GB 10k RPM SAS SFF-2 Disk | | | | | | | |
| | MHB | 1752 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |
| SATA Slimline DVD-RAM Drive | | | | | | | |
| | MHC | 5771 | | | Both | Yes | No |
| PCIe2 2-Port 10GbE RoCE SR Ada | | | | | | | |
| | MHC | EC30 | | | Both | Yes | No |
| Quantity 150 of #1737 | | | | | | | |
| | MHC | EQ37 | | | Both | Yes | No |
| Quantity 150 of #1738 | | | | | | | |
| | MHB | EQ38 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |
| Quantity 150 of #1751 | | | | | | | |
| | MHC | EQ51 | | | Both | Yes | No |
| Quantity 150 of #1752 | | | | | | | |
| | MHB | EQ52 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |
| RDX USB External Docking | | | | | | | |
| | MHB | EU04 | | | Both | Yes | No |
| | MHC | | | | Both | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 9407 | | | | | | | |
| RDX SATA Internal Docking | | | | | | | |
| | M15 | EU07 | | | MES | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 9408 | | | | | | | |
| RDX SATA Internal Docking | | | | | | | |
| | M25 | EU07 | | | MES | Yes | No |

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 9409 | | | | | | | |
| RDX SATA Internal Docking | M50 | EU07 | | | MES | Yes | No |

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

| Description | Model number | Feature number | Purchase price | Minimum Monthly Maint. Charge | Initial/ MES/ Both/ Support | CSU | RP MES |
|---|---|---|---|---|---|---|---|
| Machine type 9117 | | | | | | | |
| CSC Routing Indicator | MMC | 0712 | | | Initial | N/A | No |
| CAT5E Ethernet Cbl 25M YELLOW | MMC | 1121 | | | Both | Yes | No |

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