Power Systems

Managing PCIe adapters for Machine Types 5148, 8247, 8284, 8286, 8408, 9080, 9119, and EMX0 PCIe Gen3 I/O expansion drawer

IBM

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This edition applies to IBM Power Systems servers that contain the POWER8 processor and to all associated models.

Contents

Safety notices

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, safety information documentation is included in the publications package (such as in printed documentation, on DVD, or as part of the product) shipped with the product. The documentation contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information documentation. You should also refer to the safety information documentation any time you do not clearly understand any safety information in the U.S. English publications.

Replacement or additional copies of safety information documentation can be obtained by calling the IBM Hotline at 1-800-300-8751.

German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Laser safety information

IBM® servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

Laser compliance

IBM servers may be installed inside or outside of an IT equipment rack.

DANGER: When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:
- If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
  - For AC power, disconnect all power cords from their AC power source.
  - For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected.

- For racks with AC power, connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements.
- Do not continue with the inspection if any unsafe conditions are present.
- Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.

DANGER:
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

   To Disconnect:
   1. Turn off everything (unless instructed otherwise).
   2. For AC power, remove the power cords from the outlets.
   3. For racks with a DC power distribution panel (PDP), turn off the circuit breakers located in the PDP and remove the power from the Customer's DC power source.
   4. Remove the signal cables from the connectors.
   5. Remove all cables from the devices.

   To Connect:
   1. Turn off everything (unless instructed otherwise).
   2. Attach all cables to the devices.
   3. Attach the signal cables to the connectors.
   4. For AC power, attach the power cords to the outlets.
   5. For racks with a DC power distribution panel (PDP), restore the power from the Customer's DC power source and turn on the circuit breakers located in the PDP.
   6. Turn on the devices.

   Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

(R001 part 1 of 2):

DANGER: Observe the following precautions when working on or around your IT rack system:
- Heavy equipment–personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).

- Each rack cabinet might have more than one power cord.
  - For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
  - For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

(R001 part 2 of 2):

CAUTION:
- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- *(For sliding drawers.)* Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.

- *(For fixed drawers.)* This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.

CAUTION:

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building.

- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions:**
  - **Remove all devices in the 32U position (compliance ID RACK-001 or 22U (compliance ID RR001) and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are little-to-no empty U-levels between devices installed in the rack cabinet below the 32U (compliance ID RACK-001 or 22U (compliance ID RR001) level, unless the received configuration specifically allowed it.**
- **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
- **If the rack cabinet you are relocating was supplied with removable outriggers they must be reinstalled before the cabinet is relocated.**
- **Inspect the route that you plan to take to eliminate potential hazards.**
- **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.**
- **Verify that all door openings are at least 760 x 230 mm (30 x 80 in.).**
- **Ensure that all devices, shelves, drawers, doors, and cables are secure.**
- **Ensure that the four leveling pads are raised to their highest position.**
- **Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.**
- **Do not use a ramp inclined at more than 10 degrees.**
- **When the rack cabinet is in the new location, complete the following steps:**
  - **Lower the four leveling pads.**
  - **Install stabilizer brackets on the rack cabinet.**
  - **If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.**
- **If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.**

(R002)

(L001)

DANGER: Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)

(L002)

DANGER: Rack-mounted devices are not to be used as shelves or work spaces. (L002)

(L003)

or

or

or

or
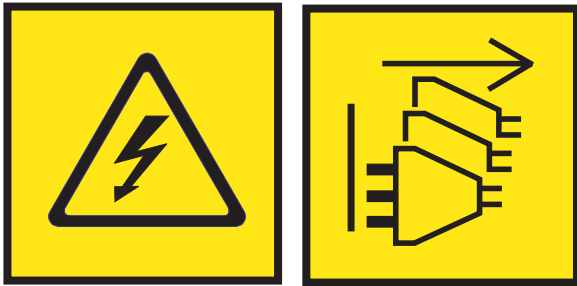
DANGER: Multiple power cords. The product might be equipped with multiple AC power cords or multiple DC power cables. To remove all hazardous voltages, disconnect all power cords and power cables. (L003)

(L007)

CAUTION: A hot surface nearby. (L007)

(L008)

CAUTION: Hazardous moving parts nearby. (L008)

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

CAUTION:
This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:
- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

(C026)

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers many not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (C027)

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

CAUTION:
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

CAUTION:
The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not:
- **___ Throw or immerse into water**
- **___ Heat to more than 100°C (212°F)**
- **___ Repair or disassemble**

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

CAUTION:

Regarding IBM provided VENDOR LIFT TOOL:

- Operation of LIFT TOOL by authorized personnel only.
- LIFT TOOL intended for use to assist, lift, install, remove units (load) up into rack elevations. It is not to be used loaded transporting over major ramps nor as a replacement for such designated tools like pallet jacks, walkies, fork trucks and such related relocation practices. When this is not practicable, specially trained persons or services must be used (for instance, riggers or movers).
- Read and completely understand the contents of LIFT TOOL operator's manual before using. Failure to read, understand, obey safety rules, and follow instructions may result in property damage and/or personal injury. If there are questions, contact the vendor's service and support. Local paper manual must remain with machine in provided storage sleeve area. Latest revision manual available on vendor's web site.
- Test verify stabilizer brake function before each use. Do not over-force moving or rolling the LIFT TOOL with stabilizer brake engaged.
- Do not move LIFT TOOL while platform is raised, except for minor positioning.
- Do not exceed rated load capacity. See LOAD CAPACITY CHART regarding maximum loads at center versus edge of extended platform.
- Only raise load if properly centered on platform. Do not place more than 200 lb (91 kg) on edge of sliding platform shelf also considering the load's center of mass/gravity (CoG).
- Do not corner load the platform tilt riser accessory option. Secure platform riser tilt option to main shelf in all four (4x) locations with provided hardware only, prior to use. Load objects are designed to slide on/off smooth platforms without appreciable force, so take care not to push or lean. Keep riser tilt option flat at all times except for final minor adjustment when needed.
- Do not stand under overhanging load.
- Do not use on uneven surface, incline or decline (major ramps).
- Do not stack loads.
- Do not operate while under the influence of drugs or alcohol.
- Do not support ladder against LIFT TOOL.
- Tipping hazard. Do not push or lean against load with raised platform.
- Do not use as a personnel lifting platform or step. No riders.
- Do not stand on any part of lift. Not a step.
- Do not climb on mast.
- Do not operate a damaged or malfunctioning LIFT TOOL machine.
- Crush and pinch point hazard below platform. Only lower load in areas clear of personnel and obstructions. Keep hands and feet clear during operation.
- No Forks. Never lift or move bare LIFT TOOL MACHINE with pallet truck, jack or fork lift.
- Mast extends higher than platform. Be aware of ceiling height, cable trays, sprinklers, lights, and other overhead objects.
- Do not leave LIFT TOOL machine unattended with an elevated load.
- Watch and keep hands, fingers, and clothing clear when equipment is in motion.
- Turn Winch with hand power only. If winch handle cannot be cranked easily with one hand, it is probably over-loaded. Do not continue to turn winch past top or bottom of platform travel. Excessive unwinding will detach handle and damage cable. Always hold handle when lowering, unwinding. Always assure self that winch is holding load before releasing winch handle.
- A winch accident could cause serious injury. Not for moving humans. Make certain clicking sound is heard as the equipment is being raised. Be sure winch is locked in position before releasing handle. Read instruction page before operating this winch. Never allow winch to unwind freely. Freewheeling will cause uneven cable wrapping around winch drum, damage cable, and may cause serious injury. **(C048)**

Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:
- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intrabuilding ports of this equipment are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of this equipment *must not* be metallically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Note: All Ethernet cables must be shielded and grounded at both ends.

The ac-powered system does not require the use of an external surge protection device (SPD).

The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

The dc-powered system is intended to be installed in a common bonding network (CBN) as described in GR-1089-CORE.

Managing PCIe adapters

Find information about using and managing the Peripheral Component Interconnect (PCI) Express (PCIe) adapters that are supported for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, 8286-42A, 8408-44E, 8408-E8E, 9080-MHE, 9080-MME, 9119-MHE, 9119-MME, and EMX0 PCIe Gen3 I/O expansion drawer. Also, find information about specifications and installation notes for specific adapters.

Overview of managing PCIe adapters

Learn how to use and manage Peripheral Component Interconnect (PCI) Express (PCIe) adapters adapters. Find general information about Peripheral Component Interconnect (PCI) Express (PCIe) adapters, related publications, safety information, and handling static sensitive devices.

PCI Express

Learn about PCI Express (PCIe) adapters and slots.

PCI Express (PCIe) adapters use a different type of slot than Peripheral Component Interconnect (PCI) and Peripheral Component Interconnect-X (PCI-X) adapters. If you attempt to force an adapter into the wrong type of slot, you might damage the adapter or the slot. A PCI adapter can be installed in a PCI-X slot, and a PCI-X adapter can be installed in a PCI adapter slot. A PCIe adapter cannot be installed in a PCI or PCI-X adapter slot, and a PCI or PCI-X adapter cannot be installed in a PCIe slot. The following illustration shows an example of a PCI-X adapter **(A)** next to a PCIe 4x **(B)** adapter.
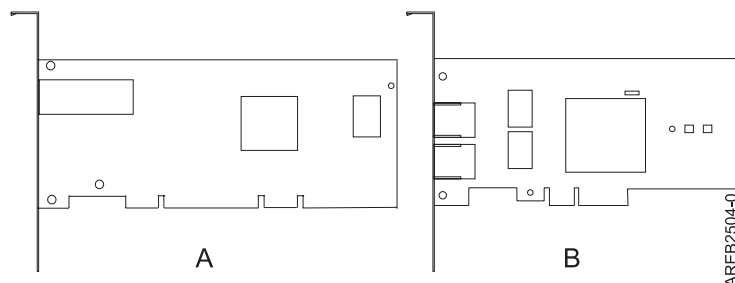
Figure 1. PCI-X adapter and PCIe 4x adapter

PCIe adapters and slots come in 4 different sizes: 1x, 4x, 8x, and 16x. Smaller size adapters do fit in larger slots, but larger size adapters do not fit in smaller slots. Table 1 shows PCIe slot compatibility.

Table 1. PCIe slot compatibility

	1x slot	4x slot	8x slot	16x slot
1x adapter	Supported	Supported	Supported	Supported
4x adapter	Not supported	Supported	Supported	Supported
8x adapter	Not supported	Not supported	Supported	Supported
16x adapter	Not supported	Not supported	Not supported	Supported

Important partitioning considerations with dual-slot and multi-adapter configurations

Learn about partitioning considerations with dual-slot and multi-adapter configurations.

Logical partitions can own physical I/O resources. Physical I/O resources are assigned to logical partitions at the slot level. Assigning a slot to a logical partition enables the operating system that runs in the logical partition to control the functionality of the I/O resource and power for that slot. When the operating system powers a slot on or off, the physical I/O resource is powered on or off.

There are two I/O configurations involving adapter pairs:
- Mult-initiator and high availability
- Auxiliary Write Cache

Multi-initiator and high availability

The terms multi-initiator and high availability (HA) refer to connecting multiple adapters (typically two adapters) to a common set of disk expansion drawers for increasing availability. This configuration is also referred to as Dual Storage IOA configuration. This type of connection is commonly done in either of the following configurations:

Note: Some systems have SAS RAID adapters integrated onto the system boards and use a Cache RAID - Dual IOA Enablement Card (FC 5662) to enable storage adapter Write Cache and Dual Storage IOA (HA RAID Mode). For these configurations, installation of the Cache RAID - Dual IOA Enablement Card places the two integrated adapters into a HA RAID configuration. There are no separate SAS cables required to connect the two integrated SAS RAID adapters to each other.

HA two-system configuration

An HA two-system configuration provides a high-availability environment for system storage by enabling two systems or partitions to have access to the same set of disks and disk arrays. This feature is typically used with the IBM PowerHA® SystemMirror®. The IBMPowerHA SystemMirror software provides a commercial computing environment that ensures that mission-critical applications can recover quickly from hardware and software failures. The support for this configuration is operating system dependent.

HA single system configuration

An HA single system configuration provides for redundant adapters from a single system to the same set of disks and disk arrays. This feature is typically referred to as Multi-Path I/O (MPIO). MPIO support is part of the operating system support and can be used to provide a redundant IBM SAS RAID controller configuration with RAID protected disks.

Auxiliary write cache adapter

The auxiliary write cache (AWC) adapter provides a duplicate, nonvolatile copy of write cache data of the RAID controller to which it is connected.

Protection of data is enhanced by having two battery-backed (nonvolatile) copies of write cache, each stored on separate adapters. If a failure occurs to the write cache portion of the RAID controller, or the RAID controller itself fails in such a way that the write cache data is not recoverable, the AWC adapter provides a backup copy of the write cache data to prevent data loss during the recovery of the failed RAID controller. The cache data is recovered to the new replacement RAID controller and then written out to disk before resuming normal operations.

The AWC adapter is not a failover device that can keep the system operational by continuing disk operations when the attached RAID controller fails. The system cannot use the auxiliary copy of the cache for runtime operations even if only the cache on the RAID controller fails. The AWC adapter does not support any other device attachment and performs no other tasks than communicating with the attached RAID controller to receive backup write cache data. The purpose of the AWC adapter is to

minimize the length of an unplanned outage, due to a failure of a RAID controller, by preventing loss of critical data that might have otherwise required a system reload.

It is important to understand the difference between multi-initiator connections and AWC connections. Connecting controllers in a multi-initiator environment refers to multiple RAID controllers connected to a common set of disk enclosures and disks. The AWC controller is not connected to the disks, and it does not perform device media accesses.

The RAID controller and the AWC adapter each require a PCI bus connection and are required to be in the same partition. The two adapters are connected by an internal connection. For the planar RAID enablement and planar auxiliary cache features, the dedicated connection is integrated into the system planar.

Handling static-sensitive devices

Learn about precautions you must take to prevent damage to electronic components from static electricity discharge.

Electronic boards, adapters, media drives, and disk drives are sensitive to static electricity discharge. These devices are wrapped in antistatic bags to prevent this damage. Take the following precautions to prevent damage to these devices from static electricity discharge.

- Attach a wrist strap to an unpainted metal surface of your hardware to prevent electrostatic discharge from damaging your hardware.
- When you are using a wrist strap, follow all electrical safety procedures. A wrist strap is for static control. It does not increase or decrease your risk of receiving electric shock when you are using or working on electrical equipment.
- If you do not have a wrist strap, before you remove the product from ESD packaging and installing or replacing hardware, touch an unpainted metal surface of the system for a minimum of 5 seconds.
- Do not remove the device from the antistatic bag until you are ready to install the device in the system.
- With the device still in its antistatic bag, touch it to the metal frame of the system.
- Grasp cards and boards by the edges. Avoid touching the components and gold connectors on the adapter.
- If you need to lay the device down while it is out of the antistatic bag, lay it on the antistatic bag. Before you pick it up again, touch the antistatic bag and the metal frame of the system at the same time.
- Handle the devices carefully to prevent permanent damage.

PCIe adapters for POWER systems

Learn the PCIe adapters that can be used in your specific system.

Choose from the following options:
- "Managing PCIe adapters for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system" on page 4
- "Managing PCIe adapters for the 8247-42L, 8286-41A, or 8286-42A system" on page 9
- "Managing PCIe adapters for the 8408-44E or 8408-E8E system" on page 14
- "Managing PCIe adapters for the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system" on page 18
- "PCIe adapter information by feature type for the EMX0 PCIe Gen3 I/O expansion drawer" on page 22

Managing PCIe adapters for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system

Learn about the PCIe adapters that can be used with the IBM Elastic Storage Server Management Server (5148-21L), IBM Elastic Storage Server Data Server (5148-22L), IBM Power® System S812L (8247-21L), IBM Power System S822L (8247-22L), IBM Power System S812 (8284-21A), and the IBM Power System S822 (8284-22A).

Overview of managing PCIe adapters for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system

Learn how to use and manage Peripheral Component Interconnect (PCI) Express (PCIe) adapters adapters. Find general information about Peripheral Component Interconnect (PCI) Express (PCIe) adapters, related publications, safety information, and handling static sensitive devices.

The following features are electromagnetic compatibility (EMC) Class B features. See the Class B Notices in the Hardware Notices section.

Table 2. Electromagnetic compatibility (EMC) Class B features

Feature	Description
5269	POWER® GXT145 PCI Express Graphics Accelerator
5271	4-port 10/100/1000 Base-TX PCI Express Adapter
5274	2-port Gb Ethernet-SX PCI Express Adapter
5275	10 Gb Ethernet-SR PCI Express Adapter
5277	4-port Async EIA-232 PCIe 1X LP Adapter
5281	1 Gb Ethernet UTP 2-port PCIe Adapter
5769	10 Gb Ethernet-SR PCI Express Adapter
5772	10 Gb Ethernet-LR PCI Express Adapter
EC2G and EL39	PCIe LP 2-Port 10 GbE SFN6122F Adapter
EC2J	PCIe 2-Port 10 GbE SFN6122F Adapter
EC41	PCIe2 LP 3D Graphics Adapter x1
EL3Z	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter
EN0X	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter

The adapter information that is shown here is used during non-directed service activities. The information can be used to:
- Identify an adapter
- Find specific technical information about an adapter
- Where applicable, show special installation or cabling instructions
- Show signal names for the output-pins of the adapter connectors
- Where applicable, show the settings for switches or jumpers

Adapters can be identified by their feature code (FC) or their custom-card identification number (CCIN). Normally, the CCIN number is labeled on the adapter. The field replaceable unit (FRU) part number (P/N) of your adapter might not match the FRU P/N listed in this information. If the part numbers do not match, verify that the CCIN is the same. If the CCIN is same, the adapter has the same function and can be used in the same way.

Adapters must be placed in specific PCI Express (PCIe) slots to function correctly or optimally.

SAS RAID cards

Find information about the SAS RAID cards that are installed in the system. Also, find information about the SAS RAID controllers that are supported in the system.

Table 3 provides information about the SAS RAID cards that are supported for an 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system.

Table 3. SAS RAID Controllers supported

Feature Code (FC)	Description	Function
FC EJ0T (CCIN 57D7)	one SAS RAID Controller card	Provides just a bunch of disks (JBOD) or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8284-21A or 8284-22A or system.
FC EJ0V (CCIN 57D7)	Split Disk - two SAS RAID Controller cards	FC EJ0V can be used to split the disk backplane into two sets of six disks. Provides JBOD or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8284-21A or 8284-22A system.
FC EL3T (CCIN 57D7)	one SAS RAID Controller card	Provides just a bunch of disks (JBOD) or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8247-21L or 8247-22L system.
FC EL3V (CCIN 57D7)	Split Disk - two SAS RAID Controller cards	FC EL3V can be used to split the disk backplane into two sets of six disks. Provides JBOD or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8247-21L or 8247-22L system.
FC EJ0U (CCIN 57D8)	Dual high performance SAS RAID Controller cards	FC EJ0U is used with the high function disk backplane to support up to 8 small form-factor disk drives or solid-state drives and up to 6 1.8 inch form-factor solid state drives. Provides SAS RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2 functions depending on the Operating System support for the attached disk drives in the expanded function 8284-21A or 8284-22A system. Provides two external SAS ports that can be used to connect to one external FC 5887.
FC EL3U (CCIN 57D8)	Dual high performance SAS RAID Controller cards	FC EL3U is used with the high function disk backplane to support up to 18 small form-factor disk drives or solid-state drives and up to 8 1.8 inch form-factor solid state drives. Provides SAS RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2 functions depending on the Operating System support for the attached disk drives in the expanded function 8247-21L or 8247-22L system. Provides two external SAS ports that can be used to connect one external FC 5887.
FC EL3W (CCIN 57DC)	High performance SAS RAID Controller card	FC EL3W is used only in the Elastic Storage Server offering. It supports up to 8 small form-factor disk drives or solid-state drives, up to 6 1.8 inch form-factor solid state drives, and two external SAS ports. Provides SAS RAID 0, 5, 6, and 10 functions for the attached disk drives.
FC EJ0M (CCIN 57B4)	PCIe3 RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5278	PCIe LP 2-x4-port SAS Adapter 3Gb	The SAS RAID controller can be used to connect to an external FC 5887 in an 8284-21A or 8284-22A system.
FC EL10	PCIe LP 2-x4-port SAS Adapter 3Gb	The SAS RAID controller can be used to connect to an external FC 5887 in an 8247-21L or 8247-22L system.

For more information about the SAS RAID controllers, see the following topics:
- SAS RAID controllers for AIX®.
- SAS RAID controllers for IBM i.
- SAS RAID controllers for Linux.

PCIe adapter information by feature type for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A

Find information about the Peripheral Component Interconnect (PCI) Express (PCIe) adapters that are supported for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system that contains the POWER8® processor.

The table shows the available adapters by feature code (FC), description, customer card identification number (CCIN), adapter FRU number, and provides a link to more details for each adapter.

Important:
- This document does not replace the latest sales and marketing publications and tools that document supported features.
- If you are installing a new feature, ensure that you have the software required to support the new feature and determine whether you must install any existing program temporary fix (PTF) prerequisites. To do this, use the IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

Table 4. PCIe adapters supported in the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system that is running the AIX, IBM i, or Linux operating system

Feature code	Description, FC, CCIN, and adapter FRU number
5260	PCIe2 LP 4-port 1 GbE Adapter (FC 5260; CCIN 576F); Adapter FRU number: 74Y4064
5269[1]	POWER GXT145 PCI Express Graphics Accelerator (FC 5269; CCIN 5269); Adapter FRU number: 74Y3227
5270[1]	10 Gb FCoE PCIe Dual-port Adapter (FC 5270; CCIN 2B3B); Adapter FRU number: 46K8088
5271	4-port 10/100/1000 Base-TX PCI Express Adapter (FC 5271; CCIN 5717); Adapter FRU number: 46Y3512
5273	PCIe2 8 Gb Dual-port Fibre Channel Adapter (FC 5273; CCIN 577D); Adapter FRU number: 10N9824
5274[1]	2-port Gb Ethernet-SX PCI Express Adapter (FC 5274; CCIN 5768); Adapter FRU number: 10N6846
5275 [1]	10 Gb Ethernet-SR PCI Express Adapter (FC 5275; CCIN 5275); Adapter FRU number: 46K7897
5276[1]	4-Gb PCI Express Dual-port Fibre Channel Adapter (FC 5276; CCIN 5774); Adapter FRU number: 10N7255
5277	4-port Async EIA-232 PCIe 1X LP Adapter (FC 5277; CCIN 57D2); adapter FRU number 46K6734
5278	PCIe Dual-x4 SAS Adapter (FC 5278; CCIN 57B3); Adapter FRU number: 44V4852
5280[1]	PCIe2 LP 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5280; CCIN 2B54); Adapter FRU number 74Y1988
5281[1]	1 Gb Ethernet UTP 2-port PCIe Adapter (FC 5281; CCIN 5767); Adapter FRU number: 46K6601
5283[1]	PCIe2 LP 2-port 4X InfiniBand QDR Adapter (FC 5283; CCIN 58E2); Adapter FRU number: 74Y2987
5284	PCIe2 LP 2-port 10 GbE SR Adapter (FC 5284; CCIN 5287); Adapter FRU number: 74Y3242
5290[1]	PCIe LP 2-port Async EIA-232 Adapter (FC 5290; CCIN 57D4); Adapter FRU number 74Y4085

Table 4. PCIe adapters supported in the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system that is running the AIX, IBM i, or Linux operating system (continued)

Feature code	Description, FC, CCIN, and adapter FRU number
5805[1]	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter (FC 5805; CCIN 574E); Adapter FRU number: 46K4735
5899[1]	PCIe2 4-port 1 GbE Adapter (FC 5899; CCIN 576F); Adapter FRU number: 74Y4064
EC27[1]	PCIe2 LP 2-port 10 GbE RoCE SFP+ adapter (FC EC27; CCIN EC27); Adapter FRU number: 000E1493
EC29[1]	PCIe2 LP 2-port 10 GbE RoCE SR adapter (FC EC29; CCIN EC29); Adapter FRU number: 00E1600
EC2G[1]	PCIe LP 2-Port 10 GbE SFN6122F Adapter (FC EC2G; CCIN EC2G); Adapter FRU number: 00E8224
EC2M[4]	PCIe3 LP 2-port 10 GbE NIC and RoCE SR adapter (FC EC2M; CCIN 57BE); Adapter FRU number: 00RX875, low-profile tailstock: 00RX872
EC32[1]	PCIe3 low profile 2-port 56 Gb FDR InfiniBand Adapter x16 (FC EC32; CCIN 2CE7); Adapter FRU number: 00RX852
EC37[4]	PCIe3 LP 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC37; CCIN 57BC); Adapter FRU number: 00RX859
EC3A[1]	PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3A; CCIN 57BD); Adapter FRU number: 00FW105
EC3E[1]	PCIe3 2-port 100 Gb EDR IB Adapter x16 (FC EC3E and EC3F; CCIN 2CEA); Adapter FRU number: 00WT075
EC3L[1]	PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter (FC EC3L and EC3M; CCIN 2CEC); Adapter FRU number: 00WT078
EC3T[1]	PCIe3 LP 1-port 100 Gb EDR InfiniBand Adapter x16 (FC EC3T; CCIN 2CEB) Adapter FRU number: 00WT013
EC41[1]	PCIe2 LP 3D Graphics Adapter x1 (FC EC41); Adapter FRU number: 00E3980
EC45	PCIe2 LP 4-port USB 3.0 Adapter (FC EC45; CCIN 58F9); Adapter FRU number: 00E2932; low-profile tailstock part number: 00E2934
EC51[1]	PCIe2 LP 3D Graphics Adapter x16 (FC EC51)
EC54[1]	PCIe3 1.6 TB NVMe Flash Adapter (FC EC54 and EC55; CCIN 58CB); Adapter FRU number: 00MH991
EC56[1]	PCIe3 3.2 TB NVMe Flash Adapter (FC EC56 and EC57; CCIN 58CC); Adapter FRU number: 00MH993
EJ05[1]	PCIe3 cable adapter for the EMX0 PCIe Gen3 I/O expansion drawer (FC EJ05; CCIN 2B1C); Adapter FRU number: 000RR809
EJ0M	PCIe3 RAID SAS quad-port 6 Gb LP Adapter (FC EJ0M; CCIN 57B4); Adapter FRU number: 000MH910
EJ0T and EJ0V[3]	PCIe3 x8 SAS RAID internal adapter 6Gb (FC EJ0T and FC EJ0V; CCIN 57D7); Adapter FRU number: 00MH906
EJ0U[3]	PCIe3 x8 cache SAS RAID internal adapter 6Gb (FC EJ0U; CCIN 57D8); Adapter FRU number: 00MA025
EJ11	PCIe3 LP 4 x8 SAS Port Adapter (FC EJ11; CCIN 57B4); Adapter FRU number: 000MH910
EJ13[1]	PCIe3 LP FPGA Compression Accelerator Adapter (FC EJ13; CCIN 59AB); Adapter FRU number: 000NK006
EJ14[1]	PCIe3 12 GB Cache RAID PLUS SAS Adapter Quad-port 6 Gb x8 (FC EJ14; CCIN 57B1); Adapter FRU number 01DH742
EJ16[2]	PCIe3 LP CAPI Fibre Channel Flash Accelerator Adapter (FC EJ16); Adapter FRU number: 00NK025

Feature code	Description, FC, CCIN, and adapter FRU number
EJ18[1]	PCIe3 LP CAPI FlashSystem Accelerator Adapter (FC EJ18); Adapter FRU number: 00NK025
EJ1B[1]	CAPI Compression Accelerator Adapter (FC EJ1A and EJ1B; CCIN 2CF0); Adapter FRU number: 00WT173
EJ32[1]	4767-001 Cryptographic Coprocessor (FC EJ32 and EJ33; CCIN 4767)
EJ1K[1]	PCIe3 1.92 TB CAPI NVMe Flash Accelerator Adapter (FC EJ1K; CCIN 58CD)
EJ1N	PCIe1 LP SAS Tape/DVD Dual-port 3 Gb x8 Adapter (EJ1N; CCIN 57B3); Adapter FRU:44V4852
EJ1P[1]	PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter (FC EJ1P; CCIN 57B3); Adapter FRU:44V4852
EL09[2]	PCIe LP 4 Gb 2-port Fibre Channel Adapter (FC EL09; CCIN 5774); adapter FRU number: 000E0807, 000E0904
EL10[2]	PCIe LP 2-port SAS Adapter 3 Gb (FC EL10; CCIN 57B3); Adapter FRU number: 44V4852
EL27[2]	PCIe2 2-port 10 GbE RoCE SFP+ adapter (FC EL27; CCIN EC27); Adapter FRU number: 74Y1988
EL2N[2]	PCIe 8 Gb Dual-port Fibre Channel Adapter (FC EL2N; CCIN 577D); Adapter FRU number: 10N9824
EL2P[2]	PCIe2 LP 2-port 10 GbE SR Adapter (FC EL2P; CCIN 5287); Adapter FRU number: 74Y3242
EL2Z[2]	PCIe2 LP 2-port 10 GbE RoCE SR adapter (FC EL2Z; CCIN EC29); Adapter FRU number: 00E1600
EL38[2]	PCIe3 LP 4-port (10 Gb FCoE, 1 GbE) SFP+ Adapter (FC EL38, CCIN 2B93); Adapter FRU number: 000E9284
EL39[2]	PCIe LP 2-Port 10 GbE SFN6122F Adapter (FC EL39; CCIN EC2G); Adapter FRU number: 00E8224
EL3B[2]	PCIe3 LP RAID SAS Adapter (FC EL3B; CCIN 57B4); Adapter FRU number: 000MH910
EL3C [2]	PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EL3C; CCIN 2CC1); Adapter FRU number: 00E8140
EL3D[2]	PCIe3 LP 2-port 56 Gb FDR IB Adapter x16 (FC EL3D; CCIN 2CE7); Adapter FRU number: 00RX852
EL3U[2]	PCIe3 x8 cache SAS RAID internal adapter 6 Gb (FC EL3U; CCIN 57D8)
EL3V[2]	PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EL3V; CCIN 57D7)
EL3W	PCIe3 x8 cache SAS RAID internal adapter 6 Gb (FC EL3W; CCIN 57DC) in the IBM Elastic Storage Server
EL3X[2]	PCIe3 LP 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EL3X; CCIN 57BC); Adapter FRU number: 0RX859; Low-profile tailstock: 00RX856
EL3Z[2]	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter (FC EL3Z; CCIN 2CC4); Adapter FRU number: 00E2714; Full-height tailstock part number: 00E2862; Low-profile tailstock part number: 00E2721
EL40[2]	PCIe3 LP 2-port 10 GbE NIC and RoCE SR Adapter (FC EL40; CCIN 57BE); Adapter FRU number: 00RX875
EL4M[1]	PCIe2 4-port 1 GbE Adapter (FC EL4L and EL4M; CCIN 576F); Adapter FRU number: 74Y4064
EL5Y[1]	PCIe2 8 Gb 2-Port Fibre Channel Adapter (FC EL5Y and EL5Z; CCIN 578D); Adapter FRU number: 00WT111
EL60[2]	PCIe3 LP 4 x8 SAS Port Adapter (FC EJ60; CCIN 57B4); Adapter FRU number: 000MH910

Table 4. PCIe adapters supported in the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A system that is running the AIX, IBM i, or Linux operating system (continued)

Feature code	Description, FC, CCIN, and adapter FRU number
EN0B	PCIe3 LP 16 Gb 2-port Fibre Channel Adapter (FC EN0B; CCIN 577F); Adapter FRU number: 000E9283
EN0F	PCIe2 8Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D); Adapter FRU number: 00WT111
EN0J[1]	PCIe3 LP 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0J, CCIN 2B93); Adapter FRU number: 00E3498
EN0L[1]	PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0L; CCIN 2CC1)Adapter FRU number: 00E3502
EN0N[1]	PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0N; CCIN 2CC0); Adapter FRU number: 00E8143; low-profile tailstock part number: 00E8163
EN0T	PCIe2 LP 4-port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0T; CCIN 2CC3); Adapter FRU number: 00E2715; Low-profile tailstock (PN): 00E2720
EN0V	PCIe2 LP 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0V; CCIN 2CC3); Adapter FRU number: 00E2715; low-profile tailstock: 00E2720
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EN0W; CCIN 2CC4); Adapter FRU number: 00E2714
EN0X	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter (FC EN0X; CCIN 2CC4); Adapter FRU number: 00E2714; low-profile tailstock part number: 00E2721
EN0Y[1]	PCIe2 LP 8 Gb 4-port Fibre Channel Adapter (FC EN0Y; CCIN EN0Y); Adapter FRU number: 74Y3923
EN12[1]	PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12; CCIN EN0Y); Adapter FRU number 00WT107
EN28[1]	PCIe 2-port Async EIA-232 LP Adapter (FC EN28; CCIN 57D4); Adapter FRU number 000ND487
ESA4[1]	LSI SAS 9206-16E 6 Gbps host bus adapter (FC ESA4) in the IBM Elastic Storage Server; Adapter FRU number: 00MH942

[1]Adapter supported only for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, and 8284-22A. Adapter not supported for the 8284-21A.

[2]Adapter supported only on the 8247-21L or 8247-22L.

[3]Adapter supported only on the 8284-21A and 8284-22A.

[4]The adapters FCs EC2M and EC37 are not supported in the 8284-22A system with processor card FCs ELPF and EPXL.

Managing PCIe adapters for the 8247-42L, 8286-41A, or 8286-42A system

Learn about the PCIe adapters that can be used with the IBM Power System S824L (8247-42L), IBM Power System S814 (8286-41A), and the IBM Power System S824 (8286-42A).

Overview of managing PCIe adapters for the 8247-42L, 8286-41A, or 8286-42A sytem

Learn how to use and manage Peripheral Component Interconnect (PCI) Express (PCIe) adapters adapters for the IBM Power System S824L (8247-42L), IBM Power System S814 (8286-41A), and the IBM Power System S824 (8286-42A). Find general information about Peripheral Component Interconnect (PCI) Express (PCIe) adapters, related publications, safety information, and handling static sensitive devices.

The following features are electromagnetic compatibility (EMC) Class B features. See the Class B Notices in the Hardware Notices section.

Table 5. Electromagnetic compatibility (EMC) Class B features

Feature	Description
5717	4-port 10/100/1000 Base-TX PCI Express Adapter
5748	POWER GXT145 PCI Express Graphics Accelerator
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter
5768	2-port Gb Ethernet-SX PCI Express Adapter
5769	10 Gb Ethernet-SR PCI Express Adapter
5785	4 Port Async EIA-232 PCIe Adapter
EC2J	PCIe 2-Port 10 GbE SFN6122F Adapter
EC42	PCIe2 3D Graphics Adapter x1
EC47	PCIe gen3 x16 GPU Adapter
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter

The adapter information that is shown here is used during non-directed service activities. The information can be used to:
- Identify an adapter
- Find specific technical information about an adapter
- Where applicable, show special installation or cabling instructions
- Show signal names for the output-pins of the adapter connectors
- Where applicable, show the settings for switches or jumpers

Adapters can be identified by their feature code (FC) or their custom-card identification number (CCIN). Normally, the CCIN number is labeled on the adapter. The field replaceable unit (FRU) part number (P/N) of your adapter might not match the FRU P/N listed in this information. If the part numbers do not match, verify that the CCIN is the same. If the CCIN is same, the adapter has the same function and can be used in the same way.

Adapters must be placed in specific PCI Express (PCIe) slots to function correctly or optimally.

SAS RAID cards

Find information about the SAS RAID cards that are installed in the system. Also, find information about the SAS RAID controllers that are supported in the system.

Table 6 provides information about the SAS RAID cards that are supported for an 8247-42L, 8286-41A, or 8286-42A system.

Table 6. SAS RAID Controllers supported

Feature Code (FC)	Description	Function
FC EJ0N (CCIN 57D7)	one SAS RAID Controller card	Provides just a bunch of disks (JBOD) or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8247-42L, 8286-41A, or 8286-42A system.
FC EJ0S (CCIN 57D7)	Split Disk - two SAS RAID Controller cards	FC EJ0S can be used to split the disk backplane into two sets of six disks. Provides JBOD or in SAS RAID 0, 5, 6, and 10, functions for the attached disk drives in the base function 8286-41A or 8286-42A system.

Table 6. SAS RAID Controllers supported (continued)

Feature Code (FC)	Description	Function
FC EJ0P (CCIN 57D8)	Dual high performance SAS RAID Controller cards	FC EJ0P is used with the expanded function disk backplane to support up to 18 small form-factor disk drives or solid-state drives and up to 8 1.8 inch form-factor solid state drives. Provides SAS RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2 functions depending on the Operating System support for the attached disk drives in the expanded function 8286-41A or 8286-42A system. Provides two external SAS ports that can be used to connect one external FC 5887. **Note:** The SAS YO cable that is used to attach a FC 5887 disk drive enclosure to the rear SAS ports of system models 8286-41A or 8286-42A must not exceed the maximum supported length of 3 meters.
FC EJ0L (CCIN 57CE)	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC EJ0J (CCIN 57B4)	PCIe3 RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5805	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5901	PCIe Dual x4 SAS adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC ESA3 (CCIN 57BB)	PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6Gb	The SAS RAID controller can be used to connect to an external FC 5887.

For more information about the SAS RAID controllers, see the following topics:

- SAS RAID controllers for AIX.
- SAS RAID controllers for IBM i.
- SAS RAID controllers for Linux.

PCIe adapter information by feature type for the 8247-42L, 8286-41A, or 8286-42A

Find technical information for specific adapters that are supported for the system. Adapters can be identified by their feature code (FC) or their custom card identification number (CCIN).

Table 7. PCIe adapters supported in the 8247-42L, 8286-41A, or 8286-42A system that is running the AIX, IBM i, or Linux operating system

Feature code details	Description
2893 and 2894	PCI Express 2-Line WAN with Modem (FC 2893 and FC 2894; CCIN 576C); Adapter FRU number: 44V5323
4807	PCIe Cryptographic Coprocessor (FC 4807; CCIN 4765); Adapter FRU number: 45D7948
5285[1]	PCIe2 2-port 4X InfiniBand QDR Adapter (FC 5285; CCIN 58E2); Adapter FRU number: 74Y2987
5287	PCIe2 2-port 10 GbE SR Adapter (FC 5287; CCIN 5287); Adapter FRU number: 74Y3457
5287	PCIe 2-port Async EIA-232 PCIe 1X LPC Adapter (FC 5289; CCIN 57D4); Adapter FRU number: 74Y4084
5708	PCIe 10 Gb FCoE 2-port Adapter (FC 5708; CCIN 2B3B)
5717	4-port 10/100/1000 Base-TX PCI Express Adapter (FC 5717; CCIN 5217); Adapter FRU number: 46Y3512
5729	PCIe2 FH 4-port 8 Gb74Y3467 Fibre Channel Adapter (FC 5729; CCIN 5729); Adapter FRU number: 74Y3467

Table 7. PCIe adapters supported in the 8247-42L, 8286-41A, or 8286-42A system that is running the AIX, IBM i, or Linux operating system (continued)

Feature code details	Description
5735	8 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5735; CCIN 577D); Adapter FRU number: 10N9824
5744	PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5744; CCIN 2B44); Adapter FRU number: 74Y1987
5748	POWER GXT145 PCI Express Graphics Accelerator (FC 5748; CCIN 5748); Adapter FRU number: 10N7756
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter (FC 5767; CCIN 5767); Adapter FRU number: 46K6601
5768	2-port Gigabit Ethernet-SX PCI Express Adapter (FC 5768; CCIN 5768); Adapter FRU number: 10N6846
5769	10 Gb Ethernet-SR PCI Express Adapter (FC 5769; CCIN 5769); Adapter FRU number: 46K7897
5772	10 Gb Ethernet-LR PCI Express Adapter (FC 5772; CCIN 576E); Adapter FRU number: 10N9034
5774	4 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5774; CCIN 5774); Adapter FRU number: 10N7255
5785	4-port Async EIA-232 PCIe Adapter (FC 5785; CCIN 57D2); Adapter FRU number: 46K6734
5805	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter (FC 5805; CCIN 574E); Adapter FRU number: 46K4735
5899	PCIe2 4-port 1 GbE Adapter (FC 5899; CCIN 576F); Adapter FRU number: 74Y4064
5901	PCIe Dual - x4 SAS Adapter (FC 5901; CCIN 57B3); Adapter FRU number: 44V4852
5913	PCIe2 1.8 GB Cache RAID SAS Tri-port 6 Gb Adapter (FC 5913; CCIN 57B5); Adapter FRU number: 00J0596
EC28	PCIe2 2-port 10 GbE RoCE SFP+ adapter (FC EC28; CCIN EC27); Adapter FRU number: 000E1491
EC2J	PCIe 2-Port 10 GbE SFN6122F Adapter (FC EC2J; CCIN EC2G); Adapter FRU number: 00E8224
EC2N	PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EC2N; CCIN 57BE); Adapter FRU number: 00RX875
EC30	PCIe2 FH 2-port 10 GbE RoCE SR adapter (FC EC30; CCIN EC29); Adapter FRU number: 00E1601
EC38	PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC38; CCIN 57BC); Adapter FRU number: 00RX859
EC3B	PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3B; CCIN 57BD); Adapter FRU number: 00FW105
EC3F	PCIe3 2-port 100 Gb EDR IB Adapter x16 (FC EC3E and EC3F; CCIN 2CEA); Adapter FRU number: 00WT075
EC3M	PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter (EC3M; CCIN 2CEC); Adapter FRU number: 00WT078
EC3U	PCIe3 1-port 100 Gb EDR Infiniband Adapter x16 (FC EC3U; CCIN 2CEB) Adapter FRU number: 00WT013
EC42	PCIe2 3D Graphics Adapter x1 (FC EC42); Adapter FRU number: 00E3980
EC46	PCIe2 4-port USB 3.0 Adapter (FC EC46; CCIN 58F9); Adapter FRU number: 00E2932
EC47[1]	PCIe gen3 x16 GPU Adapter (FC EC47; CCIN 2CE8); Adapter FRU number: 01AF012
EC4B[1]	PCIe gen3 x16 GPU Adapter (FC EC4B; CCIN 2CE9); Adapter FRU number: 00RR999

Table 7. PCIe adapters supported in the 8247-42L, 8286-41A, or 8286-42A system that is running the AIX, IBM i, or Linux operating system (continued)

Feature code details	Description
EC55	PCIe3 1.6 TB NVMe Flash Adapter (FC EC54 and EC55; CCIN 58CB); Adapter FRU number: 00MH991
EC57	PCIe3 3.2 TB NVMe Flash Adapter (FC EC56 and EC57; CCIN 58CC); Adapter FRU number: 00MH993
EJ08	PCIe3 cable adapter that is used to connect your system to the EMX0 PCIe3 expansion drawer (FC EJ08; CCIN 2CE2); Adapter FRU number: 041T9901
EJ0J	PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EJ0J; CCIN 57B4); Adapter FRU number: 000FX846
EJ0L	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter (FC EJ0L; CCIN 57CE); Adapter FRU number: 00FX840
EJ0N and EJ0S	PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EJ0N and FC EJ0S; CCIN 57D7); Adapter FRU number: 00MH908
EJ0P	PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EJ0P; CCIN 57D8); Adapter FRU number: 00MA020
EJ0Z	SAS ports and cabling for dual IOA backplane • Two SAS ports and internal SAS cables • Requires slot P1-C11
EJ10	PCIe3 4 x8 SAS Port Adapter (FC EJ10; CCIN 57B4); Adapter FRU number: 00RR793 for 8408-44E or 8408-E8E and 00MH959 for all other machine type models
EJ12	PCIe3 FPGA Compression Accelerator Adapter (FC EJ12; CCIN 59AB); Adapter FRU number: 000NK006
EJ14	PCIe3 12 GB Cache RAID PLUS SAS Adapter Quad-port 6 Gb x8 (FC EJ14; CCIN 57B1); Adapter FRU number 01DH742
EJ17	PCIe3 CAPI FlashSystem Accelerator Adapter (FC EJ17); Adapter FRU number: 00NK025
EJ1P	PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter (FC EJ1P and EJ1N; CCIN 57B3); Adapter FRU:44V4852
EJ27	PCIe Cryptographic Coprocessor (FC EJ27; CCIN 4765); Adapter FRU number: 45D7948
EJ32	4767-001 Cryptographic Coprocessor (FC EJ32 and EJ33; CCIN 4767)
EL4L	PCIe2 4-port 1 GbE Adapter (FC EL4L and EL4M; CCIN 576F); Adapter FRU number: 74Y4064
EL50[1]	PCIe3 2-port 56 Gb FDR IB Adapter x16 (FC EL50; CCIN 2CE7); Adapter FRU number: 00RX852
EL53[1]	PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EL53; CCIN 57BC); Adapter FRU number: 00RX859; Low-profile tailstock: 00RX856
EL54[1]	PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EL54; CCIN 57BE); Adapter FRU number: 00RX875
EL55[1]	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EL55; CCIN 2CC4); Adapter FRU number: 00E2714
EL56[1]	PCIe2 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EL56, CCIN 2B93); Adapter FRU number: 00E3498
EL57[1]	PCIe2 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EL57; CCIN 2CC1); Adapter FRU number: 00E8140
EL58[1]	8 Gb PCI Express Dual-port Fibre Channel Adapter (FC EL58; CCIN 577D); Adapter FRU number: 10N9824

Feature code details	Description
EL59[1]	PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EL59; CCIN 57B4); Adapter FRU number: 000E9284
EL5B[1]	PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EL5B; CCIN 577F); Adapter FRU number: 00E3496
EN0A	PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EN0A; CCIN 577F); Adapter FRU number: 00E3496
EN0G	PCIe2 8Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D); Adapter FRU number: 00WT111
EN0H	PCIe3 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0H; CCIN 2B93); Adapter FRU number: 00E3498
EN0K	PCIe3 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0K; CCIN 2CC1); Adapter FRU number: 00E8140
EN0M	PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0M; CCIN 2CC0); Adapter FRU number: 00E8144
EN0S[1]	PCIe2 4-port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0S; CCIN 2CC3); Adapter FRU number: 00E2715; Part number (Full-height tailstock): 00E2863; Part number (Low-profile tailstock): 00E2720
EN0U	PCIe2 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0U; CCIN 2CC3); Adapter FRU number: 00E2715; low-profile tailstock: 00E2720
EN0W[1]	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EN0W; CCIN 2CC4); Adapter FRU number: 00E2714
EN12	PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12; CCIN EN0Y); Adapter FRU number 00WT107
EN13 and EN14	PCIe Binary Synchronous Adapter (FC EN13 and FC EN14; CCIN 576C)
EN15	PCIe3 4-port 10 GbE SR Adapter (FC EN15; CCIN 2CE3); Adapter FRU number: 00ND466; full-height tailstock: 00ND462
EN17	PCIe3 4-port 10 GbE SFP+ Copper Adapter (FC EN17, CCIN 2CE4); Adapter FRU number: 00ND463; full-height tailstock part number: 00ND465
EN27	PCIe 2-port Async EIA-232 Adapter (FC EN27; CCIN 57D4); Adapter FRU number: 000ND487
EN29	PCIe 2-port Async EIA-232 LP Adapter (FC EN29; CCIN 57D4); adapter FRU number 000ND487
ESA3	PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6 Gb (FC ESA3; CCIN 57BB); Adapter FRU number: 74Y7131
[1]Adapter only supported on the 8247-42L system.	

Managing PCIe adapters for the 8408-44E or 8408-E8E system

Learn about the PCIe adapters that can be used with the IBM Power System E850 (8408-44E and 8408-E8E).

Overview of managing PCIe adapters for the 8408-44E or 8408-E8E system

Learn how to use and manage Peripheral Component Interconnect (PCI) Express (PCIe) adapters adapters for the IBM Power System E850 (8408-44E and 8408-E8E). Find general information about Peripheral Component Interconnect (PCI) Express (PCIe) adapters, related publications, safety information, and handling static sensitive devices.

The following features are electromagnetic compatibility (EMC) Class B features. See the Class B Notices in the Hardware Notices section.

Table 8. Electromagnetic compatibility (EMC) Class B features

Feature	Description
5717	4-port 10/100/1000 Base-TX PCI Express Adapter
5748	POWER GXT145 PCI Express Graphics Accelerator
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter
5768	2-port Gb Ethernet-SX PCI Express Adapter
5769	10 Gb Ethernet-SR PCI Express Adapter
5785	4 Port Async EIA-232 PCIe Adapter
EC42	PCIe2 3D Graphics Adapter x1
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter

The adapter information that is shown here is used during non-directed service activities. The information can be used to:
* Identify an adapter
* Find specific technical information about an adapter
* Where applicable, show special installation or cabling instructions
* Show signal names for the output-pins of the adapter connectors
* Where applicable, show the settings for switches or jumpers

Adapters can be identified by their feature code (FC) or their custom-card identification number (CCIN). Normally, the CCIN number is labeled on the adapter. The field replaceable unit (FRU) part number (P/N) of your adapter might not match the FRU P/N listed in this information. If the part numbers do not match, verify that the CCIN is the same. If the CCIN is same, the adapter has the same function and can be used in the same way.

Adapters must be placed in specific PCI Express (PCIe) slots to function correctly or optimally.

SAS RAID cards
Find information about the SAS RAID cards that are installed in the system. Also, find information about the SAS RAID controllers that are supported in the system.

Table 9 provides information about the SAS RAID cards that are supported for an 8408-E8E system.

Table 9. SAS RAID Controllers supported.

Feature Code (FC)	Description	Function
FC EPVN (CCIN 2CCA)	Storage backplane with dual integrated SAS RAID Controller cards with write cache	FC EPVP supports 8 SFF-3 SAS bays, 4 1.8-inch SSD bays, and a slimline DVD bay. The bays are controlled by dual integrated SAS RAID controllers with effectively 7.2 GB of write cache and do not use PCIe slots. Dual controllers provide controller redundancy for the SFF-3 SAS and SSD bays. Provides SAS RAID 0, 1, 10, 5, 6, 5T2, 6T2, and 10T2 functions for the attached disk drives in the 8408-E8E system.

Table 9. SAS RAID Controllers supported (continued).

Feature Code (FC)	Description	Function
FC EPVP (CCIN 2CD2)	Storage backplane with dual integrated SAS RAID Controller cards without write cache	FC EPVP supports 8 SFF-3 SAS bays, 4 1.8-inch SSD bays, and a slimline DVD bay. The bays are controlled by dual integrated SAS RAID controllers and do not use PCIe slots. The controllers do not have write cache, but do provide controller redundancy for the SFF-3 SAS and SSD bays. Provides SAS RAID 0, 1, 10, 5, 6, 5T2, 6T2, and 10T2 functions for the attached disk drives in the 8408-E8E system.
FC EPVQ (CCIN 2CCD)	Split storage backplane with 2 integrated SAS RAID Controller cards without write cache	FC EPVQ supports 8 SFF-3 SAS bays, 4 1.8-inch SSD bays, and a slimline DVD bay. The bays are controlled by 2 integrated SAS RAID controllers and do not use PCIe slots. The controllers do not have write cache. Each controller runs 4 SFF-3 SAS bays and 2 1.8-inch SSD bays. Provides JBOD or in SAS RAID 0, 1, 10, 5, 6, and 10T2 functions for the attached disk drives in the 8408-E8E system.
FC EJ0L (CCIN 57CE)	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC EJ0J (CCIN 57B4)	PCIe3 RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5901	PCIe Dual x4 SAS adapter	The SAS RAID controller can be used to connect to an external FC 5887.

For more information about the SAS RAID controllers, see the following topics:

- SAS RAID controllers for AIX.
- SAS RAID controllers for IBM i.
- SAS RAID controllers for Linux.

PCIe adapter information by feature type for the 8408-44E or 8408-E8E

Find technical information for specific adapters that are supported for the system. Adapters can be identified by their feature code (FC) or their custom card identification number (CCIN).

Table 10. PCIe adapters supported in the 8408-44E or 8408-E8E system.

Feature code	Description
5285	PCIe2 2-port 4X InfiniBand QDR Adapter (FC 5285; CCIN 58E2); Adapter FRU number: 74Y2987
5287	PCIe2 2-port 10 GbE SR Adapter (FC 5287; CCIN 5287); Adapter FRU number: 74Y3457
5708	PCIe 10 Gb FCoE 2-port Adapter (FC 5708; CCIN 2B3B)
5717	4-port 10/100/1000 Base-TX PCI Express Adapter (FC 5717; CCIN 5217); Adapter FRU number: 46Y3512
5729	PCIe2 FH 4-port 8 Gb74Y3467 Fibre Channel Adapter (FC 5729; CCIN 5729); Adapter FRU number: 74Y3467
5735	8 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5735; CCIN 577D); Adapter FRU number: 10N9824
5744	PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5744; CCIN 2B44); Adapter FRU number: 74Y1987
5748	POWER GXT145 PCI Express Graphics Accelerator (FC 5748; CCIN 5748); Adapter FRU number: 10N7756

Table 10. PCIe adapters supported in the 8408-44E or 8408-E8E system (continued).

Feature code	Description
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter (FC 5767; CCIN 5767); Adapter FRU number: 46K6601
5768	2-port Gigabit Ethernet-SX PCI Express Adapter (FC 5768; CCIN 5768); Adapter FRU number: 10N6846
5769	10 Gb Ethernet-SR PCI Express Adapter (FC 5769; CCIN 5769); Adapter FRU number: 46K7897
5774	4 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5774; CCIN 5774); Adapter FRU number: 10N7255
5785	4-port Async EIA-232 PCIe Adapter (FC 5785; CCIN 57D2); Adapter FRU number: 46K6734
5899	PCIe2 4-port 1 GbE Adapter (FC 5899; CCIN 576F); Adapter FRU number: 74Y4064
5901	PCIe Dual - x4 SAS Adapter (FC 5901; CCIN 57B3); Adapter FRU number: 44V4852
EC2N	PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EC2N; CCIN 57BE); Adapter FRU number: 00RX875
EC30	PCIe2 FH 2-port 10 GbE RoCE SR adapter (FC EC30; CCIN EC29); Adapter FRU number: 00E1601
EC38	PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC38; CCIN 57BC); Adapter FRU number: 00RX859
EC3B	PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3B; CCIN 57BD); Adapter FRU number: 00FW105
EC3F	PCIe3 2-port 100 Gb EDR IB Adapter x16 (FC EC3E and EC3F; CCIN 2CEA); Adapter FRU number: 00WT075
EC3U	PCIe3 1-port 100 Gb EDR Infiniband Adapter x16 (FC EC3U; CCIN 2CEB) Adapter FRU number: 00WT013
EC3M	PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter (FC EC3L and EC3M; CCIN 2CEC); Adapter FRU number: 00WT078
EC42	PCIe2 3D Graphics Adapter x1 (FC EC42); Adapter FRU number: 00E3980
EC46	PCIe2 4-port USB 3.0 Adapter (FC EC46; CCIN 58F9); Adapter FRU number: 00E2932
EJ08	PCIe3 cable adapter that is used to connect your system to the EMX0 PCIe3 expansion drawer (FC EJ08; CCIN 2CE2); Adapter FRU number: 041T9901
EJ0J	PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EJ0J; CCIN 57B4); Adapter FRU number: 000FX846
EJ0L	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter (FC EJ0L; CCIN 57CE); Adapter FRU number: 00FX840
EJ10	PCIe3 4 x8 SAS Port Adapter (FC EJ10; CCIN 57B4); Adapter FRU number: 00RR793 for 8408-44E or 8408-E8E and 00MH959 for all other machine type models
EJ14	PCIe3 12 GB Cache RAID PLUS SAS Adapter Quad-port 6 Gb x8 (FC EJ14; CCIN 57B1); Adapter FRU number 01DH742
EJ1P	PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter (FC EJ1P; CCIN 57B3); Adapter FRU:44V4852
EJ27	PCIe Cryptographic Coprocessor (FC EJ27, FC EJ28, and FC EJ29; CCIN 476A); Adapter FRU number: 45D7948
EJ27, EJ28, and EJ29	PCIe Cryptographic Coprocessor (FC EJ27, FC EJ28, and FC EJ29; CCIN 476A); Adapter FRU number: 45D7948
EJ32	4767-001 Cryptographic Coprocessor (FC EJ32 and EJ33; CCIN 4767)
EN0A	PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EN0A; CCIN 577F); Adapter FRU number: 00E3496

Feature code	Description
EN0G	PCIe2 8Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D); Adapter FRU number: 00WT111
EN0H	PCIe3 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0H; CCIN 2B93); Adapter FRU number: 00E3498
EN0K	PCIe3 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0K; CCIN 2CC1); Adapter FRU number: 00E8140
EN0M	PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0M; CCIN 2CC0); Adapter FRU number: 00E8144
EN0S	PCIe2 4-port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0S; CCIN 2CC3); Adapter FRU number: 00E2715; Part number (Full-height tailstock): 00E2863; Part number (Low-profile tailstock): 00E2720
EN0U	PCIe2 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0U; CCIN 2CC3); Adapter FRU number: 00E2715; low-profile tailstock: 00E2720
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EN0W; CCIN 2CC4); Adapter FRU number: 00E2714
EN12	PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12; CCIN EN0Y); Adapter FRU number 00WT107
EN15	PCIe3 4-port 10 GbE SR Adapter (FC EN15; CCIN 2CE3); Adapter FRU number: 00ND466; full-height tailstock: 00ND462
EN17	PCIe3 4-port 10 GbE SFP+ Copper Adapter (FC EN17, CCIN 2CE4); Adapter FRU number: 00ND463; full-height tailstock part number: 00ND465
EN27	PCIe 2-port Async EIA-232 Adapter (FC EN27; CCIN 57D4); Adapter FRU number: 000ND487

Managing PCIe adapters for the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system

Learn about the PCIe adapters that can be used with the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system.

Overview of managing PCIe adapters for the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system

Learn how to use and manage Peripheral Component Interconnect (PCI) Express (PCIe) adapters adapters. Find general information about Peripheral Component Interconnect (PCI) Express (PCIe) adapters, related publications, safety information, and handling static sensitive devices.

The following features are electromagnetic compatibility (EMC) Class B features. See the Class B Notices in the Hardware Notices section.

Table 11. Electromagnetic compatibility (EMC) Class B features

Feature	Description
5717	4-port 10/100/1000 Base-TX PCI Express Adapter
5748	POWER GXT145 PCI Express Graphics Accelerator
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter
5768	2-port Gb Ethernet-SX PCI Express Adapter
5769	10 Gb Ethernet-SR PCI Express Adapter
5772	10 Gb Ethernet-LR PCI Express Adapter
5785	4 Port Async EIA-232 PCIe Adapter

Table 11. Electromagnetic compatibility (EMC) Class B features (continued)

Feature	Description
EC2G	PCIe LP 2-Port 10 GbE SFN6122F Adapter
EC41	PCIe2 LP 3D Graphics Adapter x1
EC42	PCIe2 3D Graphics Adapter x1
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter
EN0X	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter

The adapter information that is shown here is used during non-directed service activities. The information can be used to:
- Identify an adapter
- Find specific technical information about an adapter
- Where applicable, show special installation or cabling instructions
- Show signal names for the output-pins of the adapter connectors
- Where applicable, show the settings for switches or jumpers

Adapters can be identified by their feature code (FC) or their custom-card identification number (CCIN). Normally, the CCIN number is labeled on the adapter. The field replaceable unit (FRU) part number (P/N) of your adapter might not match the FRU P/N listed in this information. If the part numbers do not match, verify that the CCIN is the same. If the CCIN is same, the adapter has the same function and can be used in the same way.

Adapters must be placed in specific PCI Express (PCIe) slots to function correctly or optimally.

SAS RAID cards
Find information about the SAS RAID cards that are installed in the system. Also, find information about the SAS RAID controllers that are supported in the system.

Table 12 provides information about the SAS RAID cards that are supported for an 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system.

Table 12. SAS RAID controllers supported

Feature Code (FC)	Description	Function
FC EJ0L (CCIN 57CE)	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC EJ0J (CCIN 57B4)	PCIe3 RAID SAS quad-port 6 Gb Adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5805	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC 5901	PCIe Dual x4 SAS adapter	The SAS RAID controller can be used to connect to an external FC 5887.
FC ESA3 (CCIN 57BB)	PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6Gb	The SAS RAID controller can be used to connect to an external FC 5887.

For more information about the SAS RAID controllers, see the following topics:
- SAS RAID controllers for AIX.
- SAS RAID controllers for IBM i.
- SAS RAID controllers for Linux.

PCIe adapter information by feature type for the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME

Find technical information for specific adapters that are supported for the system. Adapters can be identified by their feature code (FC) or their custom card identification number (CCIN).

Table 13. PCIe adapters supported in the 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME system

Feature code	Description
2893 and 2894	PCI Express 2-Line WAN with Modem (FC 2893 and FC 2894; CCIN 576C); Adapter FRU number: 44V5323
5260	PCIe2 LP 4-port 1 GbE Adapter (FC 5260; CCIN 576F); Adapter FRU number: 74Y4064
5269	POWER GXT145 PCI Express Graphics Accelerator (FC 5269; CCIN 5269); Adapter FRU number: 74Y3227
5270	10 Gb FCoE PCIe Dual-port Adapter (FC 5270; CCIN 2B3B); Adapter FRU number: 46K8088
5271	4-port 10/100/1000 Base-TX PCI Express Adapter (FC 5271; CCIN 5717); Adapter FRU number: 46Y3512
5273	PCIe2 8 Gb Dual-port Fibre Channel Adapter (FC 5273; CCIN 577D); Adapter FRU number: 10N9824
5274	2-port Gb Ethernet-SX PCI Express Adapter (FC 5274; CCIN 5768); Adapter FRU number: 10N6846
5275	10 Gb Ethernet-SR PCI Express Adapter (FC 5275; CCIN 5275); Adapter FRU number: 46K7897
5276	4-Gb PCI Express Dual-port Fibre Channel Adapter (FC 5276; CCIN 5774); Adapter FRU number: 10N7255
5277	4-port Async EIA-232 PCIe 1X LP Adapter (FC 5277; CCIN 57D2); adapter FRU number 46K6734
5280	PCIe2 LP 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5280; CCIN 2B54); Adapter FRU number 74Y1988
5281	1 Gb Ethernet UTP 2-port PCIe Adapter (FC 5281; CCIN 5767); Adapter FRU number: 46K6601
5283	PCIe2 LP 2-port 4X InfiniBand QDR Adapter (FC 5283; CCIN 58E2); Adapter FRU number: 74Y2987
5284	PCIe2 LP 2-port 10 GbE SR Adapter (FC 5284; CCIN 5287); Adapter FRU number: 74Y3242
5744	PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5744; CCIN 2B44); Adapter FRU number: 74Y1987
5805	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter (FC 5805; CCIN 574E); Adapter FRU number: 46K4735
EC27	PCIe2 LP 2-port 10 GbE RoCE SFP+ adapter (FC EC27; CCIN EC27); Adapter FRU number: 000E1493
EC29	PCIe2 LP 2-port 10 GbE RoCE SR adapter (FC EC29; CCIN EC29); Adapter FRU number: 00E1600
EC2G	PCIe LP 2-Port 10 GbE SFN6122F Adapter (FC EC2G; CCIN EC2G); Adapter FRU number: 00E8224
EC2M	PCIe3 LP 2-port 10 GbE NIC and RoCE SR adapter (FC EC2M; CCIN 57BE); Adapter FRU number: 00RX875, low-profile tailstock: 00RX872
EC37	PCIe3 LP 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC37; CCIN 57BC); Adapter FRU number: 00RX859
EC3A	PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3A; CCIN 57BD); Adapter FRU number: 00FW105

Feature code	Description
EC3E	PCIe3 2-port 100 Gb EDR IB Adapter x16 (FC EC3E and EC3F; CCIN 2CEA); Adapter FRU number: 00WT075
EC3L	PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter (FC EC3L and EC3M; CCIN 2CEC); Adapter FRU number: 00WT078
EC3T	PCIe3 LP 1-port 100 Gb EDR InfiniBand Adapter x16 (FC EC3T; CCIN 2CEB) Adapter FRU number: 00WT013
EC41	PCIe2 LP 3D Graphics Adapter x1 (FC EC41); Adapter FRU number: 00E3980
EC45	PCIe2 LP 4-port USB 3.0 Adapter (FC EC45; CCIN 58F9); Adapter FRU number: 00E2932; low-profile tailstock part number: 00E2934
EC54	PCIe3 1.6 TB NVMe Flash Adapter (FC EC54 and EC55; CCIN 58CB); Adapter FRU number: 00MH991
EC56	PCIe3 3.2 TB NVMe Flash Adapter (FC EC56 and EC57; CCIN 58CC); Adapter FRU number: 00MH993
EJ07	PCIe3 cable adapter for the PCIe3 expansion drawer (FC EJ07; CCIN 6B52); Adapter FRU number: 00TK704
EJ0M	PCIe3 RAID SAS quad-port 6 Gb LP Adapter (FC EJ0M; CCIN 57B4); Adapter FRU number: 000MH910
EJ11	PCIe3 LP 4 x8 SAS Port Adapter (FC EJ11; CCIN 57B4); Adapter FRU number: 000MH910
EJ14	PCIe3 12 GB Cache RAID PLUS SAS Adapter Quad-port 6 Gb x8 (FC EJ14; CCIN 57B1); Adapter FRU number 01DH742mm
EJ18	PCIe3 LP CAPI FlashSystem Accelerator Adapter (FC EJ18); Adapter FRU number: 00NK025
EJ1P	PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter (FC EJ1P; CCIN 57B3); Adapter FRU:44V4852
EJ32	4767-001 Cryptographic Coprocessor (FC EJ32 and EJ33; CCIN 4767)
EL4M	PCIe2 4-port 1 GbE Adapter (FC EL4L and EL4M; CCIN 576F); Adapter FRU number: 74Y4064
EN0B	PCIe3 LP 16 Gb 2-port Fibre Channel Adapter (FC EN0B; CCIN 577F); Adapter FRU number: 000E9283
EN0F	PCIe2 8Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D); Adapter FRU number: 00WT111
EN0J	PCIe3 LP 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0J, CCIN 2B93); Adapter FRU number: 00E3498
EN0L	PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0L; CCIN 2CC1)Adapter FRU number: 00E3502
EN0M	PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0M; CCIN 2CC0); Adapter FRU number: 00E8144
EN0N	PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0N; CCIN 2CC0); Adapter FRU number: 00E8143; low-profile tailstock part number: 00E8163
EN0T	PCIe2 LP 4-port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0T; CCIN 2CC3); Adapter FRU number: 00E2715; Low-profile tailstock (PN): 00E2720
EN0V	PCIe2 LP 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0V; CCIN 2CC3); Adapter FRU number: 00E2715; low-profile tailstock: 00E2720
EN0X	PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter (FC EN0X; CCIN 2CC4); Adapter FRU number: 00E2714; low-profile tailstock part number: 00E2721

Feature code	Description
EN0Y	PCIe2 LP 8 Gb 4-port Fibre Channel Adapter (FC EN0Y; CCIN EN0Y); Adapter FRU number: 74Y3923
EN12	PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12; CCIN EN0Y); Adapter FRU number 00WT107
EN16	PCIe3 LPX 4-port 10 GbE SR Adapter (FC EN16; CCIN 2CE3)
EN18	PCIe3 LPX 4-port 10 GbE SFP+ Copper Adapter (FC EN18, CCIN 2CE4); Adapter FRU number: 00ND463
EN28	PCIe 2-port Async EIA-232 LP Adapter (FC EN28; CCIN 57D4); Adapter FRU number 000ND487
EN29	PCIe 2-port Async EIA-232 LP Adapter (FC EN29; CCIN 57D4); adapter FRU number 000ND487

PCIe adapter information by feature type for the EMX0 PCIe Gen3 I/O expansion drawer

Find technical information for specific adapters that are supported for the system. Adapters can be identified by their feature code (FC) or their custom card identification number (CCIN).

Table 14. Supported PCIe adapters in the EMX0 PCIe Gen3 I/O expansion drawer attached to a system that is running the AIX, IBM i, or Linux operating system.

Feature code details	Description
2893 and 2894	PCI Express 2-Line WAN with Modem (FC 2893 and FC 2894; CCIN 576C); Adapter FRU number: 44V5323
5279	PCIe2 LP 2x10 GbE SFP+ Copper 2x1 GbE UTP Adapter (FC 5279; CCIN 2B52); Adapter FRU number 74Y1986
5285	PCIe2 2-port 4X InfiniBand QDR Adapter (FC 5285; CCIN 58E2); Adapter FRU number: 74Y2987
5287	PCIe2 2-port 10 GbE SR Adapter (FC 5287; CCIN 5287); Adapter FRU number: 74Y3457
5708	PCIe 10 Gb FCoE 2-port Adapter (FC 5708; CCIN 2B3B)
5717	4-port 10/100/1000 Base-TX PCI Express Adapter (FC 5717; CCIN 5217); Adapter FRU number: 46Y3512
5729	PCIe2 FH 4-port 8 Gb74Y3467 Fibre Channel Adapter (FC 5729; CCIN 5729); Adapter FRU number: 74Y3467
5735	8 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5735; CCIN 577D); Adapter FRU number: 10N9824
5744	PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5744; CCIN 2B44); Adapter FRU number: 74Y1987
5748	POWER GXT145 PCI Express Graphics Accelerator (FC 5748; CCIN 5748); Adapter FRU number: 10N7756
5767	2-port 10/100/1000 Base-TX Ethernet PCI Express Adapter (FC 5767; CCIN 5767); Adapter FRU number: 46K6601
5768	2-port Gigabit Ethernet-SX PCI Express Adapter (FC 5768; CCIN 5768); Adapter FRU number: 10N6846
5769	10 Gb Ethernet-SR PCI Express Adapter (FC 5769; CCIN 5769); Adapter FRU number: 46K7897
5772	10 Gb Ethernet-LR PCI Express Adapter (FC 5772; CCIN 576E); Adapter FRU number: 10N9034

Table 14. Supported PCIe adapters in the EMX0 PCIe Gen3 I/O expansion drawer attached to a system that is running the AIX, IBM i, or Linux operating system (continued).

Feature code details	Description
5774	4 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5774; CCIN 5774); Adapter FRU number: 10N7255
5785	4-port Async EIA-232 PCIe Adapter (FC 5785; CCIN 57D2); Adapter FRU number: 46K6734
5805	PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter (FC 5805; CCIN 574E); Adapter FRU number: 46K4735
5899	PCIe2 4-port 1 GbE Adapter (FC 5899; CCIN 576F); Adapter FRU number: 74Y4064
5901	PCIe Dual - x4 SAS Adapter (FC 5901; CCIN 57B3); Adapter FRU number: 44V4852
5913	PCIe2 1.8 GB Cache RAID SAS Tri-port 6 Gb Adapter (FC 5913; CCIN 57B5); Adapter FRU number: 00J0596
EC28	PCIe2 2-port 10 GbE RoCE SFP+ adapter (FC EC28; CCIN EC27); Adapter FRU number: 000E1491
EC2J	PCIe 2-Port 10 GbE SFN6122F Adapter (FC EC2J; CCIN EC2G); Adapter FRU number: 00E8224
EC2N	PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EC2N; CCIN 57BE); Adapter FRU number: 00RX875
EC30	PCIe2 FH 2-port 10 GbE RoCE SR adapter (FC EC30; CCIN EC29); Adapter FRU number: 00E1601
EC38	PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC38; CCIN 57BC); Adapter FRU number: 00RX859
EC3B	PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3B; CCIN 57BD); Adapter FRU number: 00FW105
EC42	PCIe2 3D Graphics Adapter x1 (FC EC42); Adapter FRU number: 00E3980
EC46	PCIe2 4-port USB 3.0 Adapter (FC EC46; CCIN 58F9); Adapter FRU number: 00E2932
EJ0J	PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EJ0J; CCIN 57B4); Adapter FRU number: 000FX846
EJ0L	PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter (FC EJ0L; CCIN 57CE); Adapter FRU number: 00FX840
EJ10	PCIe3 4 x8 SAS Port Adapter (FC EJ10; CCIN 57B4); Adapter FRU number: 00RR793 for 8408-44E or 8408-E8E and 00MH959 for all other machine type models
EJ27, EJ28, and EJ29	PCIe Cryptographic Coprocessor (FC EJ27, FC EJ28, and FC EJ29; CCIN 476A); Adapter FRU number: 45D7948
EJ33	4767-001 Cryptographic Coprocessor (FC EJ32 and EJ33; CCIN 4767)
EL53	PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EL53; CCIN 57BC); Adapter FRU number: 00RX859; Low-profile tailstock: 00RX856
EL54	PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EL54; CCIN 57BE); Adapter FRU number: 00RX875
EL55	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EL55; CCIN 2CC4); Adapter FRU number: 00E2714
EL56	PCIe2 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EL56, CCIN 2B93); Adapter FRU number: 00E3498
EL57	PCIe2 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EL57; CCIN 2CC1); Adapter FRU number: 00E8140
EL58	8 Gb PCI Express Dual-port Fibre Channel Adapter (FC EL58; CCIN 577D); Adapter FRU number: 10N9824

Table 14. Supported PCIe adapters in the EMX0 PCIe Gen3 I/O expansion drawer attached to a system that is running the AIX, IBM i, or Linux operating system (continued).

Feature code details	Description
EL59	PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EL59; CCIN 57B4); Adapter FRU number: 000E9284
EL5B	PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EL5B; CCIN 577F); Adapter FRU number: 00E3496
EN0A	PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EN0A; CCIN 577F); Adapter FRU number: 00E3496
EN0H	PCIe3 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0H; CCIN 2B93); Adapter FRU number: 00E3498
EN0K	PCIe3 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0K; CCIN 2CC1); Adapter FRU number: 00E8140
EN0M	PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0M; CCIN 2CC0); Adapter FRU number: 00E8144
EN0S	PCIe2 4-port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0S; CCIN 2CC3); Adapter FRU number: 00E2715; Part number (Full-height tailstock): 00E2863; Part number (Low-profile tailstock): 00E2720
EN0U	PCIe2 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0U; CCIN 2CC3); Adapter FRU number: 00E2715; low-profile tailstock: 00E2720
EN0W	PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EN0W; CCIN 2CC4); Adapter FRU number: 00E2714
EN12	PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12; CCIN EN0Y); Adapter FRU number 00WT107
EN13 and EN14	PCIe Binary Synchronous Adapter (FC EN13 and FC EN14; CCIN 576C)
EN15	PCIe3 4-port 10 GbE SR Adapter (FC EN15; CCIN 2CE3); Adapter FRU number: 00ND466; full-height tailstock: 00ND462
EN17	PCIe3 4-port 10 GbE SFP+ Copper Adapter (FC EN17, CCIN 2CE4); Adapter FRU number: 00ND463; full-height tailstock part number: 00ND465
EN27	PCIe 2-port Async EIA-232 Adapter (FC EN27; CCIN 57D4); Adapter FRU number: 000ND487
EN29	PCIe 2-port Async EIA-232 LP Adapter (FC EN29; CCIN 57D4); adapter FRU number 000ND487
ESA3	PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6 Gb (FC ESA3; CCIN 57BB); Adapter FRU number: 74Y7131

Reference information for managing PCIe adapters

Learn how to install operating system device driver software, verify device driver software, and how to manage adapter battery packs.

Installing the AIX device driver software

Learn to install the AIX device driver software for a PCI adapter.

If you are installing the AIX operating system at this time, install the adapter before you install the operating system. When you install AIX, the adapter device driver is automatically installed and the following procedure does not apply to your situation.

If you are installing only the device driver for a PCI adapter, perform these steps:

1. Log in to the system unit as root user.

2. Insert the media containing the device driver software (for example, the CD) into the media device. If your system does not have a CD-ROM drive, refer to your system documentation for performing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`.
4. Press **Enter**. The Install Additional Device Software window highlights the INPUT device / directory for software option.
5. Type the name of the input device that you are using, or press **F4** to select the input device from a list.
6. Press **Enter**. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press **F4** to select List.
8. Type / to display the Find window.
9. Type the device package name, and press **Enter**. The system finds and highlights this device driver software.
10. Press **F7** to select the highlighted device driver software, and press **Enter**. The INSTALL ADDITIONAL DEVICE SOFTWARE window is displayed. The entry fields are automatically updated.
11. Press **Enter** to accept the information. The ARE YOU SURE window is displayed.
12. Press **Enter** to accept the information. The COMMAND STATUS window is displayed.
    - The message `RUNNING` is highlighted to indicate that the installation and configuration command is in progress.
    - When `RUNNING` changes to `OK`, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, `SUCCESS` displayed in the **Result** column of the installation summary at the bottom of the page.
13. Remove the installation media from the drive.
14. Press **F10** to exit SMIT.

You can verify if the device driver has installed for the PCI adapter. For instructions, see .

Verifying the AIX device driver software

Learn to verify if whether the AIX device driver is installed for a PCI adapter.

To verify that the AIX device driver for an adapter is installed, do the following steps:
1. If necessary, log in as root user.
2. At the command line, type `lslpp -l devices.`*xxxxxxxxxx* where *xxxxxxxxxx* is the device package name.
3. Press **Enter**.

If the adapter device driver is installed, the following is an example of the data that is displayed on the window.

File set	Level	State	Description
Path: /usr/lib/objrepos devices.*xxxxxxxxx*	5.3.8.0	COMMITTED	*Adapter name* software

Verify that the file sets are installed at the AIX version level you are running. Level 5.3.8.0 is an example. If no data is displayed on your screen, the adapter device driver was not installed correctly. Try reinstalling the driver.

Adapter battery packs

Find information about the cache battery packs that are located on the PCI adapters.

Displaying rechargeable battery information

Learn about the procedure to display information about the rechargeable battery in the RAID controller for your operating system.

The following list provides the procedures to display rechargeable battery information in the SAS RAID adapters for the system or logical partition that is running on the AIX, IBM i, or Linux operating systems:

* For information about displaying the rechargeable battery information for the system running on the AIX operating system, see Displaying rechargeable battery information.
* For information about displaying the rechargeable battery information for the system running on the IBM i operating system, see Displaying rechargeable battery information.
* For information about displaying the rechargeable battery information for the system running on the Linux operating system, see Displaying rechargeable battery information.

Maintaining the rechargeable battery on the CCIN 574E SAS adapters

Learn about the rechargeable battery maintenance tasks that include displaying rechargeable battery information, forcing a rechargeable battery error, and replacing the rechargeable cache battery pack.

Attention: Use these procedures only if directed from an isolation procedure or a maintenance analysis procedure (MAP).

The following list provides references to information about maintaining the rechargeable battery on the SAS adapters for systems or logical partition that run on the AIX, IBM i, or Linux operating systems:

* For information about maintaining the rechargeable battery for systems that run on the AIX operating system, see Maintaining the rechargeable battery on the CCIN 574E SAS adapters.
* For information about maintaining the rechargeable battery for systems that run on the IBM i operating system, see Rechargeable battery maintenance.
* For information about maintaining the rechargeable battery for systems that run on the Linux operating system, see Rechargeable battery maintenance.

Replacing a battery pack

Follow these guidelines before you replace the battery pack.

Note: When replacing the cache battery pack, the battery must be disconnected for at least 60 seconds before you connect the new battery. This duration is the minimum amount of time that is needed for the card to recognize that the battery has been replaced.

Note: The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call.

Attention: To prevent data loss, if the cache battery pack is not already in the error state, follow the steps described in Forcing a rechargeable battery error before proceeding. If the cache data present LED is flashing, do not replace the cache battery pack or data will be lost. See the feature descriptions and the figures in the following sections to determine if your adapter has a cache data present LED and the location of the LED.

Attention: Static electricity can damage this device and your system unit. To avoid damage, keep this device in its antistatic protective bag until you are ready to install it. To reduce the possibility of electrostatic discharge, read the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its antistatic package, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This duration drains static electricity from the package and from your body.)
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it on its static-protective package. (If your device is a controller, place it component-side up.) Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather, as heating reduces indoor humidity and increases static electricity.

Replacing a 574E concurrent maintainable battery pack:

Use this procedure to replace the concurrent maintainable battery pack on adapter type CCIN 574E.

Attention: Before continuing with this procedure, determine that it is safe to replace the cache battery pack. See "Maintaining the rechargeable battery on the CCIN 574E SAS adapters" on page 26. It is safe to replace the cache battery pack when `Yes` is displayed next to `Battery pack can be safely replaced`. If the cache data present LED is flashing, do not replace the cache battery pack or data will be lost. See the feature comparison tables for PCIe and PCI-X cards and the following figures to determine whether your adapter has a cache data present LED and its location.

To replace a 574E concurrent maintainable battery pack, complete the following steps:

1. Using the following illustration to locate the battery components, verify that the cache data present LED **(C)** is not flashing. If it is flashing, do not continue; return to **Forcing a rechargeable battery error**.

B

E

D

C

IPHBR614-0
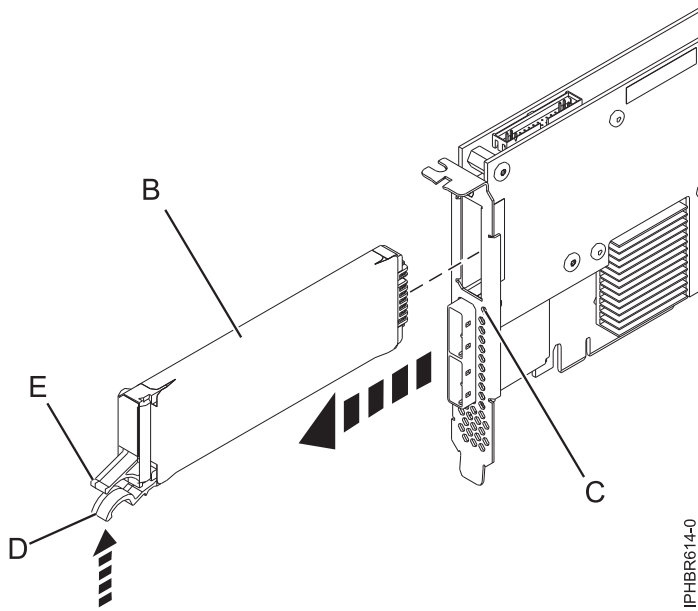
(B) Cache battery pack
(C) Cache data present LED
(D) Cache battery tab
(E) Cache battery tab

Figure 2. Replacing the 574E cache battery

2. Squeeze tab **(D)** against tab **(E)** to disengage the battery retaining tab, pull out the cache battery pack **(B)**, and remove it from the controller.

   Important: Use caution when squeezing tabs because the plastic parts can be fragile.

   Note: Ensure that the cache battery pack is disconnected for at least 60 seconds before you connect the new battery. This duration is the minimum amount of time that is needed for the card to recognize that the battery has been replaced.

3. Install the new cache battery pack by reversing this procedure. Ensure that the replacement cache battery back is fully seated.

4. Restart the write cache of the adapter by completing the following steps:

   a. Return to the **Work with Resources containing Cache Battery Packs display** and select the **Start IOA cache**. Press Enter.

   b. Ensure that you get the message `Cache was started`.

PCIe adapters

Find information about using and managing the Peripheral Component Interconnect (PCI) Express (PCIe) adapters that are supported for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, 8286-42A, 8408-44E, 8408-E8E, 9080-MHE, 9080-MME, 9119-MHE, 9119-MME, and EMX0 PCIe Gen3 I/O expansion drawer. Also, find information about specifications and installation notes for specific adapters.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe 2-Line WAN with Modem (FC 2893 and FC 2894; CCIN 576C)

Learn about the features of the PCIe 2-Line WAN with Modem.

This adapter is a 2-line per port WAN with Modem PCIe adapter. Port 0 is the modem port and supports V.92 56K Async PPP, V.92 data modem, V.44 data compression, V.34 FAX modem and FAX functions, such as ECM and 2D/1D conversion. Port 0 does not provide Sync modem capabilities (SDLC and Sync PPP). Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations.

2893 is the non-CIM (Complex Impedance Matching) version offered in all countries and regions except Australia and New Zealand.

2894 is the CIM (Complex Impedance Matching) version offered only in Australia and New Zealand.

The FRU part number for the adapters is 44V5323.

Adapter type
        Short, x4, PCIe

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  – Red Hat Enterprise Linux Version 5.6, or later
  – SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
- IBM i
  – IBM i Version 7.1, or later
  – IBM i Version 6.1, or later

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe Cryptographic Coprocessor (FC 4807, FC 4808, and FC 4809; CCIN 4765)

Learn about the specifications for the PCIe Cryptographic Coprocessor.

The PCIe Cryptographic Coprocessor adapters (feature codes (FC) 4807, FC 4808, and FC 4809) provide the secure-key cryptographic accelerator and the Cryptographic Coprocessor functions in a single PCIe card. The coprocessor functions are targeted to banking and finance applications. The financial personal identification number (PIN) processing and Euro pay, Mastercard, Visa (EMV) credit card functions are provided. EMV is a standard for the integrated-chip based credit cards. The secure-key accelerator functions are targeted to improving the performance of Secure Sockets Layer (SSL) transactions. The (FC 4807, FC 4808, and FC 4809 provide the security and performance required to support emerging digital signature applications. The host application access to the cryptographic services of the (FC 4807, FC 4808, and FC 4809 are by the Common Cryptographic Architecture (CCA) application programming interfaces (APIs) and by the Public-Key Cryptographic Standards (PKCS11). The (FC 4807, FC 4808, and FC 4809 provide secure storage of cryptographic keys in a tamper-resistant hardware security module, which is designed to meet FIPS PUB 140-2 on security requirements.

The FC 4807, FC 4808, and FC 4809 are the same adapter but the different FCs indicate if a blind-swap cassette is used and the type of the cassette.
- FC 4807 is not a blind-swap cassette
- FC 4808 is a generation-3 blind-swap cassette
- FC 4809 is a generation-4 blind-swap cassette

IBM PCIe Cryptographic adapter highlights:
- PCIe 4x standard height - half length
- Integrated Dual PPC processors
- ASIC (Accelerator engines)
- Supports the Common Cryptographic Architecture (CCA) application programming interfaces (APIs) and the Public-Key Cryptographic Standards (PKCS11) on the single firmware load.
- 3072, 4096 bit RSA CRT HW (including routing)
- SHA 256 required HW or firmware within secure module (including routing)
- Secure Key AES 128, 192, 256 bit keys
- Fast path – symmetric and asymmetric (secure and clear key)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX

- – AIX 7.1, or later
- – AIX Version 6.1, or later
- IBM i
  - – IBM i Version 7.2 or later
  - – IBM i Version 7.1, or later

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Specifications and requirements

FRU number:
> 45D7948

> RoHS compliant with server exemption

Placement information
> To view information about the PCI adapter placement rules, see the PCI adapter placement topic collection for your system.

I/O bus architecture
> PCI Express v1.1a

Storage

> Shipping and storage temperature below -35°C ± 60°C (-31°F ± 140°F) or above 1°C ± 60°C (33.8°F ± 140°F) limits.

Operation (ambient in system)

> This component collects and controls all the sensors to prevent the physical penetration and any abnormal environmental condition within its wide operational range of 10°C ± 35°C (50°F ± 95°F).

Tamper protection range
> Outside of the tamper protection range limits of -38°C ±3°C (-41.8°F to -31°F) to +90°C ± 2°C (190.4°F to 197.6°F), the card will be permanently disable.

Handling requirements
> Each PCIe Cryptographic Coprocessor includes a certified device key. This electronic key, which is stored in the adapter's battery-powered and protected memory, digitally signs status messages to confirm that the PCI Cryptographic Coprocessor is genuine and that no tampering has occurred.

> If any of the secure module's tamper sensors are triggered by tampering or by accident, the PCIe Cryptographic Coprocessor erases all data in the protected memory, including the certified device key. Incorrect removal of the batteries triggers the tamper sensors and destroys the certified device keys. The PCI Cryptographic Coprocessor cannot operate without the certified device keys. To protect the keys, follow the guidelines given in the documentation provided with the coprocessor.

> **Attention:** The batteries keep the coprocessor powered on even when it is not installed in a system. When handling, installing, or removing the adapter, do not let the adapter circuits come in contact with any conductive surface or tools. Doing so can render the adapter permanently inoperable.

> Do not remove the batteries of the adapter. Data in the protected memory is lost when battery power is removed. For information about replacing the batteries, see the Installation Manual at the IBM Cryptocard website at http://www-03.ibm.com/security/cryptocards/.

Attention: While installing the coprocessor, observe the following precautions:
- The coprocessor is always powered by the batteries, even when it is not installed in the system.
- The battery power is necessary to keep the coprocessor operational.
- The loss of battery power or a voltage drop triggers a tamper event and permanently renders the coprocessor inoperable.
- Any short on the battery power distribution circuits causes a voltage drop and a tamper event.
- Do not lay the coprocessor on or cause the coprocessor to come in contact with any conductive surface.
- Do not strike the coprocessor circuits with metal or conductive tools.
- Use static-protective measures at all times when handling the coprocessor.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 LP 4-port 1GbE Adapter (FC 5260; CCIN 576F)

Learn about the specifications and operating system requirements for the feature code (FC) 5260 adapters.

Overview

FC 5260 and FC 5899 are both the same adapter with different feature codes. FC 5260 is a low-profile adapter and the FC 5899 is a full-height adapter.

The PCIe2 LP 4-port 1GbE Adapter is a short, low-profile, generation-2 PCIe adapter. This adapter provides four 1-Gb Ethernet ports that can be configured to run at 1000 megabits per second (Mbps) (or 1 gigabit per second (Gbps)), 100 Mbps, or 10 Mbps. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The adapter supports jumbo frames when running at the 1000 Mbps speed.

Each of the Ethernet ports can be connected by using:
- CAT5e (or later) UTP cables for 1000 Mbps network attachment
- CAT5 or CAT3 UTP cables for 100 Mbps or 10 Mbps network attachment

The cables are attached to the copper RJ45 connectors. Each port is independent of one another and supports full-duplex or half-duplex. The half-duplex mode does not support a speed of 1000 Mbps.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support

- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Specifications

Item   Description
Adapter FRU number
  74Y4064 (Designed to comply with RoHS requirement)
Wrap plug
  10N7405

  Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
  PCIe2.0 x4
Slot requirement
  One PCIe x4 (low-profile) slot.
Cables
  4-pair, CAT5e, UTP cables are connected to copper RJ45 connectors.
Voltage
  3.3 V
Form factor
  short, low-profile
Maximum number
  For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Connector information
  - Two RJ-45 ports
  - Two LED adapter status indicators per port, for link activity and speed
Attributes provided
  - PCIe x4, generation-1 or generation-2
  - 4-Port machine access code (MAC)
  - High performance IPV4/IPV6 checksum offload
  - Supports large send and large receive
  - Multiple queues
  - VIOS

The following figure shows the adapter.
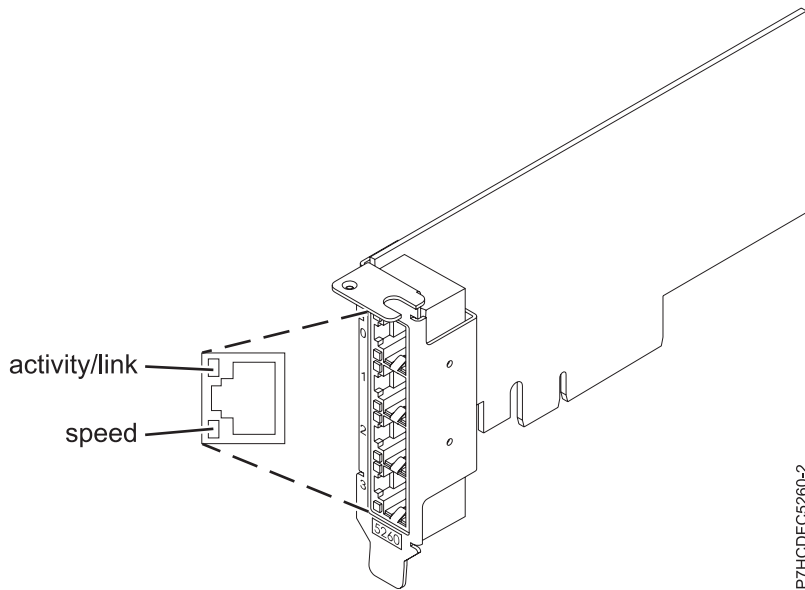
Figure 3. Adapter

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket. Figure 3 shows the location of the LEDs. Table 15 describes the different LED states and what those states indicate.

Table 15. Adapter LEDs and descriptions

LED	Light	Description
Speed	Yellow	10 Mbps or 100 Mbps
	Green	1000 Mbps or 1 Gbps
Activity/link	Green flashing	Active link or data activity
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
- SUSE Linux Enterprise Server Version 12, or later
- SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
- Ubuntu Server 14.04.3, or later
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.1.4, or later.
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe LP POWER GXT145 Graphics Accelerator (FC 5269; CCIN 5269)
Learn about the features, requirements, installation notes, and troubleshooting tips for the PCIe LP POWER GXT145 Graphics Accelerator adapter.

Overview

The PCIe LP POWER GXT145 Graphics Accelerator adapter is a versatile 2D graphics accelerator and enhances the system unit video. This adapter supports both analog and digital monitors. The adapter requires a PCI Express slot. A short converter cable is included which adapts the 28-pin port on the adapter to dual DVI-I (analog/digital video) connectors. The adapter has no hardware switches to set. Mode selection is made through the software. Figure 4 on page 36 shows the adapter connector and converter cable.
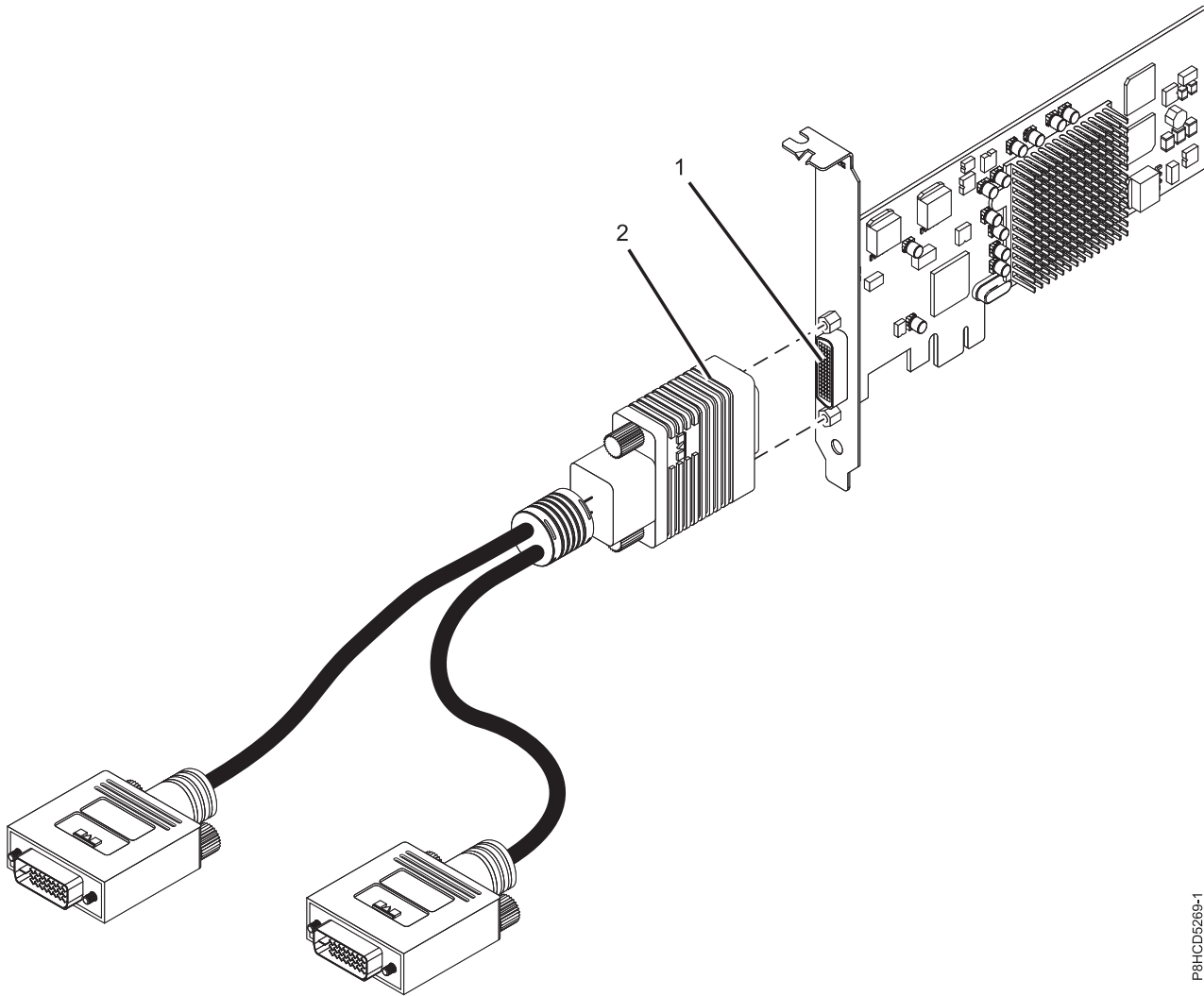
Figure 4. PCIe LP POWER GXT145 Graphics Accelerator adapter and converter cable

1   DVI connector (28 pin), analog, or digital

2   Converter cable with dual DVI-I (analog/digital video) connectors

If your monitor has a DVI connector, connect it directly to the main DVI connector (labeled 1/3) of your converter cable.

If attaching a device that requires a 15 pin D-Shell receptacle for a VGA connection (eg. when the graphic adapter output is routed directly to a 7316-TF3 display or indirectly through a KVM switch), order a VGA to DVI Connection Converter, feature number 4276 and connect it to the main DVI connector (labeled 1/3) of your converter cable.

If you're connecting only one monitor, use the main connector (labeled 1/3) of your converter cable.

In the system or logical partition running AIX, the video that is displayed on the secondary monitor is the same as the video displayed the primary monitor, and at the same resolution and refresh rate.

The following table shows the feature code, custom card identification number, and field-replaceable unit part number for the adapter.

Table 16. Adapter feature code, CCIN, and FRU part number

feature code (FC)	custom card identification number (CCIN)	field-replaceable unit (FRU) part number
5269	5269	74Y3227[*]
[*]Designed to comply with RoHS requirement		

This adapter provides the following features:

- 8-bit indexed or 24-bit true color.
- 32-MB SDRAM frame buffer.
- x1 PCIe bus interface.
- One DVI-I analog or digital connector.
- One monitor connected, analog, up to 2048 x 1536 resolution.
- One monitor connected, digital, up to 1280 x 1024 resolution.
- A second monitor supported at up to 1600 x 1200 analog or 1280 x 1024 digital.
  - For systems or logical partitions running Linux, a second monitor is supported at resolutions up to 1600 x 1200 analog or 1280 x 1024 digital.
  - For systems or logical partitions running AIX, when running with two monitors, both monitors must have an analog connection with the same resolution, up to 1600 x 1200. The image on the primary monitor is also displayed on the secondary monitor.
- Display power management: Video Electronics Standards Association (VESA), Display Power Management Signaling (DPMS)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
- Linux
  - Red Hat Enterprise Linux Version 5.6, or later
  - SUSE Linux Enterprise Server 10, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 39 for instructions. If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" for instructions.

Gathering tools and documentation

To install the adapter, make sure that you have access to the following items:
- The adapter
- The operating system documentation
- The system service guide for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The media containing the device driver software

Installing the device driver software

Find information about installing device driver software.

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

   If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pci.xxxxxxx`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.

16. Press F10 to exit SMIT.

Installing the adapter

This section explains how to install the adapter. If you are installing your operating system at this time, install your adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 38 for instructions.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The PCIe LP POWER GXT145 Graphics Accelerator adapter has an x1 PCIe connector and can be placed in a PCIe x1, x4, x8, or x16 slot. See PCI adapter placement for information about the PCIe slots on your system unit.

2. Shut down the system unit and install the adapter using the instructions in the system unit documentation PCI adapters topic.

3. Connect the converter cable to the adapter and the monitor cable.

   If necessary, you can use a DVI-A dongle (feature code 4276) for connecting a VGA 15-pin connector on a monitor cable to the DVI connector on the adapter. For example, a DVI-A dongle is needed to connect to a 7316-TF3 console or a KVM switch.

4. Start the system unit and the monitor.

5. When prompted, configure the adapter by following the online configuration instructions.

6. When **Select Display** (console) appears, press the number key on your keyboard for the monitor that is to be the default.

Troubleshooting

If you have video problems after the initial installation, follow these procedures to troubleshoot the problem:

- Check the cables.
- Check the device driver software installation.
- Check the console.
- Check the adapter installation.

Checking the cables

1. Ensure the monitor cables are connected to the correct adapter.
2. If you have more than one video adapter, be sure that each adapter is connected to a monitor.
3. Verify that the connections are secure.
4. If no log-in prompt appears, restart the system unit.

Checking the device driver software installation

Verify that the device driver for the PCIe LP POWER GXT145 Graphics Accelerator adapter is installed by typing the following command and then pressing Enter:

```
lslpp -l all | grep GXT145
```

If the GXT145 device driver is installed, the following table is an example of the data that appears if you are running AIX Version 5.2:

```
devices.pci.2b102725.X11 5.2.0.105 COMMITTED AIXwindows GXT145 Graphics
devices.pci.2b102725.diag 5.2.0.105 COMMITTED GXT145 Graphics Adapter
devices.pci.2b102725.rte   5.2.0.105   COMMITTED GXT145 Graphics Adapter
```

If the POWER GXT145 device driver did not fully install, reinstall the driver. See "Installing the device driver software" on page 38.

Checking the console

1. If you continue to experience problems, you can redirect the monitor to the new adapter using the **chdisp** command.

2. If you continue to experience problems after you have checked your cables and tried the **chdisp** command, run diagnostics.

Checking the adapter installation

Verify that the system unit recognizes the PCIe LP POWER GXT145 Graphics Accelerator adapter.

At the AIX command-line type `lsdev -Cs pci`. If the PCIe LP POWER GXT145 Graphics Accelerator adapter is correctly installed, the following is an example of the data that appears:

```
cor0 Available 0K-00 GXT145 Graphics Adapter
```

If the message indicates that the adapter is DEFINED instead of AVAILABLE, shut down the system unit and check the PCIe LP POWER GXT145 Graphics Accelerator adapter to ensure that it is installed correctly. If you continue to experience problems after following the steps in this section, contact service and support for assistance.

Related information:

➭ IBM Prerequisite website

➭ Installing, removing, or replacing PCIe adapters

➭ PCIe adapter placement

➭ PCIe adapter information by feature type

PCIe LP 10-Gb FCoE 2-port Adapter (FC 5270; CCIN 2B3B)

Learn about the features, operating system requirements, and installation notes for the feature code (FC) 5270 adapter.

Overview

This PCI Express adapter has two feature codes associated:
- FC 5270: PCIe LP 10-Gb FCoE 2-port Adapter, is the low-profile adapter.
- FC 5708: 10Gb FCoE PCIe Dual Port Adapter, is the full-height adapter.

The PCIe LP 10-Gb FCoE 2-port Adapter is a high-performance, converged network adapter (CNA). The adapter supports data networking and storage networking traffic on a single I/O adapter by using Enhanced Ethernet and Fibre Channel over Ethernet (FCoE). Both FCoE and network interface controller (NIC) functions are available for both ports simultaneously. Using FCoE requires Convergence Enhanced Ethernet (CEE) switches.

The following figure shows the adapter LEDs and connectors.
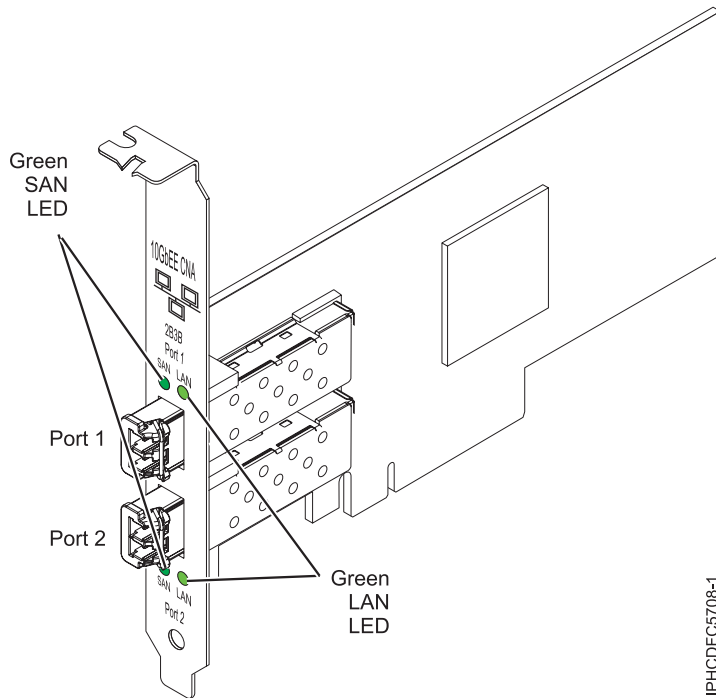
Figure 5. PCIe LP 10-Gb FCoE 2-port Adapter

The LEDs on the adapter provide information about the operation status of the adapter.

Table 17. Adapter LEDs

Green SAN LED	Green LAN LED	Activity
Off	Off	Power off
Slow flashing (unison)	Slow flashing (unison)	Power-on, no link
On	On	Link established, no activity
On	Flashing	Link established, Transmission/Receive (TX/RX) LAN only activity
Flashing	On	Link established, TX/RX SAN only activity
Flashing	Flashing	Link established, TX/RX LAN and SAN activity
Slow flashing (alternating)	Slow flashing (alternating)	Beaconing

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
FRU number
    46K8088 (Designed to comply with RoHS requirement.)
Wrap plug FRU number
    12R9314 (for Fibre LC connector)

   Note: The wrap plug is not included with the card, but can be purchased from IBM.

I/O bus architecture

> PCI Express x8 generation-1 and x4 generation-2

> PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0

Maximum number

> For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Connectors

> LC multimode fiber optic

> SFP+ (small form-factor pluggable) with SR optics

Voltage

> 3.3 V and 12-V

Form factor

> Short, low-profile with standard-size bracket

Cables

> Cables are the responsibility of the customer. Use multimode fiber optic cables with short-wave lasers that adhere to the following specifications:
> - OM1
>   - Multimode 62.5/125 micron fiber
>   - 200 MHz x km bandwidth
>   - Maximum cable distance 1 is 33 m (108 ft)
> - OM2
>   - Multimode 50/125 micron fiber
>   - 500 MHz x km bandwidth
>   - Maximum cable distance is 82 m (269 ft)
> - OM3
>   - Multimode 50/125 micron fiber
>   - 2000 MHz x km bandwidth
>   - Maximum cable distance is 300 m (984 ft)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i

– Support of this feature with IBM i requires VIOS 2.2 or later
– IBM i 7.1, or later
- VIOS
  – VIOS support requires VIOS 2.2.0.12-FP24 SP02, or later

Replacing FCoE adapters by using hot swap

When hot swapping FCoE adapters, be aware that device-related software for the storage devices might have additional devices that must be removed. See specific storage device documentation for information about how to remove these additional devices. The adapter has a unique worldwide port name (WWPN). When using the Fibre Channel function, check the zoning and LUN assignments to ensure that the Fibre Channel function is operating as expected.

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe LP 4-Port 10/100/1000 Base-TX Ethernet Adapter (FC 5271; CCIN 5717)

Learn about features, requirements, and specifications for the feature code (FC) 5271 adapter.

There are two adapters with the same CCIN. The feature code (FC) 5271 and FC 5717 are both the same adapter. FC 5271 is a low-profile adapter and the FC 5717 is a full-height adapter. The names of these two adapters are:

- FC 5271: PCIe LP 4-Port 10/100/1000 Base-TX Ethernet Adapter
- FC 5717: 4-Port 10/100/1000 Base-TX PCI Express Adapter

The PCIe LP 4-Port 10/100/1000 Base-TX Ethernet Adapter is a PCI Express (PCIe), low-profile, four ported, Gigabit Ethernet adapter that can be configured to run either port at 1000, 100, or 10 Mbps data rate. This adapter interfaces to the system through a PCIe bus and connects to a network using a 4-pair CAT-5 Unshielded Twisted Pair (UTP) cable for distances of up to 100 meters. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The 5717 also supports jumbo frames when running at the 1000 Mbps speed.

The adapter provides the following features:

- Supports interrupt moderation to deliver increased performance while significantly reducing central processing unit (CPU) utilization
- Allows quad-port operation in x4, x8, x16 slots, and each port operates without interfering with the other
- Each port operates without interfering with the other
- Auto-negotiation, full-duplex (half-duplex available for 10/100)
- Integrated media access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) and Gigabit EtherChannel (GEC) when used with capable switch
- Supports IEEE 802.3ad Link Aggregation control protocol when used with capable switch
- IEEE 802.1Q VLANs, IEEE 802.3 (z, ab, u, x) flow control support, IEEE 802.1p
- TCP checksum offload -- transmission control protocol (TCP), Internet Protocol (IP) for IPv4
- TCP Segmentation Offload (TSO) / Large Send Offload (LSO)
- Bus width x4 lane; operable in x4, x8, or x16 slots
- Bus speed (x4, encoded rate) 10 Gbps unidirectional and 20 Gbps bidirectional

- EEPROM SPI and single EEPROM support
- Interrupt levels INTA and MSI (requires system and software support for MSI)
- IEEE 802.3ab
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Four RJ-45 connectors
- LEDs on each port identifying speed and link activity
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter specifications

Item   Description
Adapter FRU number
  46Y3512 (Designed to comply with RoHS requirement)
Wrap plug FRU number
  10N7405 (1 Gb UTP wrap plug)

  Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
  - PCIe V1.0a compliant
  - Bus width x4 lane PCIe, operable in x4, x8, x16 slots
  - Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional
Busmaster
  Yes
Maximum number
  For the maximum adapters supported, see the PCI adapter placement topic collection for your system.
Form Factor
  PCIe short form
Connector information
  - Four RJ-45 ports
  - Two LED adapter status indicators per port, for link activity and speed
Cables
  Customers supply their own cables. For best performance, use cables that meet Cat 5e cabling standards, or later.

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible through the adapter mounting bracket. 4-Port 10/100/1000 Base-TX PCIe adapter shows the location of the LEDs. Table 18 on page 45 describes the different LED states and what those states indicate.

The following figure shows the adapter:
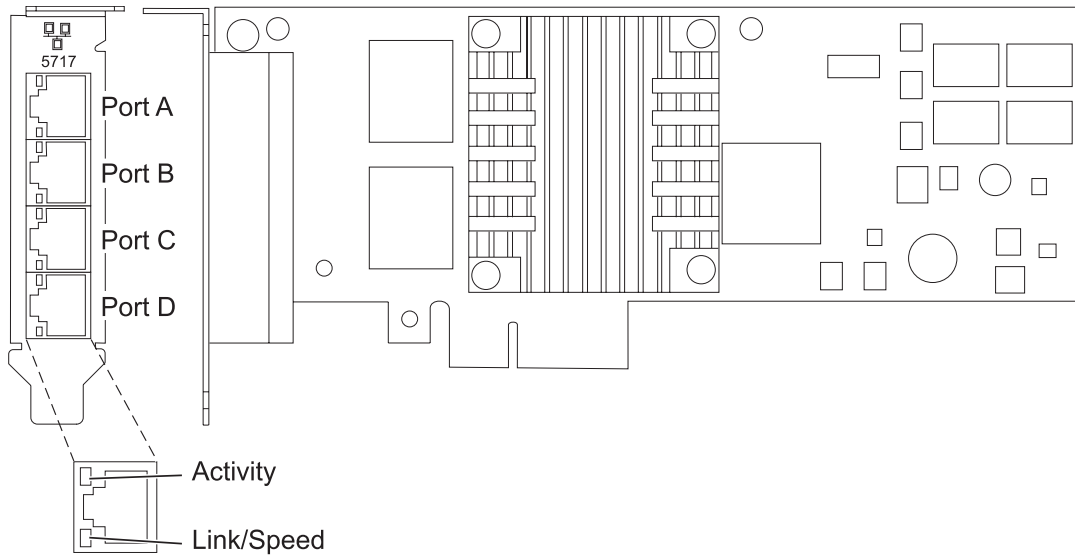
Figure 6. FC 5271 adapter

Table 18. Adapter LEDs and descriptions

LED	Light	Description
Activity/link	Green	Active link
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
	Blinking	Data activity
Speed	Off	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of the operating systems:
- AIX
  - AIX Version 7.1, or later
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
- Linux
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

If you are using another release of AIX, ensure that the adapter is supported on that release before you install the adapter. Contact service and support for assistance.

If you are installing a new feature, ensure that you have the software required to support the new feature and that you determine if there are any existing prerequisites. To do this, use the IBM Prerequisite website IBM Prerequisites.

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 47 for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you do not need to reinstall the device drive.

Verifying the hardware requirements

The adapter requires the following hardware:
- A wrap plug for the RJ-45 connector, if you are running the total diagnostics package
- Cat 5e (or higher) UTP cables for 1000 Mbps network attachment
- Cat 5 or Cat 3 UTP cables for 100 Mbps or 10 Mbps network attachment

Restriction: The cable can be no longer than 100 meters (including patch cables) from the adapter to the local switch.

Verifying the software requirements

You can use the adapter on operating systems shown in "Operating system or partition requirements" on page 45.

Gathering tools and documentation

To install the adapter, make sure you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation.
- A flat-blade screwdriver
- The AIX device driver CD, which includes the device driver.

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L™ operating system on the AIX device driver CD.

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.

3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pciex.14106803` .
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Verifying the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:

1. If necessary, log in as root user.
2. Type `lslpp -l devices.pciex.14106803.rte` and press Enter.

    If the device driver is installed, the following table is an example of the data that appears.

Table 19. Device driver information

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14106803.rte	5.*x*.0.0	COMMITTED	4-Port 10/100/1000 Base-TX PCI Express Software

3. Confirm that the devices.pciex.14106803.rte filesets are installed. If no data displays in the window, reinstall the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8 or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.

2. Install the adapter using the instructions in the system unit service guide.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe LP 8 Gb 2-Port Fibre Channel Adapter (FC 5273; CCIN 577D)

Learn about the specifications and operating system requirements for the feature code (FCs) 5273 adapter.

Overview

The PCIe LP 8 Gb 2-Port Fibre Channel Adapter is a high-performance adapter based on the Emulex LPe12002 PCIe Host Bus Adapter (HBA). The FCs 5273 is a full-height adapter. Each port provides single initiator capability over a fiber link. The ports have LC type connectors that use shortwave laser optics. The adapter connects to Fibre Channel switches and direct attached storage devices, operating at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed that the switch is capable of. LEDs on each port provide information about the status and link speed of the port.

N_Port ID Virtualization (NPIV) capability is supported through Virtual I/O Server (VIOS).
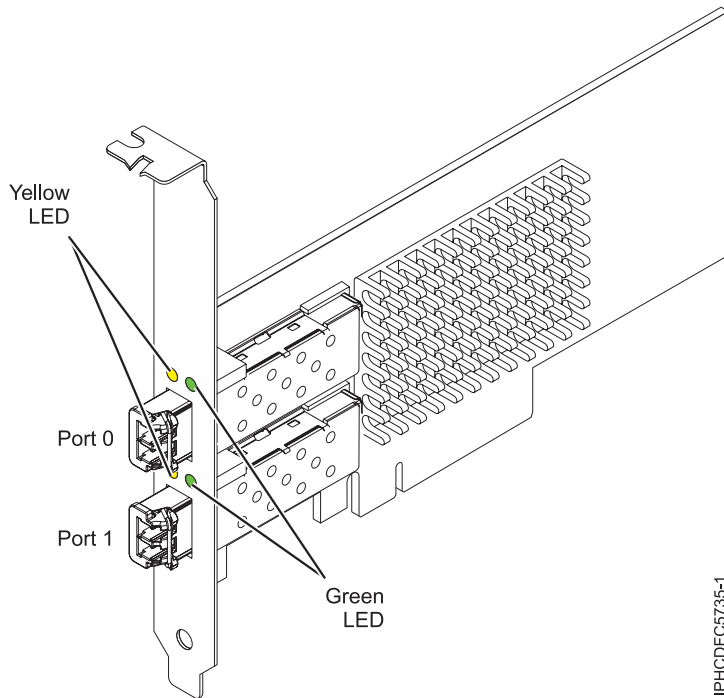
Figure 7. PCIe LP 8 Gb 2-Port Fibre Channel Adapter

Adapter specifications

Item   Description

FRU number

    10N9824 (Designed to comply with RoHS requirement)

Wrap plug FRU number

    12R9314

    Note: The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture

    PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0

    x8 PCIe bus interface

Slot requirement

    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

    3.3 V

Form factor

    Short, low-profile with standard-size bracket

FC compatibility

    2, 4, 8 Gigabit

Cables

    Cables are the responsibility of the customer.

    Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 20. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter LED

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 21 summarizes the link rate conditions. There is a 1-second pause when the LED is off between each group of fast flashes (2, 3, or 4). Observe the LED sequence for several seconds to be sure that you have correctly identified the state.

Table 21. Normal LED states

Green LED	Yellow LED	State
Slow flash	Off	Normal, link inactive or not started
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active
On	4 fast flashes	8 Gbps link rate - normal, link active

Power-on self test (POST) conditions and results are summarized in Table 22. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 22. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	On	POST failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Slow flash	Wake-up failure monitor	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Fast flash	POST failure	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.

Table 22. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
On	On	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Slow flash	Slow flash	Offline for download	None
Slow flash	Fast flash	Restricted offline mode, waiting for restart	None
Slow flash	Flashing	Restricted offline mode, test active	None
Fast flash	Off	Debug monitor in restricted mode	None
Fast flash	On	Not defined	None
Fast flash	Slow flash	Debug monitor in test fixture mode	None
Fast flash	Fast flash	Debug monitor in remote debug mode	None
Fast flash	Flashing	Not defined	None

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
* AIX
  – AIX 7.1, or later
  – AIX Version 6.1, or later
  – AIX Version 5.3, or later
* Linux
  – Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  – Red Hat Enterprise Linux Version 6.1, or later
  – SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  – Ubuntu 16.04.1, or later
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).
* IBM i
  – IBM i Version 7.2 or later
  – IBM i Version 7.1, or later

Replacing Fibre Channel adapters by using hot swap

When hot swapping Fibre Channel adapters, be aware that device-related software for the storage devices might have extra devices (for example, the disk array router (dar) device that is associated with the fiber

array storage technology (FAStT) or DS4800) that need to be removed. See the specific storage device documentation for information about how to remove these additional devices.

The new adapter has a unique worldwide port name (WWPN). Check the zoning and logical unit number (LUN) assignments to ensure that the new adapter functions as expected.

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe LP 2-Port 1GbE SX Adapter (FC 5274; CCIN 5768)

Learn about features, requirements, and specifications for the feature code (FC) 5274 adapter.

The PCIe LP 2-Port 1GbE SX Adapter provides two 1 Gbps (1000 Base-SX) full-duplex Ethernet LAN connections. The adapter interfaces to the system through a PCIe bus. It is PCIe x4 capable and conforms to the PCIe 1.0a standard. The adapter connects to a network using a standard shortwave multimode optical cable that conforms to the IEEE 802.3z standard. The adapter supports distances of 260 m (853.01 feet) for 62.5 micron Multi Mode Fiber (MMF) and 550 m (1804.46 feet) for 50.0 micron MMF. AIX Network Installation Management (NIM) boot capability is supported with this adapter.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Adapter specifications

Item   Description
FRU number
  10N6846[*]

[*]Designed to comply with RoHS requirement

I/O bus architecture
- PCI Express V1.0a compliant
- Bus width x4 lane PCI Express, operable in x4, x8, x16 slots
- Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional

Busmaster

Yes

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter size

PCIe short form

Connector information

Two fiber optic ports, LC connector

LED status indicators for link activity and speed

Wrap plug FRU number

12R9314 (SFP+ SR wrap plug)

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

Cabling

Optional LC-SC converter cables are available:
- LC-SC 62.5 micron converter cable, part number 12R9322, FC 2459.
- LC-SC 50 micron use converter cable, part number 12R9321, FC 2456.

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible through the adapter's mounting bracket. Figure 8 shows the location of the LEDs. Table 23 on page 54 describes the different LED states and what those states indicate. The following figure shows the adapter.
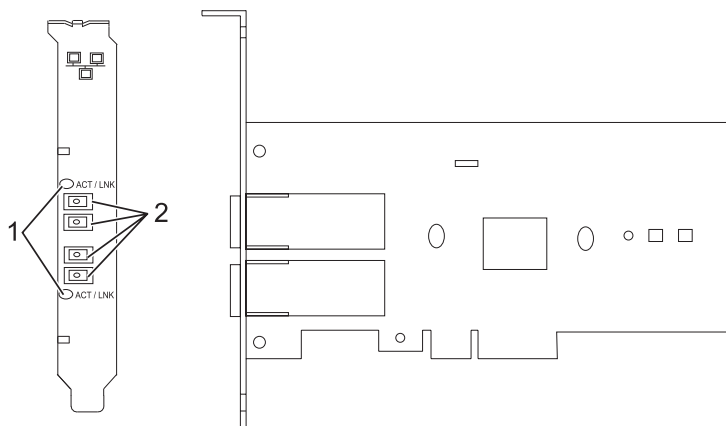
Figure 8. PCIe LP 2-Port 1GbE SX Adapter

1   LEDs

2   Multimode Fiber LC receptacles

Table 23. Adapter LEDs and descriptions

LED	Description
Off	No link (The absence of a link could indicate a bad cable, bad connector, or a configuration mismatch.)
Green	Good link, no activity
Flashing Green	Good link, data activity

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 56 for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 55 for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you must not reinstall the device drive.

Verify you hardware requirements

The adapter requires the following hardware:
- A wrap plug for the multimode fiber connector, if you are running the total diagnostics package
- Shortwave (850 nm) 50/62.5 micron multimode fiber network attachment

The following table indicates the allowable cable lengths from the adapter to the gigabit Ethernet switch, including patch cables.

Table 24. Adapter cable information

Cable type	Physical connector type	Maximum range
62.5 m MMF	LC	260 meters (853.01 feet)
50 m MMF	LC	550 meters (1804.46 feet)

Verify your software requirements

The adapter is supported on operating systems shown in Operating system or partition requirements. Ensure that your operating system supports this adapter before you install it. Contact service and support if you need assistance.

Gather tools and documentation

To install the adapter, make sure you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The AIX base operating system CD, which includes the device driver, or the AIX device driver CD

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L operating system on the AIX base operating system CD, which includes the device driver, or the AIX device driver CD

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

   If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.

6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pciex.14103f03`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Verify the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:
1. If necessary, log in as root user.
2. Type `lslpp -l devices.pciex.14103f03.rte` and press Enter.

   If the device driver is installed, the following is an example of the data that is displayed.

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14103f03.rte	5.x.0.0	COMMITTED	PCIe LP 2-Port 1GbE SX Adapter

3. Confirm that the devices.pciex.14103f03.rte filesets are installed. If no data displays, try reinstalling the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you must install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:
1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8, or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.
2. Install the adapter by using the instructions in the system unit service guide.

Connecting to an Ethernet network

Refer to your local procedures for information about connecting the adapter to your Ethernet network.

Notes:
- Only one type of network can be attached to the adapter at one time.
- If your switch has an SC receptacle, you need an LC-SC converter cable.
- You must configure an IP network interface to enable the adapter to detect the link and illuminate the link LED.

To connect the adapter to a multimode fiber network, do the following steps:
1. Insert the male fiber LC connector of the fiber cable into the adapter LC connector.
2. Insert the male fiber LC connector of the other end of the cable into the network switch.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe LP 10GbE SR 1-port Adapter (FC 5275; CCIN 5769)

Learn about the features, operating system requirements, and installation procedures for the feature code (FC) 5275 adapter.

Overview

The PCIe LP 10GbE SR 1-port Adapter is a low-profile, high performance fiber network interface controller (NIC). The product conforms to the IEEE, 802.3ae 10GBASE-SR specification for Ethernet transmission.

The following figure shows the adapter LED and network connector. Figure 9 on page 58 shows the adapter.
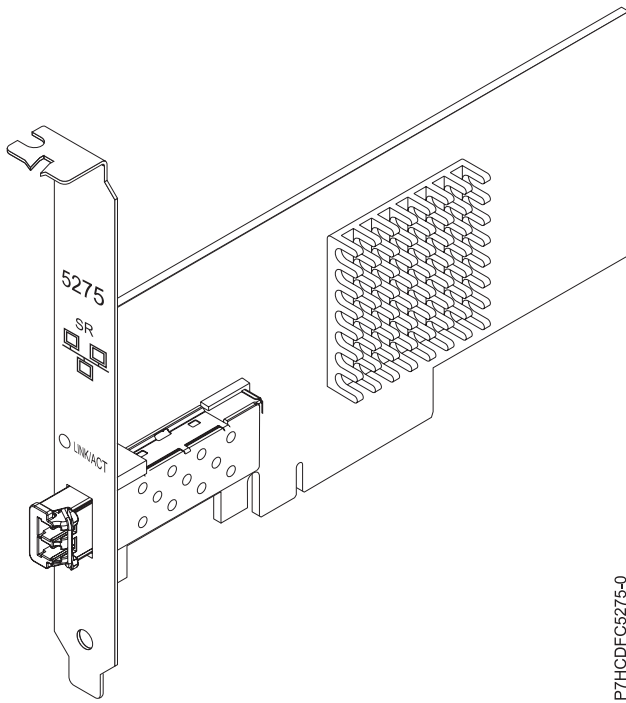
Figure 9. PCIe LP 10GbE SR 1-port Adapter

The LED on the adapter provides information about the operation status of the adapter.

Table 25. Adapter LED and descriptions

LED	Light	Description
Activity/Link	Green	Good link, no activity
	Flashing Orange	Transmit activity
	Off	No link[*]
Adapter card status	Red	Not initialized[**]
	Off	Initialized
[*]The absence of a link could be the result of a defective cable, a defective connector, or a configuration mismatch.		
[**]The adapter has not been initialized by the operating system. During such time, the following conditions are true: • If no cable is connected, the Green LED is **ON**. • If cable is connected and the LINK is sensed, the Green LED is **OFF**.		

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    46K7897 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    12R9314 (SFP+ SR wrap plug)

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

> PCIe-V1.1 x8

Busmaster

> Yes

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Form factor

> Short

Connector information

> LC multimode fiber optic

Cables

> Customers supply the cables. Optional LC-SC 62.5 micron converter cable, part number 12R9322, FC 2459, is available. For 50 micron LC-SC connections, use converter cable part number 12R9321, FC 2456.

Attributes

> The adapter provide the following features:
> - PCIe 1.1 x8
> - MSI-X, MSI and support of traditional pin interrupts
> - 10GBASE-SR short-reach optics (850 nm)
> - IEEE 802.3ae (10 GbE)
> - IEEE 802.1p priority and 802.1Q VLAN tagging
> - IEEE 802.3x flow control
> - Link aggregation, 802.3ad 802.3 compliance
> - IEEE 802.3ad load-balancing and failover
> - Ethernet II and 802.3 encapsulated frames
> - Multiple MAC addresses per interface
> - Jumbo frames up to 9.6 KB
> - TCP checksum offload for IPv4 and IPv6
> - TCP segmentation offfload (TSO) for IPv4 and IPv6
> - User datagram protocol (UDP) checksum offload for IPv4 and IPv6
> - Receive side scaling and packet steering
> - Line rate packet filtering and attack protection
> - IETF RDDP and RDMAC iWARP compliance (Linux only)
> - RDMA-enabled NIC (RNIC) specifically optimized for cluster computing (Linux only)
> - Full iSCSI initiator and target mode stack (Linux only)
> - iSCSI Header & Data Digest (CRC) generation & checking (Linux only)
> - PDU recovery (Linux only)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- Red Hat Enterprise Linux Version 6, or later
- Red Hat Enterprise Linux Version 5.6, or later
- SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

AIX host bus adapter (HBA) and Ethernet drivers are contained in the following filesets:

devices.ethernet.ct3

devices.ethernet.ct3.rte //HBA

devices.ethernet.ct3.cdli //ENT

Preparing for installation

If you are installing your operating system at this time, install your adapter before you install the operating system. If you are installing only the device driver for this adapter, install your device driver software before you install the adapter.

If you are running the total diagnostics package you need a wrap plug for the multimode fiber connector used for the adapter. To connect to a network, you need a shortwave (850 nm) 50/62.5 micron multimode fiber network attachment.

The following tables indicates the allowable cable lengths from the adapter to the gigabit Ethernet switch, including patch cables:

Table 26. Cable information

Fiber cable type	Connector type	Minimum modal bandwidth at 850 nm (MHz x km)	Operating range in meters
62.5 μm MMF	LC	160	2 to 26 (6.56 ft to 85.30 ft)
		200	2 to 33 (6.56 ft to 108.26 ft)
50 μm MMF	LC	400	2 to 66 (6.56 ft to 216.53 ft)
		500	2 to 82 (6.56 ft to 269.02 ft)
		2000	2 to 300 (6.56 ft to 984.25 ft)

Ensure that your operating system supports this adapter before you install it. See "Operating system or partition requirements" on page 59.

Installing the AIX device driver software

To install device driver software, follow the steps in "Installing the AIX device driver software" on page 24.

Installing the adapter

For general instructions on how to install a PCI adapter, see the Installing PCI adapters topic. Return here to verify the adapter installation.

Verifying the adapter installation

To verify that your system recognizes the PCI adapter, do the following steps:

1. If necessary, log in as root user.
2. At the command line, type: `lsdev -Cs pci`
3. Press Enter.

A list of PCI devices is displayed. If the adapter is installed correctly, the status of available for each port indicates that the adapter is installed and ready to use. If a message indicates that any of the ports are defined instead of available, shut down your server and verify that the adapter was installed correctly.

Connecting to an Ethernet network

This section explains how to connect the adapter to the multimode fiber network. Refer to your local procedures for information about connecting the adapter to your Ethernet network.

Note: Only one type of network can be attached to the adapter at one time.

To connect the adapter to a multimode fiber network, do the following steps:

1. Insert the male fiber LC connector of the fiber cable into the adapter LC connector.
2. Insert the male fiber LC connector of the other end of the cable into the network switch.

Notes:
- The adapter requires an 850 nm multimode fiber optic cable. See Table 26 on page 60.
- If your switch has an SC receptacle, you need an LC-SC converter cable.
- It is necessary to configure an IP network interface to enable the adapter to detect a link and to illuminate the link LED.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

4 Gigabit PCI Express Dual Port Fibre Channel Adapter (FC 5276; CCIN 5774)

Learn about the specifications and operating system requirements for the feature code (FC) 5776 adapter.

Overview

The FC 5276 (4 Gigabit PCIe Dual Port Fibre Channel Adapter) is the low-profile adapter same as the FC 5774, which is the regular height adapter. The names of the two adapters are:
- FC 5276: 4 Gigabit PCIe Dual Port Fibre Channel Adapter
- FC 5774: 4 Gigabit PCIe Dual Port Fibre Channel Adapter

The 4 Gigabit PCIe Dual Port Fibre Channel Adapter is a 64 bit, low-profile, short form factor x4, PCIe adapter with an LC-type external fiber connector that provides single initiator capability over an optical fiber link or loop. The adapter automatically negotiates the highest data rate between the adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps of which the device or switch is capable. Distances between the adapter and an attaching device or switch can reach up to 500 meters running at 1 Gbps data rate, up to 300 meters running at 2 Gbps data rate, and up to 150 meters running at 4 Gbps data rate. When used with IBM Fibre Channel storage switches supporting long-wave optics, the adapter can reach distances of up to 10 kilometers running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates.

The adapter can be used to attach devices either directly, or with Fibre Channel switches. If you are attaching a device or switch with an SC type fiber connector, you must use an LC-SC 50 micron fiber converter cable (FC 2456) or an LC-SC 62.5 micron fiber converter cable (FC 2459).

The adapter has the following features:
- Compliant with the PCIe Base and Card Electromechanical (CEM) 1.0a specifications:
  - x1 and x4 lane link interface at 2.5 Gbit/s (auto-negotiated with system)
  - Supports VC0 (1 Virtual Channel) and TC0 (1 Traffic Class)
  - Configuration and IO Memory read/write, completion, message
  - Support for 64-bit addressing
  - ECC error protection
  - Link CRC on all PCIe packets and message information
  - Large payload size: 2048 bytes for read and write
  - Large read request size: 4096 bytes
- Compatible with 1, 2, and 4 Gb Fibre Channel interface:
  - Auto-negotiate between 1 Gb, 2 Gb or 4 Gb link attachments
  - Support for all Fibre Channel topologies: point-to-point, arbitrated loop, and fabric
  - Support for Fibre Channel class 2 and 3
  - Maximum Fibre Channel throughput achieved by using full duplex hardware support
- End-to-end data path parity and CRC protection, including internal data path RAMs
- Architectural support for multiple upper layer protocols
- Internal high-speed SRAM memory
- ECC protection of local memory, includes single-bit correction and double-bit protection
- Embedded shortwave optical connection with diagnostics capability
- Onboard Context Management by firmware (per port):
  - Up to 510 FC Port Logins
  - Up to 2047 concurrent Exchanges
  - I/O multiplexing down to the FC Frame level
- Data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Link management and recovery handled by firmware
- Onboard diagnostic capability accessible by optional connection
- Parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- Performance up to 4.25 Gbps full duplex

The following figure shows the adapter.

Figure 10. 5276 adapter

Specifications

Item   Description
Adapter FRU number
> 10N7255*

> * Designed to comply with RoHS requirement

Wrap plug FRU number
> 12R9314

> **Note:** The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture
> PCIe Base and CEM 1.0a
> x4 PCIe bus interface

Slot requirement
> One available PCIe x4, x8, or x16 slot

Voltage
> 3.3V

Form factor
> Short, low-profile

FC compatibility
> 1, 2, 4 gigabit

Cables

> 50/125 micron fiber (500 MHz*km bandwidth cable)
> * 1.0625 Gbps 0.5 – 500 m
> * 2.125 Gbps 0.5 – 300 m
> * 4.25 Gbps 0.5 – 150 m

> 62.5/125 micron fiber (200 MHz*km bandwidth cable)
> * 1.0625 Gbps 0.5 – 300 m
> * 2.125 Gbps 0.5 – 150 m
> * 4.25 Gbps 0.5 – 70 m

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX Version 7.1, or later.
  - AIX Version 6.1, or later.
  - AIX Version 5.3, or later.
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 27 summarizes normal LED states. There is a 1 Hz pause when the LED is off between each group of fast flashes (1, 2 or 3). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 27. Normal LED states

Green LED	Yellow LED	State
On	1 fast flash	1 Gbps link rate - normal, link active
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active

Power-On Self Test (POST) conditions and results are summarized in Table 28. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 28. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	On	POST failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.

Table 28. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
Off	Slow flash	Wake-up failure monitor	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Fast flash	POST failure	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
On	On	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Slow flash	Slow flash	Offline for download	None
Slow flash	Fast flash	Restricted offline mode, waiting for restart	None
Slow flash	Flashing	Restricted offline mode, test active	None
Fast flash	Off	Debug monitor in restricted mode	None
Fast flash	On	Not defined	None
Fast flash	Slow flash	Debug monitor in test fixture mode	None
Fast flash	Fast flash	Debug monitor in remote debug mode	None
Fast flash	Flashing	Not defined	None

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Device ID jumper

The default setting for the two device ID jumpers labeled P0_JX and P1_JX is to set the jumpers on pins 1 and 2 as shown in Figure 11 on page 66. Do not change the jumper settings for a standard installation.
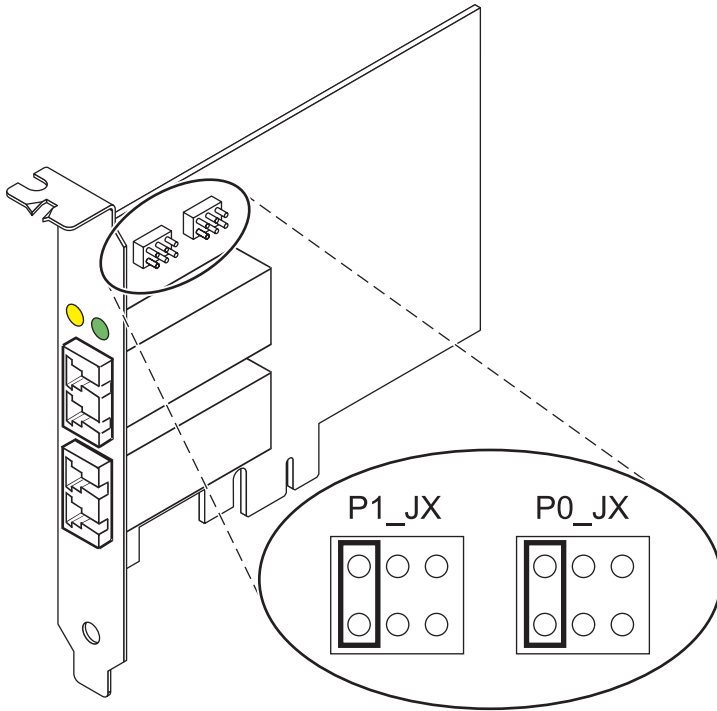
Figure 11. Device ID jumper

Replacing hot swap HBAs

Fibre Channel host bus adapters (HBAs) connected to a fiber array storage technology (FAStT) or DS4000® storage subsystem have a child device that is called a disk array router (dar). You must unconfigure the disk array router before you can hot swap an HBA that is connected to a FAStT or DS4000 storage subsystem. For instructions, see *Replacing hot swap HBAs* in the *IBM System Storage® DS4000 Storage Manager Version 9, Installation and Support Guide for AIX, HP-UX, Solaris, and Linux on Power Systems™ Servers*, order number GC26-7848.

Related information:

→ IBM Prerequisite website

→ Installing, removing, or replacing PCIe adapters

→ PCIe adapter placement

→ PCIe adapter information by feature type

PCIe LP 4-Port Async EIA-232 Adapter (FC 5277; CCIN 57D2)

Learn about the features, operating system requirements, and installation procedures for the feature code (FC) 5277 adapters.

Overview

The FC 5277 (PCIe LP 4-Port Async EIA-232 Adapter) is the low-profile version of the FC 5785 (4 Port Async EIA-232 PCIe adapter), which is a full-height adapter.

The PCIe LP 4-Port Async EIA-232 Adapter provides connections for four asynchronous EIA-232 devices using a 4-port DB-9F DTE fan-out cable. Ports are programmable to support EIA-232 protocols at a line speed of 128 Kbps.
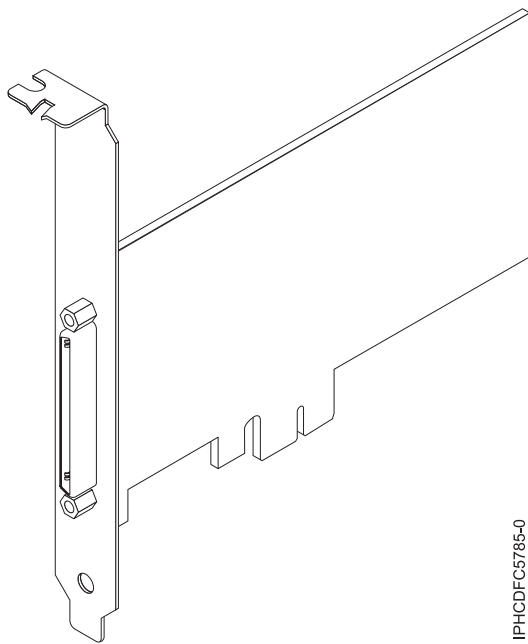
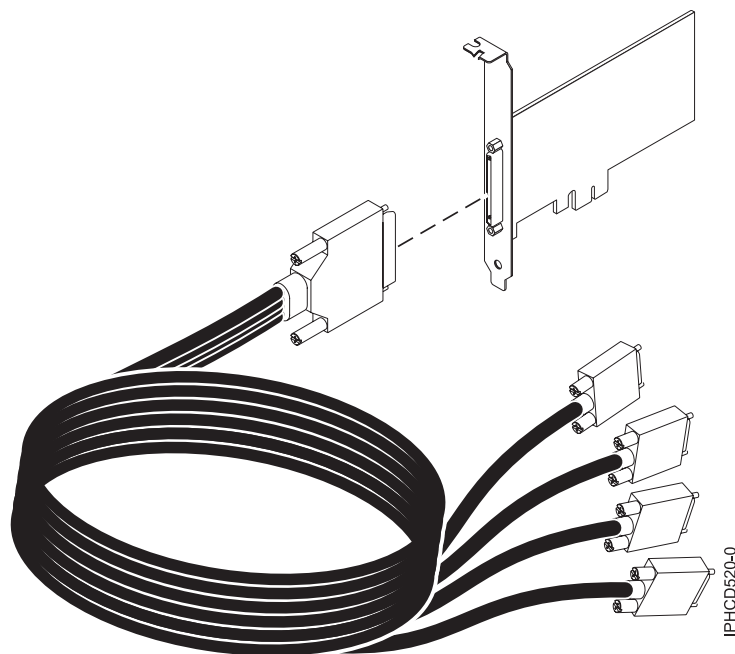The following figures show the adapter and cable.

Figure 12. Adapter

Figure 13. Cable

Specifications

Item   Description
FRU number

Adapter: 46K6734[*]

Cable: 46K6735[*]

[*]Designed to comply with RoHS requirement.

I/O bus architecture

PCIe-V1.0a 1x

Busmaster

No

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter size

PCIe 1x, short form-factor

Connectors

Adapter: 68-pin SCSI

Cable: 68-pin SCSI to DB 9-pin shell

Wrap plug

42R5143

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following operating systems:

- AIX:
  - AIX 7.1, or later
  - AIX 6.1, Technology Level 8, Service Pack 2, or later

  The AIX device package name is `devices.pci.1410a803.rte`.
- Linux:
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.1, or later
  - Red Hat Enterprise Linux Version 5.7, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server 10, Service Pack 3, or later
- IBM i
  - IBM i 7.3, or later
  - IBM i 7.2 TR4, or later
  - IBM i 7.1 TR11, or later
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Preparing for installation

If you are installing your operating system at this time, install your adapter before you install the operating system. If you are installing only the device driver for this adapter, install your device driver software before you install the adapter.

Installing the AIX device driver software

To install device driver software, follow the steps in "Installing the AIX device driver software" on page 24.

Installing the adapter

For general instructions on how to install a PCI adapter, see the For instructions on installing PCIe adapters, see Installing, removing, or replacing PCIe adapters(http://www.ibm.com/support/knowledgecenter/POWER8/p8hak/pciadapters.htm) and select the system you are working on. topic. Return here to verify the adapter installation.

Verifying the adapter installation

To verify that your system unit recognizes the PCI adapter, do the following steps:
1. If necessary, log in as root user.
2. At the command line, type: `lsdev -Cs pci`
3. Press Enter.

A list of PCI devices is displayed. If the adapter is installed correctly, the status of available for each port indicates that the adapter is installed and ready to use. If a message indicates that any of the ports are defined instead of available, shut down your server and verify that the adapter was installed correctly.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe LP Dual - x4 SAS Adapter (FC 5278; CCIN 57B3)

Learn about the specifications and operating system requirements for the feature code (FC) 5278 adapter.

Overview

The FC 5278 (PCIe LP Dual - x4 SAS adapter) is the low-profile adapter, same as the FC 5901 (CCIN 57B3), which is the full-height adapter.

The PCIe LP Dual - x4 SAS adapter is a low-profile, short form factor adapter for high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk, tape, and DVD by using a pair of mini SAS 4x connectors which allow the eight physical links to be used in various narrow and wide-port configurations. The adapter does not have write cache.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability. Some RAID level support is operating system dependent. The adapter provides RAID 0, RAID 5, RAID 6, and RAID 10 for the AIX and Linux operating systems. IBM i operating system provides mirroring and data spreading capability. IBM i operating system does not support the RAID 5 and RAID 6 configurations for

this adapter. The adapter does not have write cache. (The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter which provides write cache when using RAID 5 or RAID 6.)

The adapter can address up to 48 SAS disk drives, although the actual number of drives in a system is subject to the physical placement limitations of the system. Externally attached devices are designed to run at a data rate of 1.5 Gbps for serial ATA (SATA) devices, and 3 Gbps for SAS devices. This card supports RAID and non-RAID DASD, tape, and optical devices. This adapter supports the multi-initiator and high availability configurations in AIX and Linux. IBM i does not support feature 5278 in multi-initiator and high availability configurations.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

The FC 5278 supports SAS SFF disk drives located in a PCIe 12X I/O Drawer or SAS disk drives located in an EXP 12S Disk Drawer or SAS disk drives located in a supported POWER system unit (split disk backplane).

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
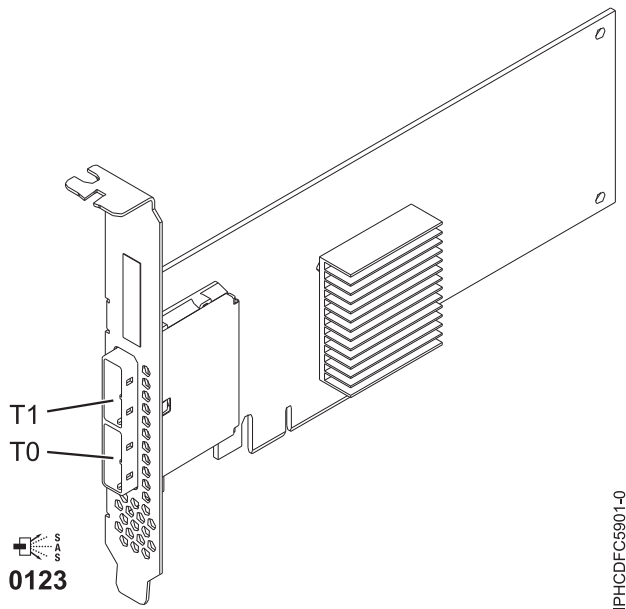
Figure 14. PCIe Dual - x4 SAS adapter

Specifications

Item   Description
Adapter FRU number
    44V4852 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe
Slot requirement
    One available PCIe x8 slot

Cables

    SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. For more information, see Serial attached SCSI cable planning.

Voltage

    3.3 V

Form factor

    Short, low-profile

Maximum number

    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Two external mini SAS 4x connectors provide attachment of SAS and Serial Advanced Technology Attachment (SATA) device enclosures
- SAS Serial SCSI Protocol (SSP), Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP)
- RAID 0, 5, 6, 10

  The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter that provides write cache when using RAID 5 or RAID 6.
- Concurrent firmware update
- Removable media device supported (Removable media is not supported in multi-initiator and high availability configurations)
- Removable media device supported
- 440 - 500 Mhz PowerPC® (PPC)
- Support for multi-initiator and high availability configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 5.6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

This adapter requires the following drivers:

- AIX: devices.pci.1410bd02 device driver package
- Linux:
  - iprutils version 2.4.1 and ipr driver version 2.0.11.6 (or later) for RHEL4 kernels
  - iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for RHEL5 kernels
  - iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for SLES10 kernels
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 LP 2x10GbE SFP+ Copper 2x1GbE UTP Adapter (FC 5279; CCIN 2B52)

Learn about the specifications and operating system requirements for the feature code (FC) 5279 adapters.

Overview

The PCIe2 LP 2x10GbE SFP+ Copper 2x1GbE adapter is a PCI Express (PCIe) generation-2, low-profile, four-ported, Ethernet unified wire adapter with a PCIe 2.0 host bus interface. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. The four-port adapter provides two 10 Gb Ethernet ports and two 1 Gb Ethernet ports. The two 10 Gb small form-factor pluggable (SFP+) copper transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second), and uses SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. Each of the RJ45 ports provides Ethernet connectivity at a data rate of 1 Gbps and are connected with unshielded twisted-pair (UTP) Ethernet cables. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 15 on page 73 shows the FC 5745 adapter.

Note: The SFP+ twinaxialial copper cables have connectors that are not the same as the AS/400 5250 connector, the CX4 connector, or the 10 GBASE-T connector.
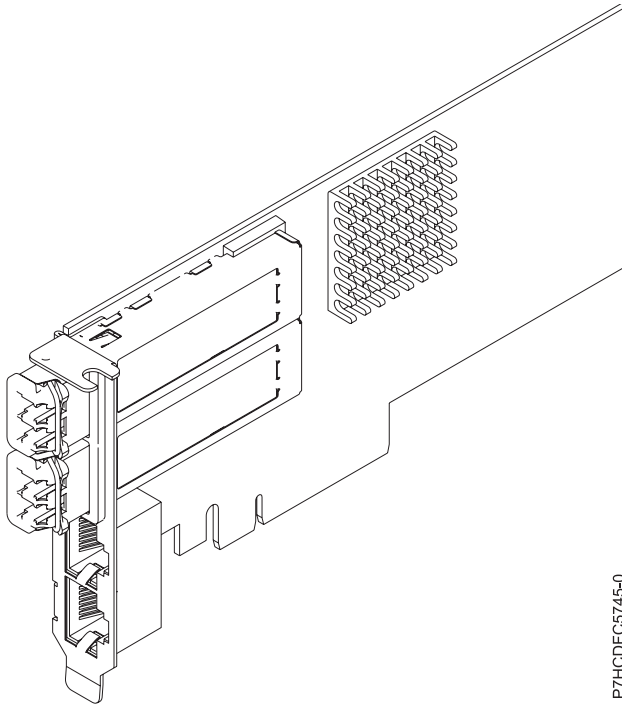
Figure 15. PCIe2 LP 2x10GbE SFP+ Copper 2x1GbE UTP Adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    FC 5279: 74Y1986 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    74Y7010 (Twinax wrap plug)

    10N7405 (1 Gb UTP wrap plug)

    Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
    PCIe2 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    See "Cables" on page 74 for details
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

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Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 16 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 29 for details about the feature codes.

P7ECF505-0
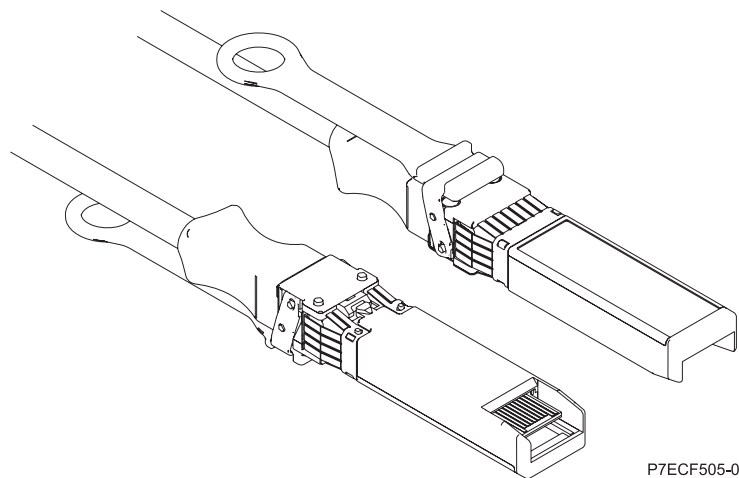
Figure 16. Top and bottom view of the cable

Table 29. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

The adapter is supported on the following versions of the operating system, depending on the system you are using:
* Linux:
  – Red Hat Enterprise Linux Version 6, or later
  – SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.

Related information:

➭ IBM Prerequisite website

➭ Installing, removing, or replacing PCIe adapters

➭ PCIe adapter placement

➭ PCIe adapter information by feature type

PCIe2 LP 2x10GbE SR 2x1GbE UTP Adapter (FC 5280; CCIN 2B54)

Learn about the specifications and operating system requirements for the feature code (FC) 5280 adapter.

Overview

The PCIe2 LP 2x10GbE SR 2x1GbE UTP Adapter is a PCI Express generation-2, low-profile, four-port Ethernet unified wire adapter with a PCI Express 2.0 host bus interface. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. The four port adapter provides two 10 Gb Ethernet ports and two 1 Gb Ethernet ports. The two 10 Gb small form-factor pluggable (SFP+) single root (SR) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ (SR) port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. Each of the RJ45 ports provides Ethernet connectivity at a data rate of 1 Gbps. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 17 shows the FC 5745 adapter.
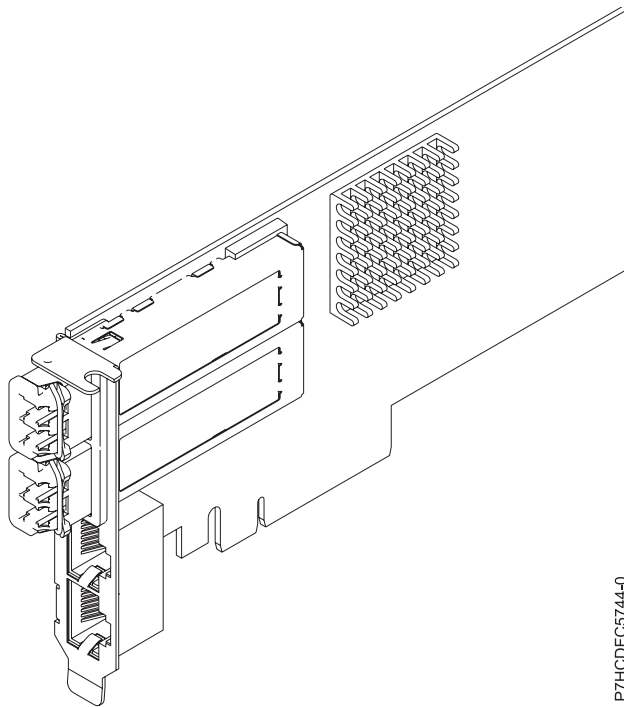
Figure 17. PCIe2 LP 2x10GbE SR 2x1GbE UTP Adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    74Y1988 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    12R9314 (SFP+ SR wrap plug)

    10N7405 (1 Gb UTP wrap plug)

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

No cables required.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe LP 2-Port 1GbE TX Adapter (FC 5281; CCIN 5767)

Learn about features, requirements, and specifications for the feature code (FC) 5281 adapter.

The PCIe LP 2-Port 1GbE TX Adapter is a low-profile, full duplex, dual port, gigabit Ethernet adapter. This adapter can be configured to run each port at 10, 100, or 1000 Mbps data rates. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The adapter supports jumbo frames when running at the 1000 Mbps speed.

The adapter provides the following features:

- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Adapter specifications

Item   Description
Adapter FRU number
    46K6601 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    10N7405 (1 Gb UTP wrap plug)

    Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
    - PCI Express V1.0a compliant
    - Bus width x4 lane PCI Express, operable in x4, x8, x16 slots
    - Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional
Busmaster
    Yes
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Adapter size
    PCIe short form
Connector information
    - Two RJ-45 ports
    - Two LED adapter status indicators per port, for link activity and speed
Cabling
    Customers supply the cables. For best performance, use cables that meet Cat 5e cabling standards, or later.

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket. 2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter shows the location of the LEDs. Table 30 describes the different LED states and what those states indicate. The following figure shows the adapter.
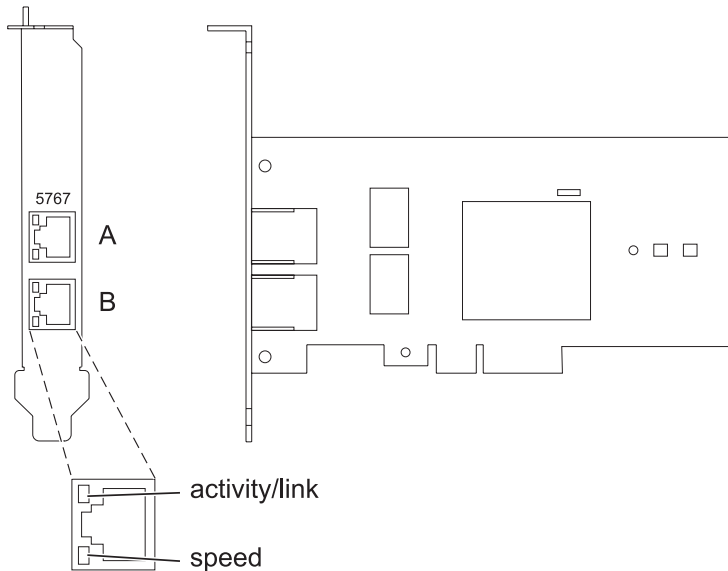
Figure 18. 2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter

Table 30. Adapter LEDs and descriptions

LED	Light	Description
Activity/link	Green	Active link
	Off	No link
		The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
	Flashing	Data activity
Speed	Off	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later
  - Red Hat Enterprise Linux Version 5.6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 81 for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 80 for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you must not reinstall the device drive.

Verifying the hardware requirements

The adapter requires the following hardware:
- A wrap plug for the RJ-45 connector, if you are running the total diagnostics package.
- Cat 5e (or higher) UTP cables for 1000 Mbps network attachment.
- Cat 5 or Cat 3 UTP cables for 100 Mbps or 10 Mbps network attachment.

Restriction: The cable can be no longer than 100 meters (including patch cables) from the adapter to the local switch.

Verifying the software requirements

You can use the adapter on operating systems shown in "Operating system or partition requirements" on page 78.

Gathering tools and documentation

To install the adapter, ensure that you have access to the following items:
- The adapter

- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The AIX device driver CD, which includes the device driver

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L operating system on the AIX device driver CD.

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

   If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pciex.14104003`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Verifying the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:
1. If necessary, log in as root user.
2. Type `lslpp -l devices.pciex.14104003.rte` and press Enter.

   If the device driver is installed, the following table is an example of the data that is shown.

Table 31. Adapter device driver fileset, level, and state

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14104003.rte	5.*x*.0.0	COMMITTED	PCIe LP 2-Port 1GbE TX Adapter

3. Confirm that the devices.pciex.14104003.rte filesets are installed. If no data is shown in the window, reinstall the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you must install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8, or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.
2. Install the adapter by using the instructions in the system unit service guide.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 LP 2-port 4X InfiniBand QDR Adapter (FC 5283; CCIN 58E2)

Learn about the specifications and operating system requirements for the feature code (FC) 5283 adapter.

Overview

The PCIe2 LP 2-port 4X IB QDR Adapter is a generation-2 4X InfiniBand QDR adapter that provides high speed connectivity with other servers or InfiniBand switches.

Each port has a maximum of 40 Gb allotted to it.

The FC 5283 is a low-profile adapter and requires an available generation-2 low-profile slot.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    74Y2987 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe x8

Slot requirement

Requires an available low-profile slot

Cables

No cables required.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX:
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, or later
- Linux:
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later
  - Red Hat Enterprise Linux Version 5.6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server 10, Service Pack 3, or later
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➜ IBM Prerequisite website

➜ Installing, removing, or replacing PCIe adapters

➜ PCIe adapter placement

➜ PCIe adapter information by feature type

PCIe2 LP 2-port 10GbE SR Adapter (FC 5284; CCIN 5287)

Learn about the specifications and operating system requirements for the feature code (FC) 5284 adapters.

Overview

The FC 5284 and FC 5287 are both the same adapter. FC 5284 is a low-profile adapter and the FC 5287 is a full-height adapter.

The PCIe2 LP 2-port 10GbE SR Adapter is a short, low-profile, high-performance, generation-2 PCIe adapter. This adapter provides two 10-Gb Ethernet ports that can be configured to run at 10 gigabits per second (Gbps). Each of the Ethernet ports can be connected by using a little connector (LC) duplex-type connector over a multi-mode fiber (MMF) 850 nm fiber cable up to 300 meters (984.25 feet) in length. The adapter conforms to the IEEE, 802.3ae 10GBASE-SR specification for Ethernet transmission.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number

74Y3242 (Designed to comply with RoHS requirement)

Wrap plug FRU number

12R9314 (SFP+ SR wrap plug)

Note: Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture

PCIe2.0 x8

Slot requirement

One PCIe x8 (low-profile) slot.

Cables

MMF 850 nm fiber cable are connected to LC duplex-type connectors.

Voltage

3.3 V

Form factor

Low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided
- PCIe x8 Generation 2
- MSI-X and support of legacy pin interrupts
- 10GBASE-SR short-reach optics
- IEEE 802.3ae (10 GbE)
- IEEE 802.1p priority and 802.1Q VLAN tagging
- IEEE 802.3x flow control
- Link aggregation, 802.3ad 802.3 compliance
- IEEE 802.3ad load-balancing and failover
- Ether II and 802.3 encapsulated frames
- Multiple MAC addresses per interface
- Jumbo frames up to 9.6 Kbytes
- TCP checksum offload for IPv4
- TCP segmentation Offload (TSO) for IPv4
- UDP checksum offload for IPv4
- Receive side scaling and packet steering
- Line rate packet filtering and attack protection

Figure 19 on page 84 shows the adapter.
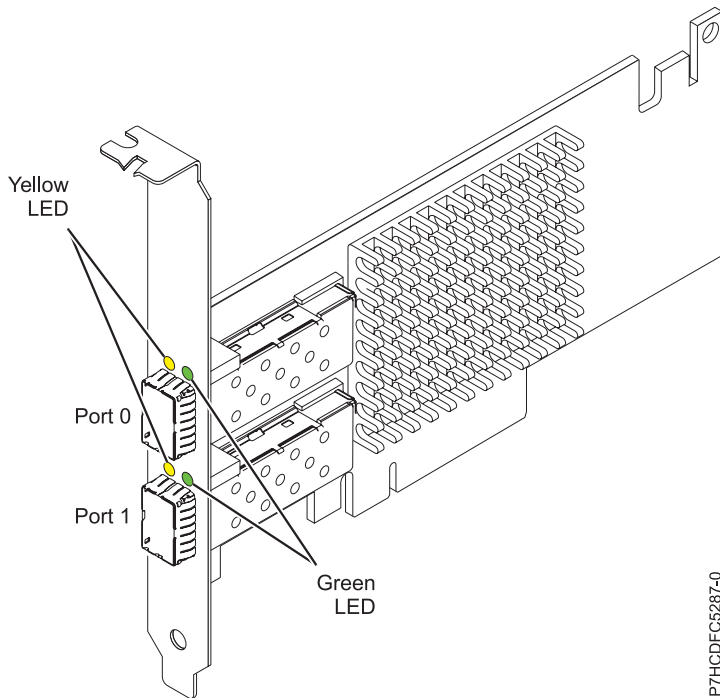
Figure 19. PCIe2 LP 2-port 10GbE SR Adapter

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible through the adapter's mounting bracket. Figure 19 shows the location of the LEDs. Table 32 describes the different LED states and what those states indicate.

Table 32. Adapter LEDs and descriptions

LED	Light	Description
Activity/link	Green	Active link
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
	Flashing	Data activity

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later

- SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.0.11 with Fix Pack 24 and Service Pack 1, or later.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 2-port 4X InfiniBand QDR Adapter (FC 5285; CCIN 58E2)

Learn about the specifications and operating system requirements for the feature code (FC) 5285 adapter.

Overview

The PCIe2 2-port 4X IB QDR Adapters are generation-2 4X InfiniBand QDR adapters that provides high speed connectivity with other servers or InfiniBand switches.

Each port has a maximum of 40 Gb allotted to it.

FC 5285 has a high-profile tailstock and requires a full-height generation-2 slot.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    74Y2987 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    No cables required.
Voltage
    3.3 V
Form factor
    Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 6, or later
  - SUSE Linux Enterprise Server 10, or later

Related information:

⬅ IBM Prerequisite website

⬅ Installing, removing, or replacing PCIe adapters

⬅ PCIe adapter placement

⬅ PCIe adapter information by feature type

PCIe2 2-port 10 GbE SR Adapter (FC 5287; CCIN 5287)

Learn about the specifications and operating system requirements for the feature code (FC) 5287 adapters.

Overview

The FC 5284 and FC 5287 are both the same adapter. FC 5284 is a low-profile adapter and the FC 5287 is a full-height adapter.

The PCIe2 2-port 10 GbE SR adapter is a short, regular-height, high-performance, generation-2 PCIe adapter. This adapter provides two 10-Gb Ethernet ports that can be configured to run at 10 Gigabits per second (Gbps). Each of the Ethernet ports can be connected by using a little connector (LC) duplex-type connector over a multi-mode fiber (MMF) 850 nm fiber cable up to 300 meters (984.25 feet) in length. The adapter conforms to the IEEE, 802.3ae 10GBASE-SR specification for Ethernet transmission.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
74Y3457 (Designed to comply with RoHS requirement)
Wrap plug FRU number
12R9314 (SFP+ SR wrap plug)

Note: Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture

PCIe2, x8

Slot requirement

One PCIe x8, generation-2 slot.

Cables

MMF 850 nm fiber cable are connected to LC duplex-type connectors.

Voltage

3.3 V

Form factor

Low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

- PCIe x8 Generation 2
- MSI-X and support of legacy pin interrupts
- 10GBASE-SR short-reach optics
- IEEE 802.3ae (10 GbE)
- IEEE 802.1p priority and 802.1Q VLAN tagging
- IEEE 802.3x flow control
- Link aggregation, 802.3ad 802.3 compliance
- IEEE 802.3ad load-balancing and failover
- Ether II and 802.3 encapsulated frames
- Multiple MAC addresses per interface
- Jumbo frames up to 9.6 Kbytes
- TCP checksum offload for IPv4
- TCP segmentation Offload (TSO) for IPv4
- UDP checksum offload for IPv4
- Receive side scaling and packet steering
- Line rate packet filtering and attack protection

Figure 20 on page 88 shows the adapter.
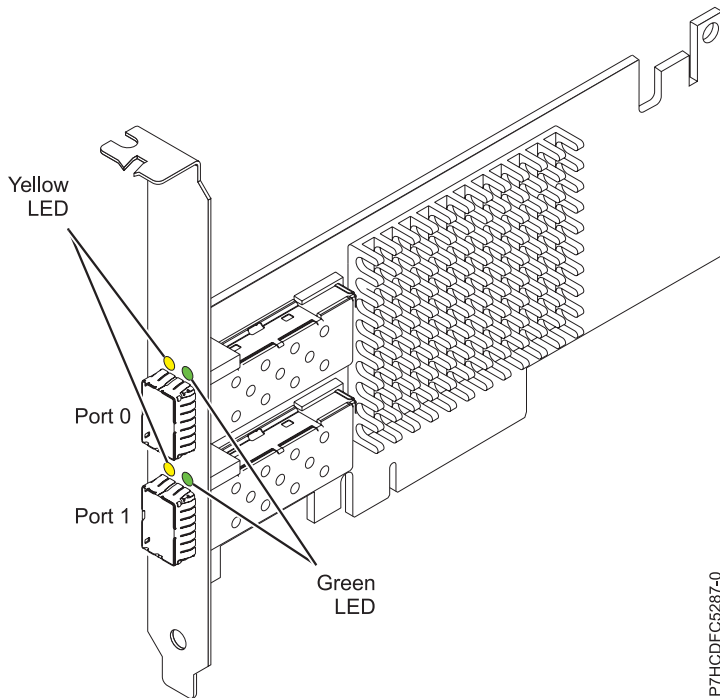
Figure 20. PCIe2 2-port 10 GbE SR adapter

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible through the adapter's mounting bracket. Figure 20 shows the location of the LEDs. Table 33 describes the different LED states and what those states indicate.

Table 33. Adapter LEDs and descriptions

LED	Light	Description
Green (Activity)	On (constantly)	Link up
	Off	Link down The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
Amber (Link)	Blink	Acitivty on the Ethernet Link
	Off	No activity on the Ethernet Link

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:

- AIX
  - AIX Version 7.1 and Service Pack 3, or later.
  - AIX Version 6.1 with the 6100-06 Technology Level, and Service Pack 3, or later.
  - AIX Version 5.3 with the 5300-12 Technology Level and Service Pack 4, or later.
- Linux
  - Red Hat Enterprise Linux.
  - SUSE Linux Enterprise Server.

- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- VIOS
  - VIOS support requires VIOS 2.2.0.11 with Fix Pack 24 and Service Pack 1, or later.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe 2-port Async EIA-232 Adapter (FC 5289; CCIN 57D4)

Learn about the specifications and operating system requirements for the feature code (FC) 5289 adapter.

Overview

The PCIe 2-port Async EIA-232 Adapter is a 2-port EIA-232 asynchronous serial communications PCI Express (PCIe) adapter that can be installed in the PCIe slots. The adapter is full-height and is based on the PCIe 1.1 host bus interface. The parallel port function is not implemented on this adapter.

Each of the two Universal Asynchronous Receiver/Transmitter (UART) channels contain 128 byte receiver-transmitter, first-in first-out (FIFO), full modem-control signaling, and standard host interrupts. If either of the two UART interrupts is active, the host can be interrupted through a single PCI interrupt. The two-port adapter provides RJ45 Ethernet ports, which are connected by DB-9 connectors.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    74Y4084 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe 1.1
Slot requirement
    For the slot priorities, see the PCI adapter placement topic collection for your system.
Cables
    Cat 5 unshielded twisted-pair cables
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

This adapter is supported for the following versions of the operating systems:
- AIX:
  - AIX 7.1 with the 7100-01 Technology Level, or later

- – AIX 6.1 with the 6100-07 Technology Level, or later
- – AIX 5.3 with the 5300-12 Technology Level, and Service Pack 5, or later
- Linux:
  - – SUSE Linux Enterprise Server 11 SP1, or later
  - – SUSE Linux Enterprise Server 10 SP4, or later
  - – Red Hat Enterprise Linux Version 6.1, or later
  - – Red Hat Enterprise Linux Version 5.7, or later
  - – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe LP 2-port Async EIA-232 Adapter (FC 5290; CCIN 57D4)

Learn about the specifications and operating system requirements for the feature code (FC) 5290 adapters.

Overview

FC 5289 and 5290 are both the same adapter. FC 5289 is a full-height adapter, and the FC 5290 is a low-profile adapter.

The FC 5289 and FC 5290 are 2-port EIA-232 asynchronous serial communications PCI Express (PCIe) adapters that can be installed in the PCIe slots. The adapters are based on the PCIe 1.1 host bus interface. The parallel port function is not implemented on these adapters.

Each of the two universal asynchronous receiver/transmitter (UART) channels contain 128 byte receiver-transmitter, first-in first-out (FIFO), full modem-control signaling, and standard host interrupts. If either of the two UART interrupts are active, the host can be interrupted through a single PCI interrupt. The two-port adapter provides RJ45 Ethernet ports, which are connected by DB-9 connectors.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number
  74Y4085 (Designed to comply with RoHS requirement)

I/O bus architecture
  PCIe 1.1

Slot requirement
  For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
  Cat 5 unshielded twisted-pair cables

Voltage
  3.3 V

Form factor
    Short
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX:
    - AIX 7.1, Technology Level 3, Service Pack 2, or later
    - AIX 7.1, Technology Level 2, Service Pack 3, or later
    - AIX 6.1, Technology Level 9, or later
    - AIX Version 5.3, Technology Level 12, or later
- Linux:
    - Red Hat Enterprise Linux Version 6.1, or later
    - Red Hat Enterprise Linux Version 5.7, or later
    - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
    - SUSE Linux Enterprise Server 10, Service Pack 4, or later
    - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
    - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i:
    - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe 10-Gb FCoE 2-port Adapter (FC 5708 CCIN 2B3B)
Learn about the features, operating system requirements, and installation notes for the feature code (FC) 5708 adapter.

Overview

This PCI Express adapter has two feature codes associated:
- FC 5270: PCIe LP 10-Gb FCoE 2-port Adapter, is the low-profile adapter.
- FC 5708: PCIe 10-Gb FCoE 2-port Adapter, is the full-height adapter.

The PCIe 10 Gb FCoE 2-port Adapter is a high-performance, converged network adapter (CNA). The adapter supports data networking and storage networking traffic on a single I/O adapter by using Enhanced Ethernet and Fibre Channel over Ethernet (FCoE). Both FCoE and network interface controller (NIC) functions are available for both ports simultaneously. Using FCoE requires Convergence Enhanced Ethernet (CEE) switches.

The following figure shows the adapter LEDs and connectors.
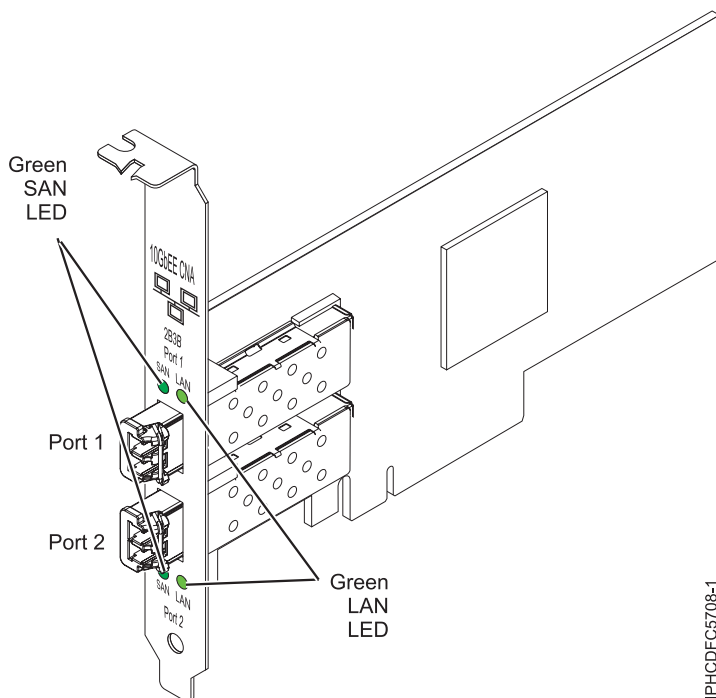
Figure 21. PCIe 10 Gb FCoE 2-port Adapter

The LEDs on the adapter provide information about the operation status of the adapter.

Table 34. Adapter LEDs

Green SAN LED	Green LAN LED	Activity
Off	Off	Power off
Slow flashing (unison)	Slow flashing (unison)	Power-on, no link
On	On	Link established, no activity
On	Flashing	Link established, Transmission/Receive (TX/RX) LAN only activity
Flashing	On	Link established, TX/RX SAN only activity
Flashing	Flashing	Link established, TX/RX LAN and SAN activity
Slow flashing (alternating)	Slow flashing (alternating)	Beaconing

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

FRU number

46K8088 (Designed to comply with RoHS requirement.)

Wrap plug FRU number

12R9314 (for Fibre LC connector)

Note: The wrap plug is not included with the card, but can be purchased from IBM.

I/O bus architecture

PCI Express x8 generation-1 and x4 generation-2

PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Connectors

LC multimode fiber optic

SFP+ (small form-factor pluggable) with SR optics

Voltage

3.3 V and 12-V

Form factor

Short, low-profile with standard-size bracket

Cables

Cables are the responsibility of the customer. Use multimode fiber optic cables with short-wave lasers that adhere to the following specifications:
*   OM1
    *   Multimode 62.5/125 micron fiber
    *   200 MHz x km bandwidth
    *   Maximum cable distance 1 is 33 m (108 ft)
*   OM2
    *   Multimode 50/125 micron fiber
    *   500 MHz x km bandwidth
    *   Maximum cable distance is 82 m (269 ft)
*   OM3
    *   Multimode 50/125 micron fiber
    *   2000 MHz x km bandwidth
    *   Maximum cable distance is 300 m (984 ft)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
*   AIX
    *   AIX 7.1, Technology Level 3, Service Pack 2, or later
    *   AIX 6.1, Technology Level 8, Service Pack 3, or later
    *   AIX Version 5.3, Technology Level 12, or later
*   Linux
    *   Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

– Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.

– SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.

– For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

- IBM i
  – Support of this feature with IBM i requires VIOS 2.2 or later
  – IBM i 7.1, or later
- VIOS
  – VIOS support requires VIOS 2.2.0.12-FP24 SP02, or later

Replacing FCoE adapters by using hot swap

When hot swapping FCoE adapters, be aware that device-related software for the storage devices might have additional devices that must be removed. See specific storage device documentation for information about how to remove these additional devices. The adapter has a unique worldwide port name (WWPN). When using the Fibre Channel function, check the zoning and LUN assignments to ensure that the Fibre Channel function is operating as expected.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

4-Port 10/100/1000 Base-TX PCI Express Adapter (FC 5717; CCIN 5717)

Learn about features, requirements, and specifications for the feature code (FC) 5717 adapter.

The 4-Port 10/100/1000 Base-TX PCI Express Adapter is a PCI Express (PCIe), full duplex, four ported, Gigabit Ethernet adapter that can be configured to run either port at 1000, 100, or 10 Mbps data rate. This adapter interfaces to the system through a PCIe bus and connects to a network using a 4-pair CAT-5 Unshielded Twisted Pair (UTP) cable for distances of up to 100 meters. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The 5717 also supports jumbo frames when running at the 1000 Mbps speed.

The adapter provides the following features:

- Supports interrupt moderation to deliver increased performance while significantly reducing central processing unit (CPU) utilization
- Allows quad-port operation in x4, x8, x16 slots, and each port operates without interfering with the other
- Each port operates without interfering with the other
- Auto-negotiation, full-duplex (half-duplex available for 10/100)
- Integrated media access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) and Gigabit EtherChannel (GEC) when used with capable switch
- Supports IEEE 802.3ad Link Aggregation control protocol when used with capable switch
- IEEE 802.1Q VLANs, IEEE 802.3 (z, ab, u, x) flow control support, IEEE 802.1p
- TCP checksum offload -- transmission control protocol (TCP), Internet Protocol (IP) for IPv4
- TCP Segmentation Offload (TSO) / Large Send Offload (LSO)
- Bus width x4 lane; operable in x4, x8, or x16 slots

- Bus speed (x4, encoded rate) 10 Gbps unidirectional and 20 Gbps bidirectional
- EEPROM SPI and single EEPROM support
- Interrupt levels INTA and MSI (requires system and software support for MSI)
- IEEE 802.3ab
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Four RJ-45 connectors
- LEDs on each port identifying speed and link activity
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter specifications

Item   Description
Adapter FRU number
    46Y3512 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    10N7405 (1 Gb UTP wrap plug)

    Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
    - PCIe V1.0a compliant
    - Bus width x4 lane PCIe, operable in x4, x8, x16 slots
    - Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional
Busmaster
    Yes
Maximum number
    For the maximum adapters supported, see the PCI adapter placement topic collection for your system.
Adapter size
    PCIe short form
Connector information
    - Four RJ-45 ports
    - Two LED adapter status indicators per port, for link activity and speed
Cabling
    Customers supply their own cables. For best performance, use cables that meet Cat 5e cabling standards, or later.

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible through the adapter's mounting bracket. 4-Port 10/100/1000 Base-TX PCIe Adapter shows the location of the LEDs. Table 35 on page 96 describes the different LED states and what those states indicate.

The following figure shows the adapter:
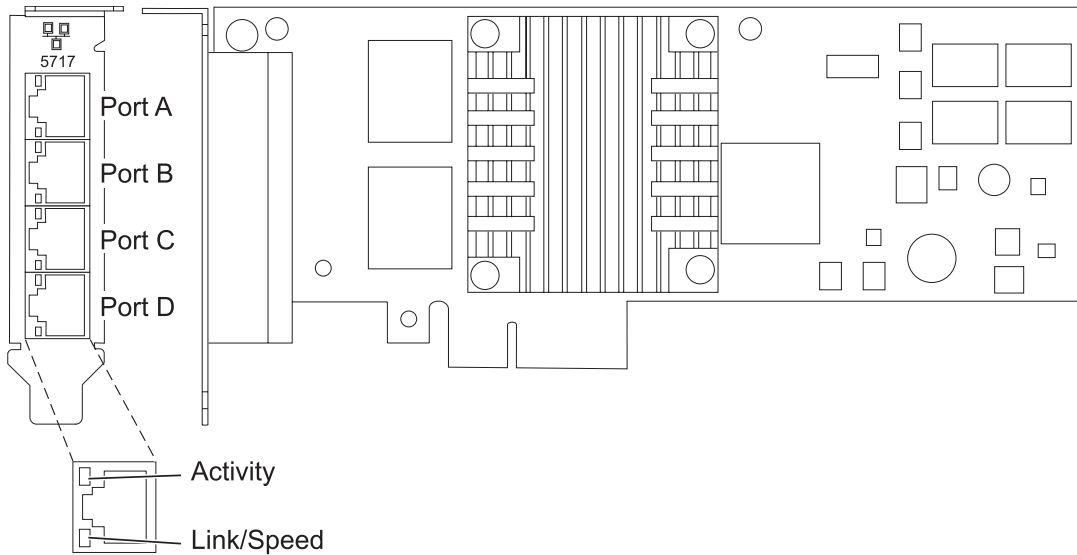
Figure 22. 4-Port 10/100/1000 Base-TX PCIe Adapter

Table 35. Adapter LEDs and descriptions

LED	Light	Description
Activity/link	Green	Active link
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
	Blinking	Data activity
Speed	Off	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of the operating systems:
- AIX
  - AIX Version 7.1, or later
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
- Linux
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

If you are using another release of AIX, ensure that the adapter is supported on that release before you install the adapter. Contact service and support for assistance.

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 98 for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you do not need to reinstall the device drive.

Verifying the hardware requirements

The adapter requires the following hardware:
- A wrap plug for the RJ-45 connector, if you are running the total diagnostics package
- Cat 5e (or higher) UTP cables for 1000 Mbps network attachment
- Cat 5 or Cat 3 UTP cables for 100 Mbps or 10 Mbps network attachment

Restriction: The cable can be no longer than 100 meters (including patch cables) from the adapter to the local switch.

Verifying the software requirements

You can use the adapter on operating systems shown in "Operating system or partition requirements" on page 96.

Gathering tools and documentation

To install the adapter, make sure you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation.
- A flat-blade screwdriver
- The AIX device driver CD, which includes the device driver.

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L operating system on the AIX device driver CD, which includes the device driver..

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.

3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`

4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.

5. Type the name of the input device that you are using, or press F4 to select the input device from a list.

6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.

7. Press F4 to select List.

8. Type / to display the Find window.

9. Type the device package name `devices.pciex.14106803` .

10. Press Enter. The system finds and highlights this device driver software.

11. Press F7 to select the highlighted device driver software.

12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.

13. Press Enter to accept the information. The ARE YOU SURE window displays.

14. Press Enter to accept the information. The COMMAND STATUS window displays.

    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.

    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.

    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.

15. Remove the installation media from the drive.

16. Press F10 to exit SMIT.

Verifying the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:

1. If necessary, log in as root user.

2. Type `lslpp -l devices.pciex.14106803.rte` and press Enter.

   If the device driver is installed, the following table is an example of the data that appears.

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14106803.rte	5.*x*.0.0	COMMITTED	4-Port 10/100/1000 Base-TX PCI Express Software

3. Confirm that the devices.pciex.14106803.rte filesets are installed. If no data displays in the window, reinstall the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8 or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.

2. Install the adapter using the instructions in the system unit service guide.

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe2 FH 4-Port 8 Gb Fibre Channel Adapter (FC 5729; CCIN 5729)

Learn about the specifications and operating system requirements for the feature code (FC) 5729 adapter.

Overview

The PCIe2 FH 4-Port 8 Gb Fibre Channel Adapter (FC 5729) is a high-performance adapter based on the Emulex LPe12004 PCIe Host Bus Adapter (HBA). FC 5729 is a generation-2 adapter and is supported on systems that support the generation-2 adapters. The adapter provides four Fibre Channel ports. Each Fibre Channel port provides single initiator capability over a fibre link. The ports have LC type connectors and use shortwave laser optics. The adapter connects to Fibre Channel switches and operates at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed of which the switch is capable. LEDs on each port provide information about the status and link speed of the port.

The following figure shows the FC 5729 adapter.
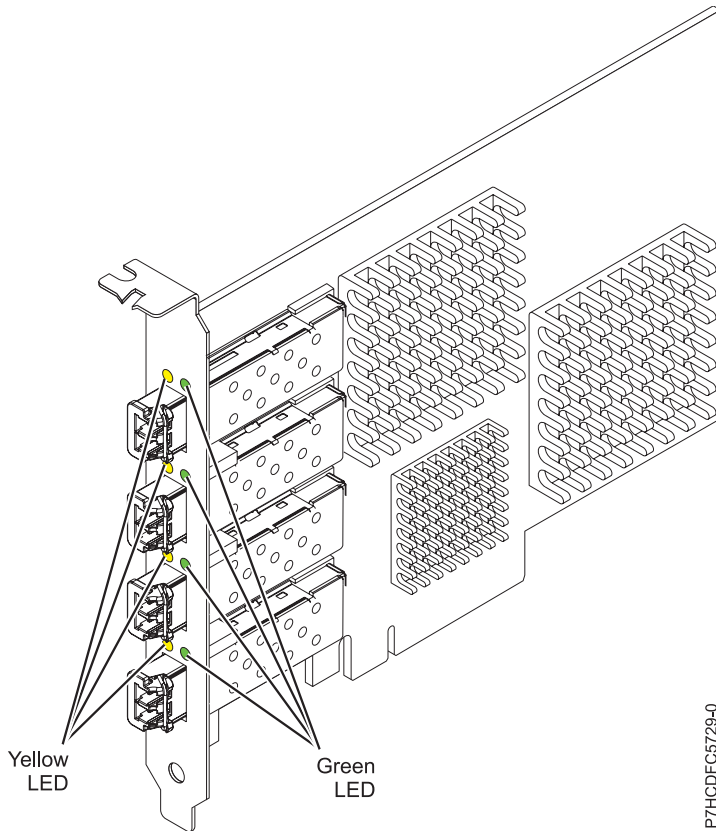
Figure 23. FC 5729 adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter specifications

Item   Description
FRU number
> 74Y3467 (Designed to comply with RoHS requirement)

Wrap plug FRU number
> 12R9314

> **Note:** The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture
> PCI Express (PCIe) Base 2.0 and x8 PCIe bus interface

Slot requirement
> One available PCIe x8 or x16 slot

Voltage
> 3.3 V

Form factor
> Full-height, full-length adapter with standard-size bracket

FC compatibility
> 2, 4, and 8 gigabit FC devices

Cables
> Cables are the responsibility of the customer. Use multimode fibre optic cables with short-wave lasers that adhere to the following specifications:
> • OM3: Multimode 50/125 micron fibre, 2000 MHz x km bandwidth

- OM2: Multimode 50/125 micron fibre, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fibre, 200 MHz x km bandwidth

Because core sizes are different, only OM1 cables can be connected to other OM1 cables. For best results, do not connect OM2 cables to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable applies to the entire length of the cables.

The following table shows the supported distances for the three different cable types at the three different link speeds.

Table 36. Supported cable distances by link speed

Cable type	2.125 Gbps	4.25 Gbps	8.5 Gbps
OM3	0.5 m - 500 m	0.5 m - 380 m	0.5 m - 150 m
OM2	0.5 m - 300 m	0.5 m -150 m	0.5 m - 50 m
OM1	0.5 m - 150 m	0.5 m - 70 m	0.5 m - 21 m

Maximum number

For system-specific adapter placement information, see the PCI adapter placement topic.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1
  - AIX 6.1

Adapter LED

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 37 summarizes the link rate conditions. There is a one second pause when the LED is off between each group of fast flashes (2, 3, or 4). Observe the LED sequence for several seconds to be sure that you have correctly identified the state.

Table 37. Normal LED states

Green LED	Yellow LED	State
Slow flashing	Off	Normal, link inactive or not started
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active
On	4 fast flashes	8 Gbps link rate - normal, link active

Power-on self test (POST) conditions and results are summarized in Table 38. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 38. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform the AIX or IBM i operating system diagnostics.

Table 38. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
Off	On	POST failure (dead board)	Perform the AIX or IBM i operating system diagnostics.
Off	Slow flashing	Wake-up failure monitor	Perform the AIX or IBM i operating system diagnostics.
Off	Fast flashes	POST failure	Perform the AIX or IBM i operating system diagnostics.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform the AIX or IBM i operating system diagnostics.
On	On	Failure while functioning	Perform the AIX or IBM i operating system diagnostics.
Slow flashes	Slow flashing	Offline for download	None
Slow flashes	Fast flashes	Restricted offline mode, waiting for restart	None
Slow flashes	Flashing	Restricted offline mode, test active	None

Replacing Fibre Channel adapters using hot swap

When hot swapping Fibre Channel adapters, be aware that device-related software for the storage devices might have additional devices (for example, the dar device associated with the FAStT or DS4800) that need to be removed. Refer to specific storage device documentation for information about how to remove these additional devices.

The adapter has a unique worldwide port name (WWPN). Check the zoning and LUN assignments to ensure that the new adapter functions as expected.

Related information:

→ IBM Prerequisite website

→ Installing, removing, or replacing PCIe adapters

→ PCIe adapter placement

→ PCIe adapter information by feature type

8 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5735; CCIN 577D)
Learn about the specifications and operating system requirements for the feature code (FC) 5735 adapter.

Overview

The 8 Gb PCI Express Dual-port Fibre Channel Adapter is a high-performance adapter based on the Emulex LPe12002 PCIe Host Bus Adapter (HBA). Each port provides single initiator capability over a fibre link. The ports have LC type connectors and utilize shortwave laser optics. The adapter connects to fibre channel switches and operates at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed of which the switch is capable. LEDs on each port provide information on the status and link speed of the port.

The following figure shows the adapter:
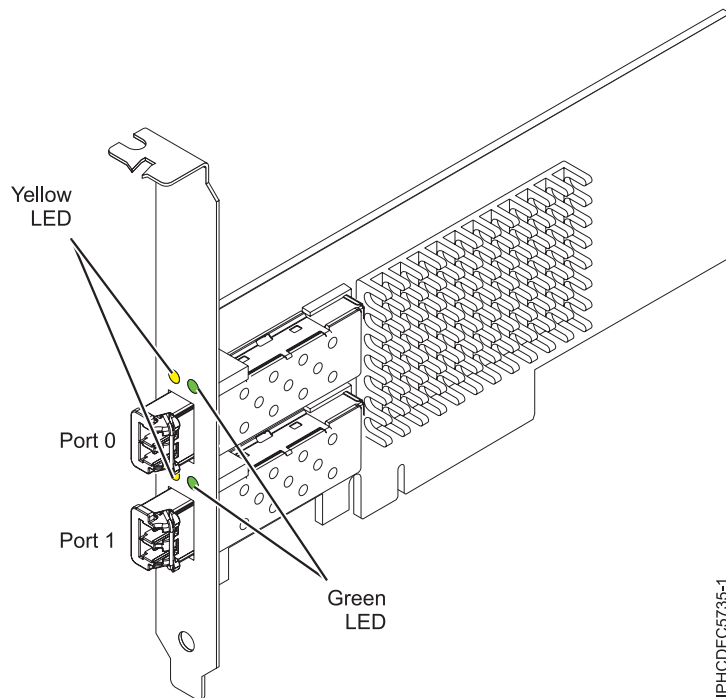
Figure 24. 5735 adapter

Adapter specifications

Item   Description

FRU number

10N9824 (Designed to comply with RoHS requirement)

Wrap plug FRU number

12R9314

Note: The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture

PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0

x8 PCIe bus interface

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

3.3 V

Form factor

Short, low-profile with standard size bracket

FC compatibility

2, 4, 8 Gigabit

Cables

Cables are the responsibility of the customer. Use multimode fibre optic cables with short-wave lasers that adhere to the following specifications:

- OM3: Multimode 50/125 micron fibre, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fibre, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fibre, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables.

The following table shows the supported distances for the three different cable types at the three different link speeds.

Table 39. Supported cable distances by link speed

Cable type	2.125 Gbps	4.25 Gbps	8.5 Gbps
OM3	0.5 m - 500 m	0.5 m - 380 m	0.5 m - 150 m
OM2	0.5 m - 300 m	0.5 m -150 m	0.5 m - 50 m
OM1	0.5 m - 150 m	0.5 m - 70 m	0.5 m - 21 m

Maximum number
For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter LED

Green and yellow LEDs can be seen through openings in the adapter mounting bracket. Green indicates firmware operation and yellow signifies port activity. Table 40 summarizes the link rate conditions. There is a 1-second pause when the LED is off between each group of fast flashes (2, 3, or 4). Observe the LED sequence for several seconds to be sure that you have correctly identified the state.

Table 40. Normal LED states

Green LED	Yellow LED	State
Slow flash	Off	Normal, link inactive or not started
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active
On	4 fast flashes	8 Gbps link rate - normal, link active

Power-on self test (POST) conditions and results are summarized in Table 41. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 41. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	On	POST failure (dead board)	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Slow blink	Wake-up failure monitor	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Fast blink	POST failure	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, Linuxor IBM i operating system diagnostics.
On	On	Failure while functioning	Perform AIX, Linuxor IBM i operating system diagnostics.

Table 41. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
Slow blink	Slow blink	Offline for download	None
Slow blink	Fast blink	Restricted offline mode, waiting for restart	None
Slow blink	Flashing	Restricted offline mode, test active	None

Replacing Fibre Channel adapters using hot swap

When hot swapping fibre channel adapters, be aware that device-related software for the storage devices might have additional devices (for example, the dar device associated with the FAStT or DS4800) that need to be removed. Refer to specific storage device documentation for information about how to remove these additional devices.

The new adapter has a unique worldwide port name (WWPN). Check the zoning and LUN assignments to ensure that the new adapter will function as expected.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
* AIX
  - AIX Version 7.1, or later
  - AIX Version 6.1, or later
  - AIX Version 5.3, or later
* Linux
  - Red Hat Enterprise Linux 6.1 for POWER, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later (with update package)
  - Ubuntu 16.04.1 or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
* IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter (FC 5744; CCIN 2B44)
Learn about the specifications and operating system requirements for the feature code (FC) 5744 adapters.

Overview

The FC 5280 and FC 5744 are both the same adapter. FC 5744 is a full-height adapter, and the FC 5280 is a low-profile adapter. The names of these two adapters are:
- FC 5744: PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter
- FC 5280: PCIe2 LP 2x10 GbE SR 2x1 GbE UTP Adapter

The PCIe2 2x10 GbE SR 2x1 GbE UTP adapter is a PCI Express generation-2, four-port Ethernet unified wire adapter with a PCI Express 2.0 host bus interface. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. The four port adapter provides two 10 Gb Ethernet ports and two 1 Gb Ethernet ports. The two 10 Gb small form-factor pluggable (SFP+) single root (SR) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ (SR) port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. Each of the RJ45 ports provides Ethernet connectivity at a data rate of 1 Gbps. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 25 shows the FC 5745 adapter.
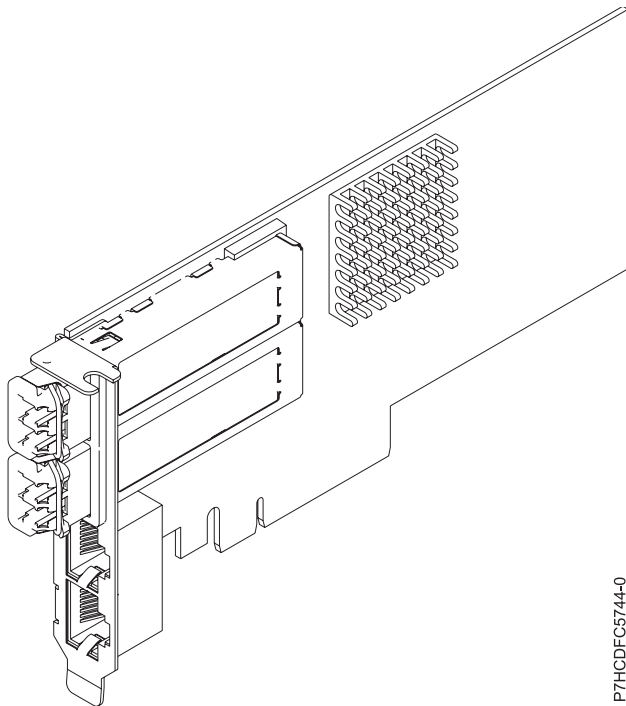
Figure 25. PCIe2 2x10 GbE SR 2x1 GbE UTP Adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number

      FC 5280: 74Y1988 (Designed to comply with RoHS requirement)

      FC 5744: 74Y1987 (Designed to comply with RoHS requirement)

Wrap plug FRU number

    12R9314 (SFP+ SR wrap plug)

    10N7405 (1 Gb UTP wrap plug)

    Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

    PCIe2 x8

Slot requirement

    For the slot priorities, see the PCI adapter placement topic collection for your system.

Cables

    No cables required.

Voltage

    3.3 V

Form factor

    Short

Maximum number

    For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Operating system or partition requirements

This adapter is supported for the following versions of the operating system:

- Linux:
  - SUSE Linux Enterprise Server
  - Red Hat Enterprise Linux

Related information:

➨ IBM Prerequisite website

➨ Installing, removing, or replacing PCIe adapters

➨ PCIe adapter placement

➨ PCIe adapter information by feature type

POWER GXT145 PCI Express Graphics Accelerator (FC 5748; CCIN 5748)

Learn about the features, requirements, installation notes, and troubleshooting tips for the POWER GXT145 PCI Express Graphics Accelerator adapter.

Overview

This PCI Express adapter has two feature codes associated:

- FC 5748: POWER GXT145 PCI Express Graphics Accelerator, is the full-height adapter.
- FC 5269: POWER GXT145 PCI Express Graphics Accelerator, is the low-profile adapter.

The POWER GXT145 PCI Express Graphics Accelerator adapter is a PCI Express (PCIe) adapter that accelerates and enhances the system unit video. The adapter has no hardware switches to set. Mode selection is made through the software. Figure 26 on page 108 shows the adapter and its connectors.
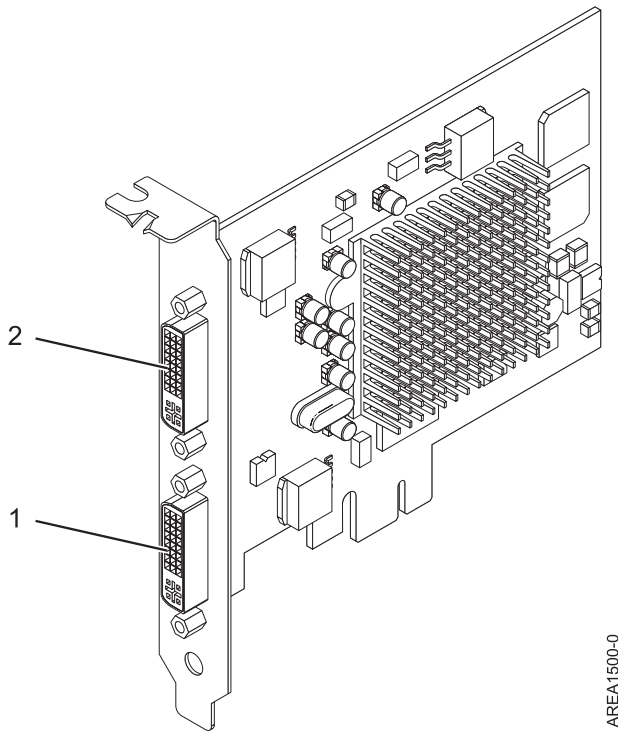
Figure 26. POWER GXT145 PCI Express Graphics Accelerator adapter

1   Primary DVI connector (28 pin), analog, or digital

2   Secondary DVI connector (28 pin), analog, or digital

Connect the primary monitor to connector 1. If you are using an optional, secondary monitor, connect the secondary monitor to connector 2. In the system or logical partition running Linux, the video that is displayed on the secondary monitor is the same as the video displayed the primary monitor, and at the same resolution and refresh rate.

The following table shows the feature code, custom card identification number (CCIN), and field-replaceable unit (FRU) part number for the adapter.

Table 42. CCIN and FRU number for FC 5748

Feature code (FC)	Custom card identification number (CCIN)	Field-replaceable unit (FRU) part number
5748	5748	10N7756[*]
[*]Designed to comply with RoHS requirement		

This adapter provides the following features:
- 8-bit indexed or 24-bit true color.
- 32-MB SDRAM frame buffer.
- x1 PCIe bus interface.
- Two DVI-I analog or digital connectors.
- One monitor connected, analog, up to 2048 x 1536 resolution.
- One monitor connected, digital, up to 1280 x 1024 resolution.

- A second monitor supported on secondary connector at up to 1600 x 1200 analog or 1280 x 1024 digital. A second monitor supported on secondary connector at up to 1600 x 1200 analog or 1280 x 1024 digital.
  - For systems or logical partitions running Linux, a second monitor is supported on the secondary connector at resolutions up to 1600 x 1200 analog or 1280 x 1024 digital.
  - For systems or logical partitions running AIX, when running with two monitors, both monitors must have an analog connection with the same resolution, up to 1600 x 1200. The image on the primary monitor is also displayed on the secondary monitor.
- Display power management: Video Electronics Standards Association (VESA), Display Power Management Signaling (DPMS)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of operating systems:
- AIX
  - AIX Version 7.1
  - AIX Version 6.1
  - AIX Version 5.3
- Linux
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 110 for instructions. If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 110 for instructions.

Gathering tools and documentation

To install the adapter, make sure that you have access to the following items:
- The adapter
- The operating system documentation
- The system service guide for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The media containing the device driver software

Installing the device driver software

Find information about installing device driver software.

To install device driver software, do the following steps:

1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

   If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pci.xxxxxxx`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Installing the adapter

This section explains how to install the adapter. If you are installing your operating system at this time, install your adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" for instructions.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The POWER GXT145 PCI Express Graphics Accelerator adapter has an x1 PCIe connector and can be placed in a PCIe x1, x4, x8, or x16 slot. See PCI adapter placement for information about the PCIe slots on your system unit.

2. Shut down the system unit and install the adapter using the instructions in the system unit documentation PCI adapters topic.
3. Connect the monitor cable to the adapter.

   If necessary, you can use a DVI-A dongle (feature code 4276) for connecting a VGA 15-pin connector on a monitor cable to the DVI connector on the adapter. For example, a DVI-A dongle is needed to connect to a 7316-TF3 console or a KVM switch.
4. Start the system unit and the monitor.
5. When prompted, configure the adapter by following the online configuration instructions.
6. When **Select Display** (console) appears, press the number key on your keyboard for the monitor that is to be the default.

Troubleshooting

If you have video problems after the initial installation, follow these procedures to troubleshoot the problem:

- Check the cables.
- Check the device driver software installation.
- Check the console.
- Check the adapter installation.

Checking the cables

1. Ensure the monitor cables are connected to the correct adapter.
2. If you have more than one video adapter, be sure that each adapter is connected to a monitor.
3. Verify that the connections are secure.
4. If no log-in prompt appears, restart the system unit.

Checking the device driver software installation

Verify that the device driver for the POWER GXT145 PCI Express Graphics Accelerator adapter is installed by typing the following command and then pressing Enter:

```
lslpp -l all | grep GXT145
```

If the GXT145 device driver is installed, the following table is an example of the data that appears if you are running AIX Version 5.2:

```
devices.pci.2b102725.X11 5.2.0.105 COMMITTED AIXwindows GXT145 Graphics
devices.pci.2b102725.diag 5.2.0.105 COMMITTED GXT145 Graphics Adapter
devices.pci.2b102725.rte   5.2.0.105  COMMITTED GXT145 Graphics Adapter
```

If the POWER GXT145 device driver did not fully install, reinstall the driver. See "Installing the device driver software" on page 110.

Checking the console

1. If you continue to experience problems, you can redirect the monitor to the new adapter using the `chdisp` command.
2. If you continue to experience problems after you have checked your cables and tried the `chdisp` command, run diagnostics.

Checking the adapter installation

Verify that the system unit recognizes the POWER GXT145 PCI Express Graphics Accelerator adapter.

At the AIX command-line type `lsdev -Cs pci`. If the POWER GXT145 PCI Express Graphics Accelerator adapter is correctly installed, the following is an example of the data that appears:

```
cor0 Available 0K-00 GXT145 Graphics Adapter
```

If the message indicates that the adapter is DEFINED instead of AVAILABLE, shut down the system unit and check the POWER GXT145 PCI Express Graphics Accelerator adapter to ensure that it is installed correctly. If you continue to experience problems after following the steps in this section, contact service and support for assistance.

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter (FC 5767; CCIN 5767)

Learn about features, requirements, and specifications for the feature code (FC) 5767 adapter.

The 2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter is a full duplex, dual port, gigabit Ethernet adapter. This adapter can be configured to run each port at 10, 100, or 1000 Mbps data rates. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The adapter supports jumbo frames when running at the 1000 Mbps speed.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Adapter specifications

Item   Description
FRU number
      46K6601 (Designed to comply with RoHS requirement)
Wrap plug FRU number
      10N7405 (1 Gb UTP wrap plug)

      Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
- PCI Express V1.0a compliant
- Bus width x4 lane PCI Express, operable in x4, x8, x16 slots
- Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional

Busmaster
      Yes
Maximum number
      For details about the maximum number of adapters that are supported, see PCIe adapter
      placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
      p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Adapter size
      PCIe short form
Connector information
- Two RJ-45 ports
- Two LED adapter status indicators per port, for link activity and speed

Cabling
      Customers supply the cables. For best performance, use cables that meet Cat 5e cabling
      standards, or later.

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are
visible through the mounting bracket. 2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter shows
the location of the LEDs. Table 43 on page 114 describes the different LED states and what those states
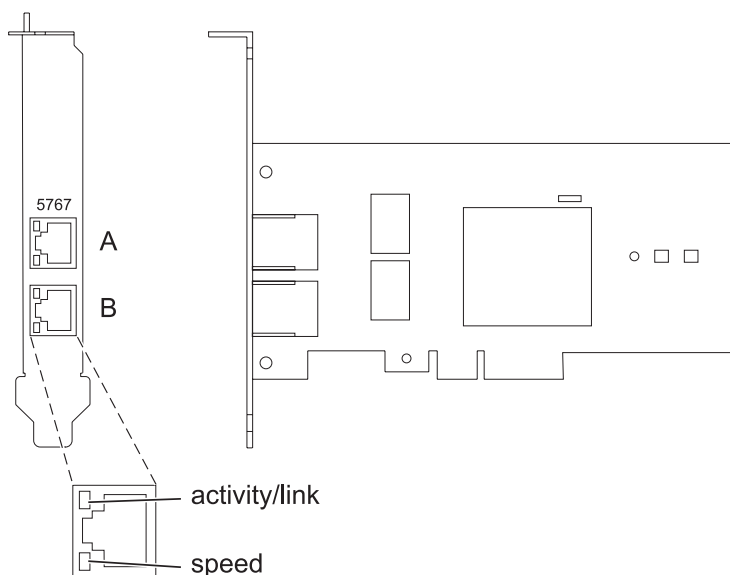indicate. The following figure shows the adapter.

Figure 27. 2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter

Table 43. Adapter LEDs and descriptions

LED	Light	Description
Activity/link	Green	Active link
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.
	Flashing	Data activity
Speed	Off	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX Version 7.1, or later.
  - AIX Version 6.1, or later.
  - AIX Version 5.3, or later.
- Linux
  - Red Hat Enterprise Linux 5.6 for POWER, or later.
  - Novel SUSE Linux Enterprise Server 11, Service Pack 1, or later.
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" on page 116 for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 115 for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you must not reinstall the device drive.

Verifying the hardware requirements

The adapter requires the following hardware:

- A wrap plug for the RJ-45 connector, if you are running the total diagnostics package.
- Cat 5e (or higher) UTP cables for 1000 Mbps network attachment.
- Cat 5 or Cat 3 UTP cables for 100 Mbps or 10 Mbps network attachment.

Restriction: The cable can be no longer than 100 meters (including patch cables) from the adapter to the local switch.

Verifying the software requirements

You can use the adapter on operating systems shown in "Operating system or partition requirements" on page 114.

Gathering tools and documentation

To install the adapter, ensure that you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The AIX device driver CD, which includes the device driver.

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L operating system on the AIX device driver CD, which includes the device driver..

To install device driver software, do the following steps:
1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

    If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pciex.14104003`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.

- When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
- After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.

15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Verifying the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:

1. If necessary, log in as root user.
2. Type `lslpp -l devices.pciex.14104003.rte` and press Enter.

   If the device driver is installed, the following table is an example of the data that is shown.

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14104003.rte	5.*x*.0.0	COMMITTED	2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter

3. Confirm that the devices.pciex.14104003.rte filesets are installed. If no data is shown in the window, reinstall the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you must install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8, or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.
2. Install the adapter by using the instructions in the system unit service guide.

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

2-Port Gigabit Ethernet-SX PCI Express Adapter (FC 5768; CCIN 5768)

Learn about features, requirements, and specifications for the 5768 adapter.

The 2-Port Gigabit Ethernet-SX PCI Express Adapter provides two 1 Gbps (1000 Base-SX) full-duplex Ethernet LAN connections. The adapter connects to a network using a standard shortwave multimode optical cable that conforms to the IEEE 802.3z standard. The adapter supports distances of 260 m for 62.5 micron Multi Mode Fiber (MMF) and 550 m for 50.0 micron MMF. AIX Network Installation Management (NIM) boot capability is supported with this adapter.

The adapter provides the following features:

- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Adapter specifications

Item   Description
Adapter FRU number
    10N6846 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    12R9314 (LC Fiber Optic)

    Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.
I/O bus architecture
    - PCI Express V1.0a compliant
    - Bus width x4 lane PCI Express, operable in x4, x8, x16 slots
    - Bus speed (x4, encoded rate) 10 Gbps unidirectional; 20 Gbps bidirectional
Busmaster
    Yes
Form factor
    Short
Connector information
    Two fiber optic ports, LC connector

    LED status indicators for link activity and speed
Cables
    Optional LC-SC converter cables are available:
    - LC-SC 62.5 micron converter cable, part number 12R9322, FC 2459.
    - LC-SC 50 micron use converter cable, part number 12R9321, FC 2456.
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter

placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Adapter LED states

The LEDs on the adapter provide information about the adapter's operation status. The LEDs are visible
through the adapter's mounting bracket. Figure 28 shows the location of the LEDs. Table 44 describes the
different LED states and what those states indicate. The following figure shows the adapter.
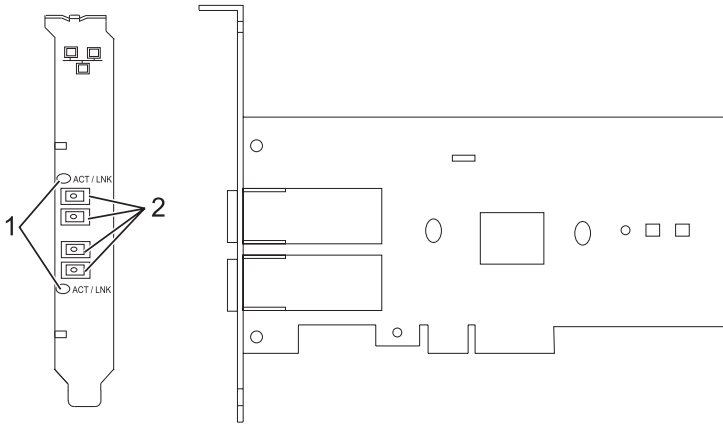
Figure 28. 2-Port Gigabit Ethernet-SX PCI Express Adapter

1   LEDs

2   Multimode Fiber LC receptacles

Table 44. Adapter LEDs and descriptions

LED	Description
Off	No link (The absence of a link could indicate a bad cable, bad connector, or a configuration mismatch.)
Green	Good link, no activity
Flashing Green	Good link, data activity

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities
(http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and
select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
* AIX
    - AIX Version 7.1, or later.
    - AIX Version 6.1, or later.
    - AIX Version 5.3, or later.
* Linux

- – Red Hat Enterprise Linux 5.6 for POWER, or later.
- – Novel SUSE Linux Enterprise Server 11, Service Pack 1, or later.
- IBM i
  - – IBM i Version 7.2 or later
  - – IBM i Version 7.1, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See Installing the adapter for instructions.

If you are installing only the device driver for this adapter, install the device driver software before you install the adapter. See "Installing the device driver software" on page 120 for instructions.

If you already have one of these adapters installed and working with your AIX operating system and you are preparing to install additional adapters, the device driver is already installed and you must not reinstall the device drive.

Verify you hardware requirements

The adapter requires the following hardware:
- A wrap plug for the multimode fiber connector, if you are running the total diagnostics package
- Shortwave (850 nm) 50/62.5 micron multimode fiber network attachment

The following table indicates the allowable cable lengths from the adapter to the gigabit Ethernet switch, including patch cables.

Table 45. Adapter cable information

Cable type	Physical connector type	Maximum range
62.5 m MMF	LC	260 meters
50 m MMF	LC	550 meters

Verify your software requirements

The adapter is supported on operating systems shown in Operating system or partition requirements. Ensure that your operating system supports this adapter before you install it. Contact service and support if you need assistance.

Gather tools and documentation

To install the adapter, make sure you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The AIX device driver CD, which includes the device driver.

Installing the device driver software

This section explains how to install device driver software. The device driver is provided for the AIX 5L operating system on the AIX device driver CD.

To install device driver software, do the following steps:

1. Log in to the system unit as root user.
2. Insert the media containing the device driver software (for example, the CD) into the media device.

   If your system does not have a CD-ROM drive, refer to your system documentation for completing a Network Installation Management (NIM) installation.
3. Type the following System Management Interface Tool (SMIT) fast path command: `smit devinst`
4. Press Enter. The Install Additional Device Software window highlights the **INPUT device / directory for software** option.
5. Type the name of the input device that you are using, or press F4 to select the input device from a list.
6. Press Enter. The Install Additional Device Software window highlights the SOFTWARE to install option.
7. Press F4 to select List.
8. Type / to display the Find window.
9. Type the device package name `devices.pciex.14103f03`.
10. Press Enter. The system finds and highlights this device driver software.
11. Press F7 to select the highlighted device driver software.
12. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window displays. The entry fields are automatically updated.
13. Press Enter to accept the information. The ARE YOU SURE window displays.
14. Press Enter to accept the information. The COMMAND STATUS window displays.
    - The message RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the installation summary.
    - After a successful installation, SUCCESS displays in the Result column of the installation summary at the bottom of the page.
15. Remove the installation media from the drive.
16. Press F10 to exit SMIT.

Verify the AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:

1. If necessary, log in as root user.
2. Type `lslpp -l devices.pciex.14103f03.rte` and press Enter.

   If the device driver is installed, the following is an example of the data that is displayed.

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.14103f03.rte	5.*x*.0.0	COMMITTED	2-Port Gigabit Ethernet-SX PCI Express Adapter software

3. Confirm that the devices.pciex.14103f03.rte filesets are installed. If no data displays, try reinstalling the driver.

Installing the adapter

This section explains how to install the adapter. If you are installing the operating system at this time, install the adapter before you install the operating system. If the operating system is already installed and you must install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:

1. Determine the PCIe slot in which to place the adapter.

   The adapter has an x4 PCIe connector and can be placed in a x4, x8, or x16 slot. See the PCI adapter placement for information about the PCIe slots on your system unit.

2. Install the adapter by using the instructions in the system unit service guide.

Connecting to an Ethernet network

Refer to your local procedures for information about connecting the adapter to your Ethernet network.

Notes:
- Only one type of network can be attached to the adapter at one time.
- If your switch has an SC receptacle, you need an LC-SC converter cable.
- You must configure an IP network interface to enable the adapter to detect the link and illuminate the link LED.

To connect the adapter to a multimode fiber network, do the following steps:

1. Insert the male fiber LC connector of the fiber cable into the adapter LC connector.
2. Insert the male fiber LC connector of the other end of the cable into the network switch.

Related information:

IBM Prerequisite website

Installing, removing, or replacing PCIe adapters

PCIe adapter placement

PCIe adapter information by feature type

10 Gigabit Ethernet-SR PCI Express Adapter (FC 5769; CCIN 5769)

Learn about the features, operating system requirements, and installation procedures for the feature code (FC) 5769 adapter.

Overview

The 10 Gigabit Ethernet-SR PCIe Adapter is a low-profile, high performance fiber network interface controller (NIC). The product conforms to the IEEE, 802.3ae 10GBASE-SR specification for Ethernet transmission.

The following figure shows the adapter LED and network connector. The following figure shows the adapter.
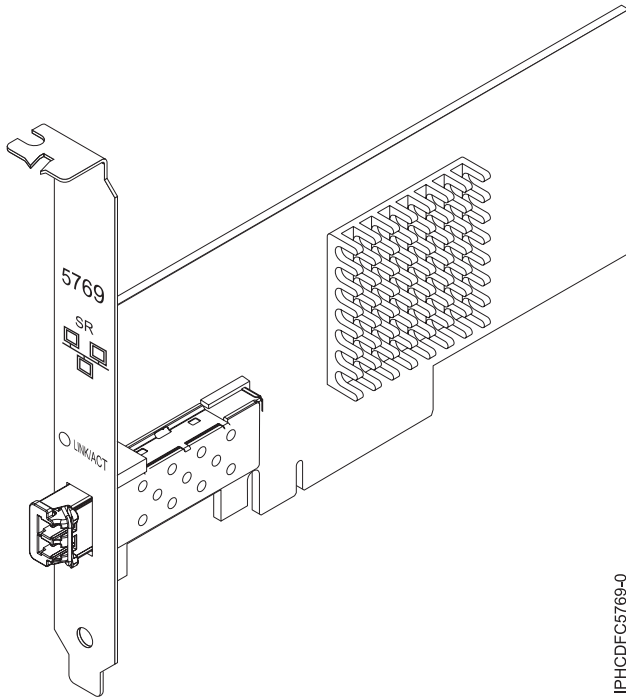
Figure 29. 10 Gigabit Ethernet-SR PCIe Adapter

The LED on the adapter provides information about the operation status of the adapter.

Table 46. Adapter LED

LED	Light	Description
Activity/Link	Green	Good link, no activity
	Flashing Orange	Transmit activity
	Off	No link[*]
Adapter card status	Red	Not initialized[**]
	Off	Initialized

[*]The absence of a link could be the result of a defective cable, a defective connector, or a configuration mismatch.

[**]The adapter has not been initialized by the operating system. During such time, the following conditions are true:
- If no cable is connected, the Green LED is **ON**.
- If cable is connected and the LINK is sensed, the Green LED is **OFF**.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
FRU number
    46K7897 (Designed to comply with RoHS requirement.)
I/O bus architecture
    PCIe-V1.1 x8
Busmaster
    Yes

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Adapter size

PCIe x8, short form

Connector information

LC multimode fiber optic

Wrap plug FRU number

12R9314 (LC Fiber Optic)

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

Cables

Customers supply the cables. Optional LC-SC 62.5 micron converter cable, part number 12R9322, FC 2459, is available. For 50 micron LC-SC connections, use converter cable part number 12R9321, FC 2456.

Attributes

The adapter provide the following features:
- PCIe 1.1 x8
- MSI-X, MSI and support of traditional pin interrupts
- 10GBASE-SR short-reach optics (850 nm)
- IEEE 802.3ae (10 GbE)
- IEEE 802.1p priority and 802.1Q VLAN tagging
- IEEE 802.3x flow control
- Link aggregation, 802.3ad 802.3 compliance
- IEEE 802.3ad load-balancing and failover
- Ethernet II and 802.3 encapsulated frames
- Multiple MAC addresses per interface
- Jumbo frames up to 9.6 KB
- TCP checksum offload for IPv4 and IPv6
- TCP segmentation offfload (TSO) for IPv4 and IPv6
- User datagram protocol (UDP) checksum offload for IPv4 and IPv6
- Receive side scaling and packet steering
- Line rate packet filtering and attack protection
- IETF RDDP and RDMAC iWARP compliance (Linux only)
- APIs: RNIC-PI, kDAPL and Open Fabrics Enterprise Distribution (OFED) 1.4 (Linux only)
- Full iSCSI software and hardware initiator support (Linux only)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of operating systems:
- AIX
  - AIX Version 6.1 with the 6100-03 Technology Level, or later
  - AIX Version 5.3 with the 5300-10 Technology Level, or later
- Linux
  - Red Hat Enterprise Linux Version 5 Update 3, or later
  - SUSE Linux Enterprise Server 11, or later

AIX host bus adapter (HBA) and Ethernet drivers are contained in the following filesets:

devices.ethernet.ct3

devices.ethernet.ct3.rte //HBA
devices.ethernet.ct3.cdli //ENT

Preparing for installation

If you are installing your operating system at this time, install your adapter before you install the operating system. If you are installing only the device driver for this adapter, install your device driver software before you install the adapter.

If you are running the total diagnostics package you need a wrap plug for the multimode fiber connector used for the adapter. To connect to a network, you need a shortwave (850 nm) 50/62.5 micron multimode fiber network attachment.

The following tables indicates the allowable cable lengths from the adapter to the gigabit Ethernet switch, including patch cables:

Table 47. Cable information

Fiber cable type	Connector type	Minimum modal bandwidth at 850 nm (MHz x km)	Operating range in meters
62.5 μm MMF	LC	160	2 to 26
		200	2 to 33
50 μm MMF	LC	400	2 to 66
		500	2 to 82
		2000	2 to 300

Ensure that your operating system supports this adapter before you install it. See "Operating system or partition requirements" on page 123.

Installing the AIX device driver software

To install device driver software, follow the steps in "Installing the AIX device driver software" on page 24.

Installing the adapter

For general instructions on how to install a PCI adapter, see the Installing PCI adapters topic. Return here to verify the adapter installation.

Verifying the adapter installation

To verify that your system recognizes the PCI adapter, do the following steps:
1. If necessary, log in as root user.
2. At the command line, type: `lsdev -Cs pci`
3. Press Enter.

A list of PCI devices is displayed. If the adapter is installed correctly, the status of available for each port indicates that the adapter is installed and ready to use. If a message indicates that any of the ports are defined instead of available, shut down your server and verify that the adapter was installed correctly.

Connecting to an Ethernet network

This section explains how to connect the adapter to the multimode fiber network. Refer to your local procedures for information about connecting the adapter to your Ethernet network.

Note: Only one type of network can be attached to the adapter at one time.

To connect the adapter to a multimode fiber network, do the following steps:
1. Insert the male fiber LC connector of the fiber cable into the adapter LC connector.
2. Insert the male fiber LC connector of the other end of the cable into the network switch.

Notes:
- The adapter requires an 850 nm multimode fiber optic cable. See Table 47 on page 124.
- If your switch has an SC receptacle, you need an LC-SC converter cable.
- It is necessary to configure an IP network interface to enable the adapter to detect a link and to illuminate the link LED.

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

10 Gigabit Ethernet-LR PCI Express Adapter (FC 5772; CCIN 576E)

Learn about the features, operating system requirements, and installation notes for the feature code (FC) 5772 adapter.

Overview

The 10 Gigabit Ethernet-LR PCI Express Adapter is a low-profile, fiber network interface controller (NIC). This adapter is based on the dual port 82598EB 10 GbE controller. The product conforms to the IEEE 802.3 standard and supports standards for system manageability and power management. Additionally, it conforms to the 802.3ae 10GBASE-LR specification for Ethernet transmissions over 1310 nm single-mode fiber optic cable for distances up to 10 kilometers.

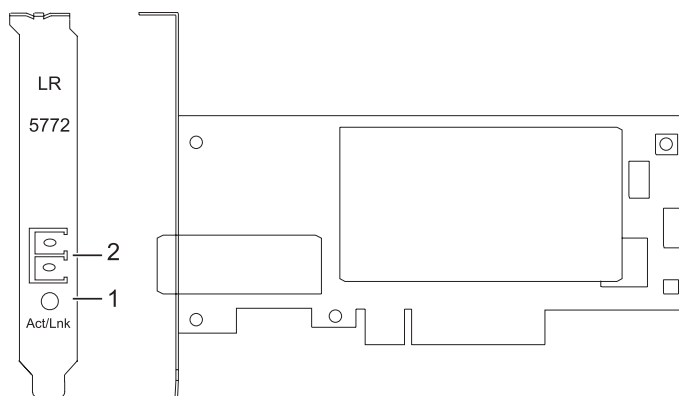The following figure shows the adapter LEDs and network connector.

Figure 30. 10 Gigabit Ethernet-LR PCI Express Adapter

1   Activity/Link LED

2	Multimode fiber LC receptacle

Specifications

Item   Description
Adapter FRU number
>   10N9034 (Designed to comply with RoHS requirement.)

Wrap plug FRU number
>   12R9314 (LC Fiber Optic)

>   **Note:** These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture
>   PCI-Express V1.1 and v2.0 (gen 1 only)

Busmaster
>   Yes

Maximum number
>   For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Form factor
>   Short

Cables
>   Customers supply the cables.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1, or later
  - AIX 6.1, or later
  - AIX 5.3, or later
- Linux
  - Red Hat Enterprise Linux 5.6 for POWER, or later
  - SUSE Linux Enterprise Server 11 Service Pack 1, or later
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Preparing for installation

This section helps you prepare to install your adapter. Preparing to install the adapter involves the following tasks:
- Verifying your hardware requirements

- Verifying your software requirements
- Gathering tools and documentation

If you are installing your operating system at this time, install your adapter before you install the operating system. See "Installing the adapter" on page 129 for instructions.

If you are installing only the device driver for this adapter, install your device driver software before you install the adapter. See "Installing the device driver software" for instructions.

Verifying your hardware requirements

The adapter requires the following hardware:
- If you are running the total diagnostics package you will need a wrap plug for the single mode fiber connector used on the LR adapter.
- To connect to a network you will need a 1310 nm single mode fiber network attachment for the LR adapter.

The following tables indicates the allowable cable lengths from the adapter to the gigabit Ethernet switch, including patch cables:

Table 48. 10 Gigabit Ethernet-LR PCI Express Adapter cable information

Fiber cable type	Connector type	Operating range in meters
9 μm SMF	LC	10 Km

Verifying your software requirements

Ensure that your operating system supports this adapter before you install it. See "Operating system or partition requirements" on page 126.

Gathering tools and documentation

To install the adapter, make sure you have access to the following items:
- The adapter
- The operating system documentation
- The system unit documentation
- The PCI adapter placement information for the system unit
- Wrap plugs
- A flat-blade screwdriver
- The operating system CD, which includes the device driver, or the device driver CD-ROM

Installing the device driver software

This section explains how to install device driver software for the adapter. The device driver is provided for the AIX operating system.

Be sure you have read "Preparing for installation" on page 126 to determine which of the following tasks to do:
- If you should install your device driver software first, go to step 1 of this section.
- If you should install your adapter hardware first, go to "Installing the adapter" on page 129. When you install AIX, your adapter device driver is automatically installed.

To install device driver software, do the following steps:

1. Log in to the system unit as root user.
2. Insert the media that contains the device driver software (for example, a CD-ROM) into the appropriate media device.
3. Type the following System Management Interface Tool (SMIT) fast path: `smitty devinst`
4. Press Enter. The Install Additional Device Software screen highlights the INPUT device/directory for software option.
5. Select or type your input device:
   - Press F4 to display the input device list.
   - Select the name of the device (for example, CD-ROM) that you are using and press Enter.

   or

   - In the entry field, type the name of the input device you are using and press Enter.
   - The Install Additional Device Software window highlights the SOFTWARE to install option.
6. Press F4 to display the SOFTWARE to install window.
7. Type the following to display the Find window: /
8. Type the device package name: `devices.pciex.8680c71014108003.rte`.
9. Press Enter. The system finds and highlights this device driver software.
10. Press F7 to select the highlighted device driver software.
11. Press Enter. The INSTALL ADDITIONAL DEVICE SOFTWARE window is shown. The entry fields are automatically updated.
12. Press Enter to accept the information. The ARE YOU SURE window is shown.
13. Press Enter to accept the information. The COMMAND STATUS window is shown.
    - The term RUNNING is highlighted to indicate that the installation and configuration command is in progress.
    - When RUNNING changes to OK, scroll to the bottom of the page and locate the Installation Summary.
    - After a successful installation, SUCCESS is displayed in the Result column of the Installation Summary at the bottom of the page.
14. Remove the installation media from the drive.
15. Press F10 to exit SMIT.
16. Go to the adapter installation procedure, "Installing the adapter" on page 129.

Verify AIX software installation

To verify that the device driver for the adapter is installed, do the following steps:
1. If necessary, log in as root user.
2. At the command line, type `lslpp -l devices.pciex.8680c71014108003.rte`.
3. Press Enter.

If the adapter device driver is installed, the following is an example of the data that is displayed on the window:

Fileset	Level	State	Description
Path: /usr/lib/objrepos devices.pciex.8680c71014108003.rte	5.3.8.0	COMMITTED	10 Gigabit Ethernet-LR PCI Express Adapter Software

Verify that the file sets are installed at the AIX version level you are running. Level 5.3.8.0 is an example. If the correct information is displayed, continue to the next section, Installing the adapter. If no data is displayed on your screen, the adapter device driver did not install correctly. Try reinstalling the driver.

Installing the adapter

For instructions on installing PCIe adapters, see Installing, removing, or replacing PCIe adapters(http://www.ibm.com/support/knowledgecenter/POWER8/p8hak/pciadapters.htm) and select the system you are working on.

Verifying the adapter installation

To verify that your system unit recognizes the PCI adapter, do the following steps:

1. If necessary, log in as root user.
2. At the command line, type: `lsdev -Cs pci`
3. Press Enter.

A list of PCI devices are displayed. If the adapter is installed correctly, an Available status for each port indicates that the adapter is installed and ready to use. If the message on your screen indicates that any of the ports are DEFINED instead of AVAILABLE, shut down your server and verify that the adapter was installed correctly.

Connecting to an Ethernet network

This section explains how to connect the adapter to the multimode fiber network. Refer to your local procedures for information about connecting the adapter to your Ethernet network.

Note: Only one type of network can be attached to the adapter at one time.

To connect the adapter to a multimode fiber network, do the following steps:

1. Insert the male fiber LC connector of the fiber cable into the adapter LC connector.
2. Insert the male fiber LC connector of the other end of the cable into the network switch.

Notes:
- The adapter requires a 1310 nm single-mode fiber optic cable. See Table 48 on page 127.
- If your switch has an SC receptacle, you need an LC-SC converter cable.
- It is necessary to configure an IP network interface to enable the adapter to detect a link and to illuminate the link LED.

Adapter LEDs

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket and, when lit, indicate the following conditions:

Table 49. Adapter LEDs and descriptions

LED	Light	Description
Activity/Link	Green	Good link, no activity
	Blinking	Transmit activity
	Off	No link[*]
[*]The absence of a link could be the result of a defective cable, a defective connector, or a configuration mismatch.		

Related information:

➟ IBM Prerequisite website

➟ Installing, removing, or replacing PCIe adapters

➟ PCIe adapter placement

4 Gb PCI Express Dual-port Fibre Channel Adapter (FC 5774; CCIN 5774)

Learn about the specifications and operating system requirements for the feature code (FC) 5774 adapter.

Overview

The 4 Gb PCI Express Dual-port Fibre Channel Adapter is a 64 bit, short form factor x4, PCIe adapter with an LC-type external fiber connector that provides single initiator capability over an optical fiber link or loop. The adapter automatically negotiates the highest data rate between the adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps of which the device or switch is capable. Distances between the adapter and an attaching device or switch can reach up to 500 meters running at 1 Gbps data rate, up to 300 meters running at 2 Gbps data rate, and up to 150 meters running at 4 Gbps data rate. When used with IBM Fibre Channel storage switches supporting long-wave optics, the adapter can reach distances of up to 10 kilometers running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates.

The adapter can be used to attach devices either directly, or with Fibre Channel switches. If you are attaching a device or switch with an SC type fiber connector, you must use an LC-SC 50 micron fiber converter cable (FC 2456) or an LC-SC 62.5 micron fiber converter cable (FC 2459).

The adapter has the following features:
- Compliant with the PCIe Base and Card Electromechanical (CEM) 1.0a specifications:
  - x1 and x4 lane link interface at 2.5 Gbit/s (auto-negotiated with system)
  - Supports VC0 (1 Virtual Channel) and TC0 (1 Traffic Class)
  - Configuration and IO Memory read/write, completion, message
  - Support for 64-bit addressing
  - ECC error protection
  - Link CRC on all PCIe packets and message information
  - Large payload size: 2048 bytes for read and write
  - Large read request size: 4096 bytes
- Compatible with 1, 2, and 4 Gb Fibre Channel interface:
  - Auto-negotiate between 1 Gb, 2 Gb or 4 Gb link attachments
  - Support for all Fibre Channel topologies: point-to-point, arbitrated loop, and fabric
  - Support for Fibre Channel class 2 and 3
  - Maximum Fibre Channel throughput achieved by using full duplex hardware support
- End-to-end data path parity and CRC protection, including internal data path RAMs
- Architectural support for multiple upper layer protocols
- Internal high-speed SRAM memory
- ECC protection of local memory, includes single-bit correction and double-bit protection
- Embedded shortwave optical connection with diagnostics capability
- Onboard Context Management by firmware (per port):
  - Up to 510 FC Port Logins
  - Up to 2047 concurrent Exchanges
  - I/O multiplexing down to the FC Frame level
- Data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Link management and recovery handled by firmware
- Onboard diagnostic capability accessible by optional connection
- Parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)

* Performance up to 4.25 Gbps full duplex
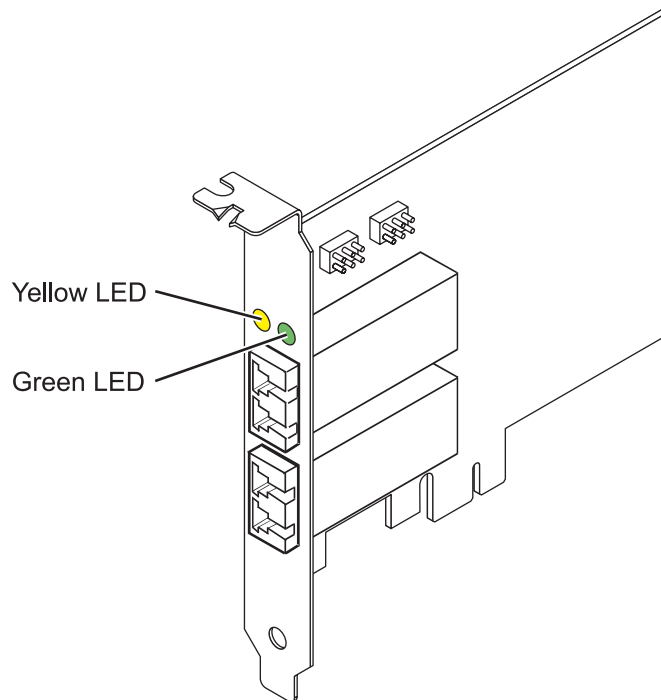
Figure 31 shows the adapter.

Figure 31. 5774 adapter

Specifications

Item   Description
Adapter FRU number
    10N7255*

    * Designed to comply with RoHS requirement
Wrap plug FRU number
    12R9314 (for Fiber LC connector)

    Note: The wrap plug is included with the card, and can also be purchased from IBM.
I/O bus architecture
    PCIe Base and CEM 1.0a
    x4 PCIe bus interface
Slot requirement
    One available PCIe x4, x8, or x16 slot
Voltage
    3.3 V
Form factor
    Short, low-profile
FC compatibility
    1, 2, 4 gigabit
Cables

    50/125 micron fiber (500 MHz*km bandwidth cable)
    * 1.0625 Gbps 0.5 – 500 m
    * 2.125 Gbps 0.5 – 300 m
    * 4.25 Gbps 0.5 – 150 m

62.5/125 micron fiber (200 MHz*km bandwidth cable)
- 1.0625 Gbps 0.5 – 300 m
- 2.125 Gbps 0.5 – 150 m
- 4.25 Gbps 0.5 – 70 m

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.1, or later
  - AIX 6.1, or later
  - AIX 5.3, or later
- Linux
  - Red Hat Enterprise Linux 5.6 for POWER, or later
  - SUSE Linux Enterprise Server 11 Service Pack 1, or later
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 50 summarizes normal LED states. There is a 1 Hz pause when the LED is off between each group of fast flashes (1, 2 or 3). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 50. Normal LED states

Green LED	Yellow LED	State
On	1 fast flash	1 Gbps link rate - normal, link active
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active

Power-On Self Test (POST) conditions and results are summarized in Table 51. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 51. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	On	POST failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.

Table 51. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
Off	Slow flash	Wake-up failure monitor	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Fast flash	POST failure	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
On	On	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Slow flash	Slow flash	Offline for download	None
Slow flash	Fast flash	Restricted offline mode, waiting for restart	None
Slow flash	Flashing	Restricted offline mode, test active	None
Fast flash	Off	Debug monitor in restricted mode	None
Fast flash	On	Not defined	None
Fast flash	Slow flash	Debug monitor in test fixture mode	None
Fast flash	Fast flash	Debug monitor in remote debug mode	None
Fast flash	Flashing	Not defined	None

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Device ID jumper

The default setting for the two device ID jumpers labeled P0_JX and P1_JX is to set the jumpers on pins 1 and 2 as shown in Figure 32 on page 134. Do not change the jumper settings for a standard installation.
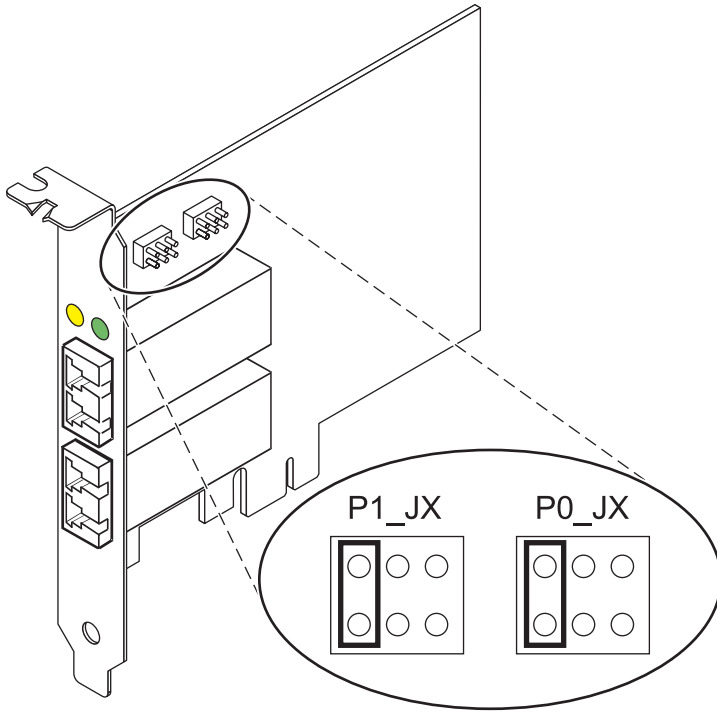
Figure 32. Device ID jumper

Replacing hot swap HBAs

Fibre Channel host bus adapters (HBAs) connected to a fiber array storage technology (FAStT) or DS4000 storage subsystem have a child device that is called a disk array router (dar). You must unconfigure the disk array router before you can hot swap an HBA that is connected to a FAStT or DS4000 storage subsystem. For instructions, see *Replacing hot swap HBAs* in the *IBM System Storage DS4000 Storage Manager Version 9, Installation and Support Guide for AIX, HP-UX, Solaris, and Linux on Power Systems Servers*, order number GC26-7848.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

4-port Async EIA-232 PCIe Adapter (FC 5785; CCIN 57D2)

Learn about the features, operating system requirements, and installation procedures for the feature code (FC) 5785 adapters.

Overview

The FC 5785 is a full-height adapter similar to FC 5277 (PCIe LP 4-port Async EIA-232 adapter), which is the low-profile adapter.

The 4-port Async EIA-232 PCIe Adapter provides connections for four asynchronous EIA-232 devices using a 4-port DB-9F DTE fan-out cable. Ports are programmable to support EIA-232 protocols at a line speed of 128 Kbps.
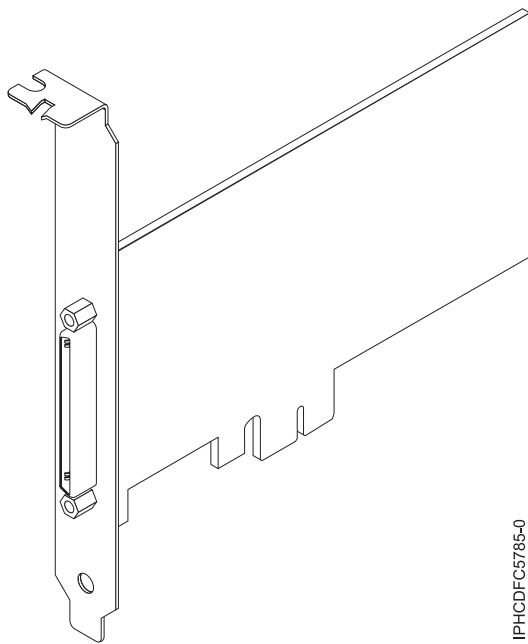
The following figures show the adapter and cable.
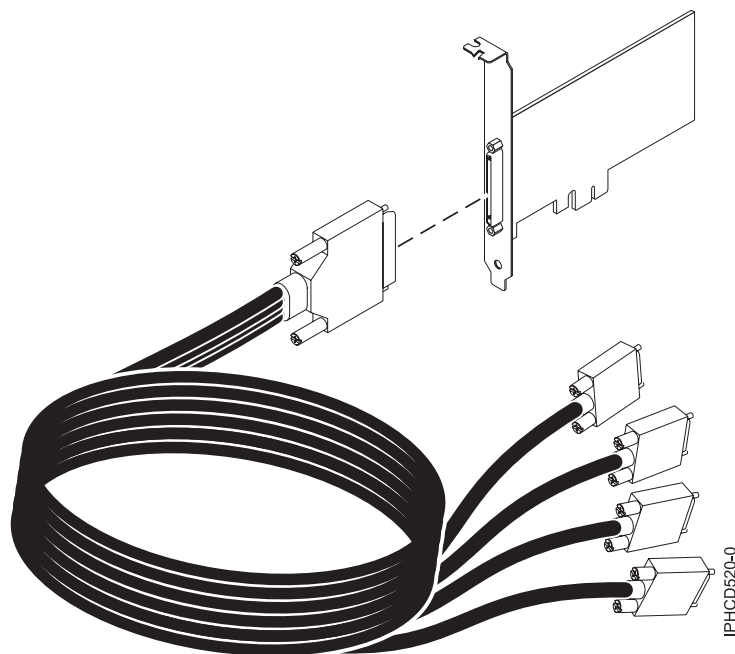

Figure 33. Adapter

Figure 34. Cable

Specifications

Item   Description
FRU number
> Adapter: 46K6734[*]

> Cable: 46K6735[*]

> [*]Designed to comply with RoHS requirement.

I/O bus architecture

PCIe-V1.0a 1x

Busmaster

No

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Adapter size

PCIe 1x, short form factor

Connectors

Adapter: 68-pin SCSI

Cable: 68-pin SCSI to DB 9-pin shell

Wrap plug

42R5143

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following operating systems:
- AIX:
  - AIX 7.1, or later
  - AIX 6.1, or later
  - AIX 5L Version 5.3 with the 5300-07 Technology Level, or later

  The AIX device package name is `devices.pci.1410a803.rte`.
- Linux:
  - SUSE Linux Enterprise Server 11, or later
  - Red Hat Enterprise Linux Version 5.3, or later
- IBM i
  - IBM i 7.3, or later
  - IBM i 7.2 TR4, or later
  - IBM i 7.1 TR11, or later

Preparing for installation

If you are installing your operating system at this time, install your adapter before you install the operating system. If you are installing only the device driver for this adapter, install your device driver software before you install the adapter.

Installing the AIX device driver software

To install device driver software, follow the steps in "Installing the AIX device driver software" on page 24.

Installing the adapter

For instructions on installing PCIe adapters, see Installing, removing, or replacing PCIe adapters(http://www.ibm.com/support/knowledgecenter/POWER8/p8hak/pciadapters.htm) and select the system you are working on.. Return here to verify the adapter installation.

Verifying the adapter installation

To verify that your system unit recognizes the PCI adapter, do the following steps:

1. If necessary, log in as root user.
2. At the command line, type: `lsdev -Cs pci`
3. Press Enter.

A list of PCI devices is displayed. If the adapter is installed correctly, the status of available for each port indicates that the adapter is installed and ready to use. If a message indicates that any of the ports are defined instead of available, shut down your server and verify that the adapter was installed correctly.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter (FC 5805; CCIN 574E)

Learn about the specifications and operating system requirements for the feature code (FC) 5805 adapter.

Overview

The PCI Express (PCIe) 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter supports the attachment of Serial attached SCSI (SAS) disk and SAS solid-state drives by using a pair of mini SAS 4x connectors. The 5805 has a 380 MB write cache and a concurrently replaceable cache battery pack. The adapter must always be installed in pairs and is always to be used in a high availability, multi-initiator RAID configuration using two adapters in dual-controller mode. Two 5805 adapters provide mirrored write-cache data and mirrored RAID parity footprints between the adapters. If the 5805 pairing is broken, then write cache is disabled.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

The 5805 supports SAS small form factor (SFF) disk drives located in a PCIe 12X I/O Drawer or SAS disk drives located in an EXP 12S Disk Drawer. It can also be connected to the internal disk drives in the system unit using the appropriate split disk backplane feature and cabling.

The adapter is a 3.3 V, PCI-e x8 bootable SAS adapter that supports RAID levels 0, 5, 6, and 10.

With adequate cabling and configuration, multiple wide ports are used to provide redundant paths to each dual port SAS drive or solid-state drive. The adapter manages SAS path redundancy and path switching in case a SAS failure occur.

The 5805 contains a LED (**(C)** in Figure 35 on page 138) that flashes if the cache data is present. The cache-data present LED flashes when there is possible data in the cache on the adapter. If the cache data present LED is flashing, do not replace the cache battery pack. If replaced when the LED is flashing, the cache data is lost. See Figure 35 on page 138 to locate the cache-data present LED on this adapter.

Attention: Do not attempt to replace the cache battery pack if the cache-data present LED on the card is flashing. The cache-data present LED indicates that there is possible data in the cache on the adapter. To prevent data loss, first make sure that the system has been shut down correctly. If the cache-data present LED is flashing, refer to one of the following topics before removing the cache battery pack.

- For Linux operating systems, see Displaying rechargeable battery information.
- For AIX operating systems, see Displaying rechargeable battery information.
- For IBM i operating systems, see Displaying rechargeable battery information.

Note: When configuring a raid array using the IBM toolkit and the FC5903 adapter for a system running Linux, the list of supported Direct Attach Storage Devices (DASD) is visible in the HMC only if you select the LVM configure option in the IBM toolkit.

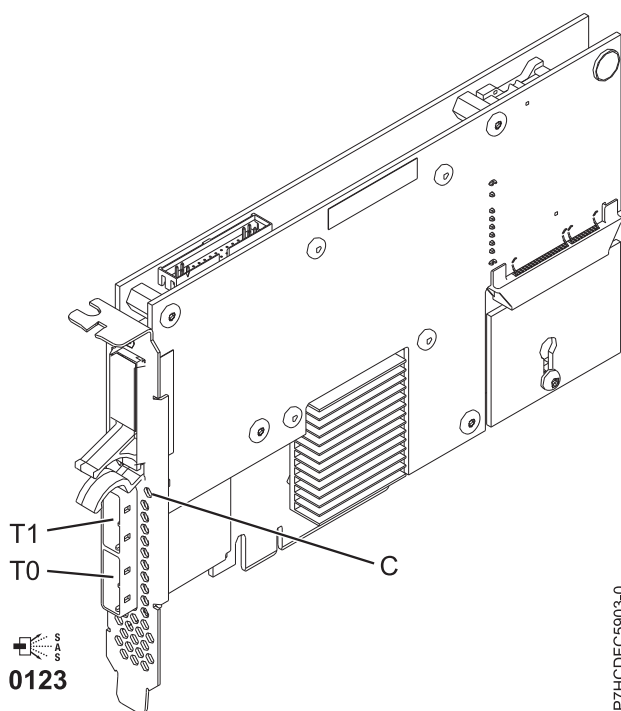The following figure shows the adapter.

Figure 35. PCIe Dual - x4 3 Gb SAS RAID Adapter

Specifications

Item   Description
Adapter FRU number
     46K4735 (Designed to comply with RoHS requirement.)
Battery FRU number
     44V7597 (Designed to comply with RoHS requirement.)
I/O bus architecture
     PCIe x8
Slot requirement
     One PCIe x8 slot per adapter.

     Adapters are installed in pairs.

     Adapter pairs do not require to be in the same enclosure. For higher availability, place adapters in separate enclosures. See the PCI adapter placement for placement rules.

Cables

When you attach 5886 EXP 12S Disk Drawer, at least one of the following SAS (X) cables must be used: 3661, 3662 or 3663.

SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- 48 SAS disk dives supported when the adapter is configured with four 5886 EXP 12S Disk Drawers
- 42 SAS disk drives supported when the adapter is configured with a 19-inch PCIe 12X I/O Drawer and two 5886 EXP 12S Disk Drawers (18 SFF disk drives plus up to 24 SAS disk drives)
- SAS speed: 3 Gbps
- SAS Serial-SCSI Protocol (SSP) and Serial Management Protocol (SMP) are supported
- 380 MB of non-volatile fast write cache can increase disk subsystem performance
- Dual controller supports mirrored-write cache data and mirrored-RAID parity footprints
- Concurrent firmware update supported
- Eight physical links from two mini SAS 4x connectors are provided
- Concurrent replaceable cache battery pack
- Removable media devices are not supported

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX:
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux:
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 10, Service Pack 3, or later
- IBM i
  - IBM i Version 7.2 or later

- – IBM i Version 7.1, or later

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe2 4-port 1 GbE Adapter (FC 5899; CCIN 576F)

Learn about the specifications and operating system requirements for the feature code (FC) 5899 adapter.

Overview

FC 5260 and FC 5899 are both the same adapter with different feature codes. FC 5260 is a low-profile adapter and the FC 5899 is a full-height adapter.

The PCIe2 4-port 1 GbE Adapter is a full-height, generation-2 PCIe adapter. This adapter provides four 1-Gb Ethernet ports that can be configured to run at 1000 megabits per second (Mbps) (or 1 gigabit per second (Gbps)), 100 Mbps, or 10 Mbps. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The adapter supports jumbo frames when running at the 1000 Mbps speed.

Each of the Ethernet ports can be connected by using:
- CAT5e (or later) UTP cables for 1000 Mbps network attachment
- CAT5 or CAT3 UTP cables for 100 Mbps or 10 Mbps network attachment

The cables are attached to the copper RJ45 connectors. Each port is independent of one another and supports full-duplex or half-duplex. The half-duplex mode does not support a speed of 1000 Mbps.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB

- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Specifications

Item   Description

Adapter FRU number

74Y4064 (Designed to comply with RoHS requirement)

Wrap plug

10N7405

Note: Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture

PCIe2.0, x4

Slot requirement

One PCIe x4 slot.

Cables

4-pair, CAT5e, UTP cables are connected to copper RJ45 connectors.

Voltage

3.3 V

Form factor

Short, full-height

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Connector information

- Two RJ-45 ports
- Two LED adapter status indicators per port, for link activity and speed

Attributes provided

- PCIe x4, generation-1 or generation-2
- 4-Port machine access code (MAC)
- High performance IPV4/IPV6 checksum offload
- Large Send and Large Receive Support
- Multiple Queues
- VIOS

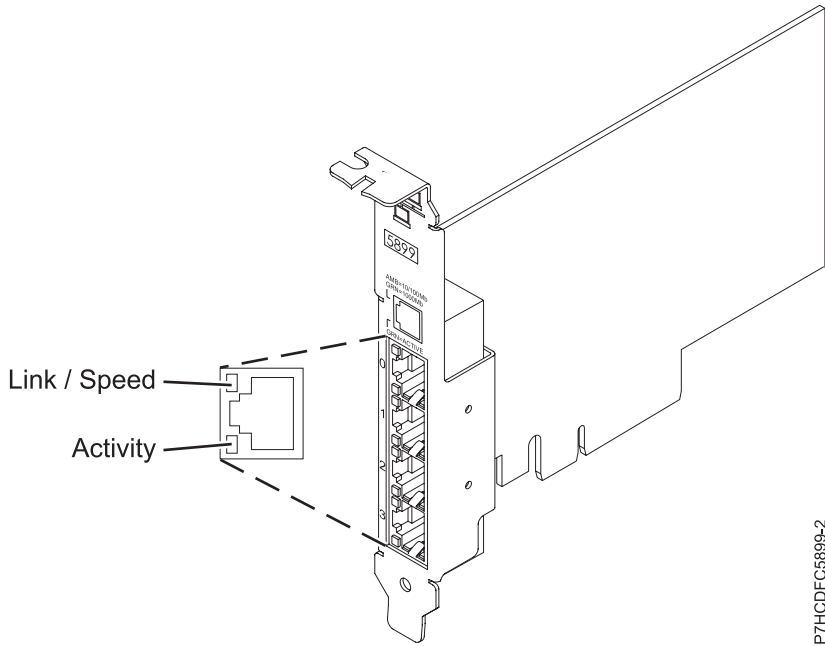The following figure shows the adapter.

Figure 36. Adapter

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket. Figure 36 shows the location of the LEDs. Table 52 describes the different LED states and what those states indicate.

Table 52. Adapter LEDs and descriptions

LED	Light	Description
Link/Speed	Yellow	10 Mbps or 100 Mbps
	Green	1000 Mbps or 1 Gbps
Activity	Green flashing	Active link or data activity
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:

- AIX
  - AIX Version 7.1 with the 7100-01 Technology Level and Service Pack 4, or later.
  - AIX Version 7.1 with the 7100-00 Technology Level and Service Pack 6, or later.
  - AIX Version 6.1 with the 6100-07 Technology Level, and Service Pack 4, or later.
  - AIX Version 6.1 with the 6100-06 Technology Level, and Service Pack 8, or later.
  - AIX Version 5.3 with the 5300-12 Technology Level and Service Pack 6, or later.
- Linux
  - Red Hat Enterprise Linux 6.2, or later.
  - Red Hat Enterprise Linux 5.8, or later.

- SUSE Linux Enterprise Server 11, Service Pack 2, or later (with update package).
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.1.4, or later.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe Dual - x4 SAS Adapter (FC 5901; CCIN 57B3)

Learn about the specifications and operating system requirements for the feature code (FC) 5901 adapter.

Overview

The PCI Express (PCIe) Dual - 4x SAS adapter is a low-profile short form factor adapter for high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk, tape, and DVD by using a pair of mini SAS 4x connectors which allow the eight physical links to be used in various narrow and wide-port configurations. The adapter does not have write cache.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability. Some RAID level support is operating system dependent. The adapter provides RAID 0, RAID 5, RAID 6, and RAID 10 for the AIX and Linux operating systems. IBM i operating system provides mirroring and data spreading capability. FC 5901 does not support the RAID 5 and RAID 6 configurations. The adapter does not have write cache. (The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter which provides write cache when using RAID 5 or RAID 6.)

The adapter can address up to 48 SAS disk drives, although the actual number of drives in a system is subject to the physical placement limitations of the system. Externally attached devices are designed to run at a data rate of 1.5 Gbps for serial ATA (SATA) devices, and 3 Gbps for SAS devices. This card supports RAID and non-RAID DASD, tape, and optical devices. This adapter supports the multi-initiator and high availability configurations in AIX and Linux. IBM i does not support feature 5901 in multi-initiator and high availability configurations.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

The 5901 supports SAS SFF disk drives located in a PCIe 12X I/O Drawer or SAS disk drives located in an EXP 12S Disk Drawer or SAS disk drives located in a supported POWER system unit (split disk backplane).
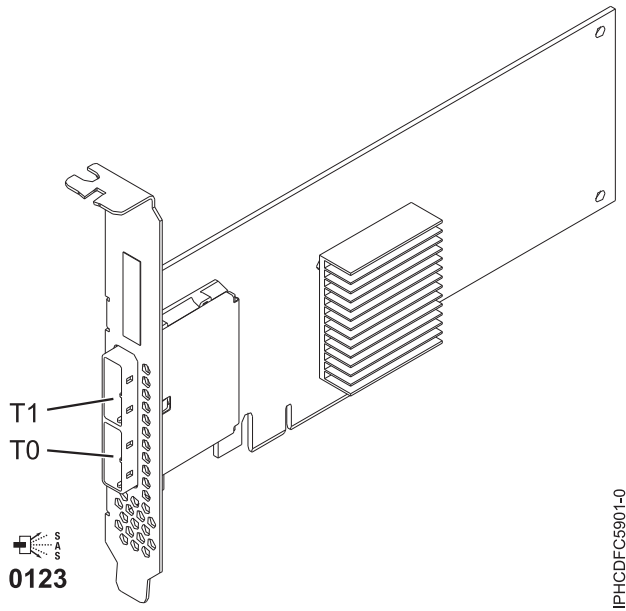
Figure 37. PCIe Dual - x4 SAS adapter

Specifications

Item   Description

Adapter FRU number

> 44V4852 (Designed to comply with RoHS requirement)

I/O bus architecture

> PCIe

Slot requirement

> One available PCIe x8 slot

Cables

> SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage

> 3.3 V

Form factor

> Short, low-profile

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Two external mini SAS 4x connectors provide attachment of SAS and Serial Advanced Technology Attachment (SATA) device enclosures
- SAS Serial SCSI Protocol (SSP), Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP)
- RAID 0, 5, 6, 10

  The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter that provides write cache when using RAID 5 or RAID 6.

- Concurrent firmware update
- Removable media device supported (Removable media is not supported in multi-initiator and high availability configurations)

- Removable media device supported
- 440 - 500 Mhz PowerPC (PPC)
- Support for multi-initiator and high availability configurations

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX Version 7.1, or later.
  - AIX Version 6.1, or later.
  - AIX Version 5.3, or later.
- Linux
  - Red Hat Enterprise Linux 5.6 for POWER, or later.
  - SUSE Linux Enterprise Server 11 Service Pack 1, or later.
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

This adapter requires the following drivers:
- AIX: devices.pci.1410bd02 device driver package
- Linux:
  - iprutils version 2.4.1 and ipr driver version 2.0.11.6 (or later) for RHEL4 kernels
  - iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for RHEL5 kernels
  - iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for SLES10 kernels

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 1.8 GB Cache RAID SAS Tri-port 6 Gb Adapter (FC 5913; CCIN 57B5)
Learn about the specifications and operating system requirements for the feature code (FC) 5913 adapters.

Overview

The PCI Express (PCIe) generation-2, 1.8 GB Cache RAID SAS Tri-port 6 Gb Adapter is a large cache PCIe2 SAS adapter that provides high-performance capabilities and supports the attachment of serial-attached SCSI (SAS) disks and SAS solid-state drives through mini SAS HD (high density) connectors. The feature code (FC) 5913 has a 1.8 GB write-cache. The adapter must be installed in pairs and must be used in a high availability, multi-initiator RAID configuration with two adapters in dual-controller mode (Dual Storage IOA configuration). Two FC 5913 adapters provide additional

performance and adapter redundancy with mirrored write-cache data and mirrored RAID parity footprints between the adapters. If the FC 5913 pairing is broken, then the write cache is disabled. Integrated flash memory with capacitors provides protection of the write cache in case of power failure, without the need for batteries as were used with previous large cache adapters.

To provide the highest bandwidth between two paired feature 5913 adapters for the mirroring of cache data and parity update footprints, a SAS Adapter-to-Adapter (AA) cable is required by default on the third adapter port until maximum device quantity attachment is required. When all three connectors are attaching SAS drives, the communication between the adapter pair is performed through the SAS fabric via the I/O drawer and cabling.

The FC 5913 is a single wide, full-height, short adapter.

Every FC 5913 requires another 6 Gbps SAS RAID adapter (FC 5913) on this server, or on another server, which pairs with the SAS RAID adapter and enables the onboard caches to function. See Figure 38 on page 147 that shows the FC 5913 adapter.

Systems running the AIX or Linux operating systems support either having both 5913 features in the same system or partition, or in two separate systems or partitions. Systems running the IBM i operating system do not support the pairing of adapters on different servers or different partitions, so both the 5913 features must be installed on the same system and partition.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    00J0596 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe2.0 x8
Slot requirement
    One PCIe x8 slot per adapter.

    Adapters are installed in pairs.

    For higher availability, place adapters in separate enclosures where supported.
Cables
    Specific X , YO, AA, or AT SAS cables with HD connectors are used to attach to the expansion drawers.

    SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations.
Voltage
    3.3 V
Form factor
    Short, full-height
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Attributes provided
    • Provides three mini-SAS high-density (HD) connectors for attaching the SAS drives in the FC 5887 EXP24S drawers. A maximum of three EXP24S can be attached to the same FC 5913 pair.

- Supports a maximum of 72 hard disk drives or a maximum 24 SSDs (depending on the type of enclosures attached), or a combination of both with specific placement rules for each enclosure.
- The AA cable is required on the top mini-SAS HD port of the adapter pair. Use a pair of FC 3689, 0.6 m AT SAS cables to connect the FC 5913 adapter pair to the SAS connectors. An FC 5887 EXP24S can be attached to the other port on the FC 5913 pair.
- An AA SAS cable with HD connectors attached to the FC 5913 pair provides a higher performance path for mirrored write-cache data and mirrored RAID parity footprints between the adapters and is required unless all three ports are being used to attach EXP24S drawers.

  Note: Solid-state drives (SSDs) are not allowed on the top port (T2).
- Support of the SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP).
- Provides RAID 0, RAID 5, RAID 6, and RAID 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is not supported except for the initial formatting to 528 bytes of new devices, as required.
- A single pair of FC 5913 adapters is not supported to attach to both halves of an FC 5887 EXP24S drawer that is configured in mode 2.

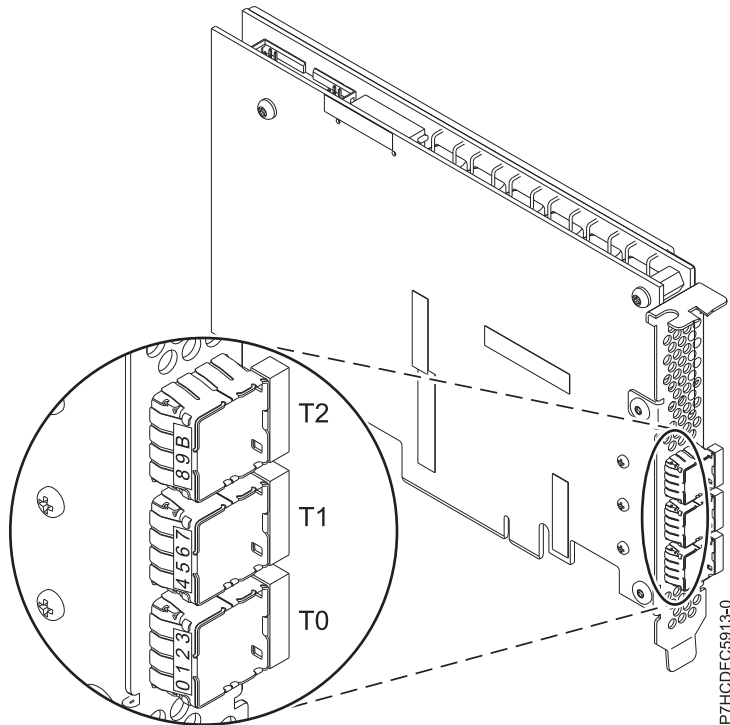The following figure shows the adapter.

Figure 38. 5913 Adapter

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, or later
  - AIX 6.1, Technology Level 7, or later
  - AIX Version 5.3, Technology Level 12, or later
- Linux

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6.1, or later
- SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
- SUSE Linux Enterprise Server 10, Service Pack 4, or later
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.0.12-FP24 SP02, or later

Other important requirements for adapter installation

- If you are attaching a new or existing FC 5887 to an FC 5913 adapter, verify that the latest System Enclosure Services (SES) code is applied to the FC 5887 before attaching to the FC 5913 adapter, see the IBM Prerequisites website.
- If you are migrating existing SAS disk enclosures and devices from existing previous SAS adapters, an automatic sector conversion takes place for use with the new FC 5913 adapters. For information about the migrating procedures, see Upgrading the adapter in the POWER7® IBM Knowledge Center.

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe2 LP 2-Port 10 GbE RoCE SFP+ Adapter (FC EC27; CCIN EC27)

Learn about the specifications and operating system requirements for the feature code (FC) EC27 adapter.

Overview

The PCIe2 LP 2-Port 10 GbE RoCE SFP+ adapter is a low-profile, PCIe generation-2 (PCIe2), dual port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the central processing unit (CPU) and providing enhanced performance. The two 10 Gb small form-factor pluggable (SFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number

000E1493 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" on page 150 for details

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Limitations

This adapter cannot be used to boot an LPAR via AIX NIM or Linux Network Install. Systems that require installation from a network source must be configured with another Ethernet adapter that supports boot capability.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.3, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- Supported on Firmware level 7.6, or later

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 39 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

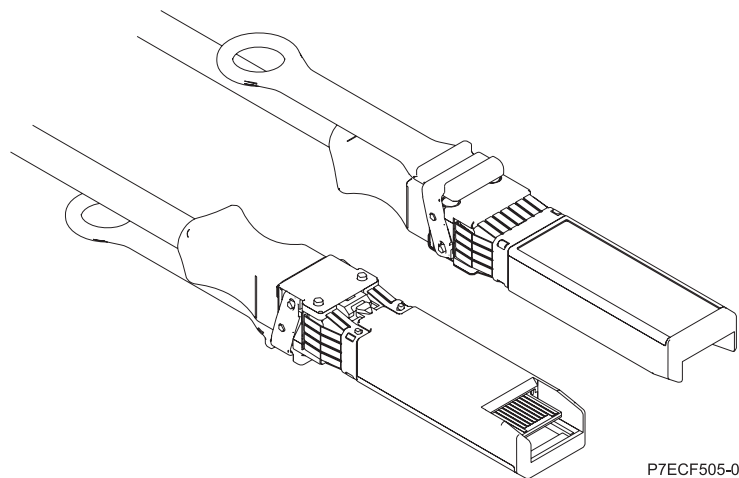See Table 53 for details about the feature codes.

P7ECF505-0

Figure 39. Top and bottom view of the cable

Table 53. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe2 2-Port 10 GbE RoCE SFP+ Adapter (FC EC28; CCIN EC27)

Learn about the specifications and operating system requirements for the feature code (FC) EC28 adapter.

Overview

The PCIe2 2-Port 10 GbE RoCE SFP+ adapter is a regular-height, PCIe generation-2 (PCIe2), dual port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the central processing unit (CPU) and providing enhanced performance. The two 10 Gb small form-factor pluggable (SFP+) transceiver

ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number

000E1491 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2 x8

Slot requirement

For the slot priorities, see the PCI adapter placement topic collection for your system.

Cables

See "Cables" for details

Voltage

3.3 V

Form factor

Short

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Limitations

This adapter cannot be used to boot an LPAR via AIX NIM or Linux Network Install. Systems that require installation from a network source must be configured with another Ethernet adapter that supports boot capability.

Operating system or partition requirements

This adapter is supported for the following versions of the operating system:
- AIX:
  - AIX Version 7.1 with the 7100-01 Technology Level and Service Pack 3, or later
  - AIX Version 6.1 with the 6100-07 Technology Level and Service Pack 3, or later
- Linux:
  - Red Hat Enterprise Linux Version 6.3 for POWER, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11 Service Pack 2, or later, with current maintenance updates available from SuSE.
- Firmware level 7.6, or later.

Cables

FC EC28 requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 40 on page 152 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.
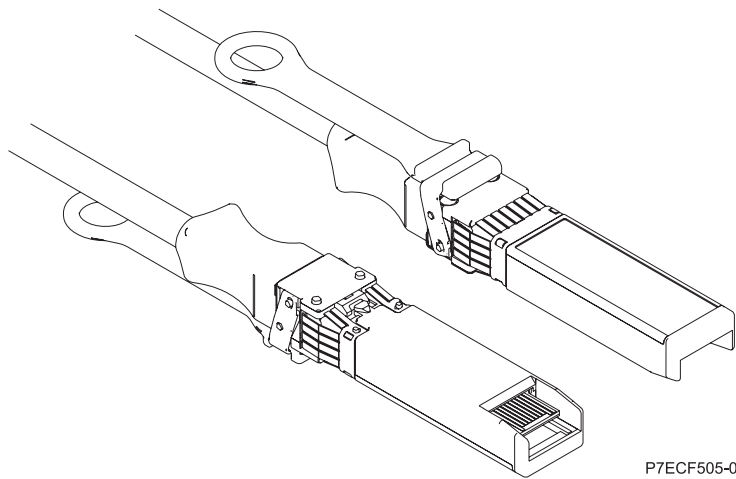
See Table 54 for details about the feature codes.

Figure 40. Top and bottom view of the cable

Table 54. Feature code and part number for varying lengths of the cable

Cable length	1 m (3.28 ft)	3 m (9.84 ft)	5 m (16.4 ft)
Feature code	EN01	EN02	EN03
CCIN	EF01	EF02	EF03
Part number	46K6182	46K6183	46K6184

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 LP 2-Port 10 GbE RoCE SR Adapter (FC EC29; CCIN EC29)

Learn about the specifications and operating system requirements for the feature code (FC) EC29 adapter.

Overview

The PCIe2 2-Port 10 GbE RoCE SR adapter is a PCIe generation-2 (PCIe2), low-profile, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

The adapter has a preinstalled optical transceiver. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    00E1600 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe2 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Limitations
    This adapter cannot be used to boot an LPAR via AIX NIM or Linux Network Install. Systems that require installation from a network source must be configured with another Ethernet adapter that supports boot capability.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.3, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

- Supported on Firmware level 7.6, or later

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe LP 2-Port 10 GbE SFN6122F Adapter (FC EC2G; CCIN EC2G)

Learn about the specifications and operating system requirements for the feature code (FC) EC2G adapters.

Overview

The FC EC2G PCIe LP 2-Port 10 GbE SFN6122F adapter is a low-profile adapter equivalent to the FC EC2J, which is a regular-height adapter.

The adapter is a PCIe generation-2 (PCIe2), dual-port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by instantiating protected virtual network interface controller (vNIC) interfaces for each running guest operating system or application, which gives it a direct pipeline to the Ethernet network. This architecture provides the most efficient way to maximize network and processor efficiency. The adapter supports Solarflare OpenOnload (http://support.solarflare.com/oem/ibmpower) for environments that require high performance and low latency. You can download the Solarflare NET drivers that support this adapter, from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

The two 10 Gb small form-factor pluggable (SFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

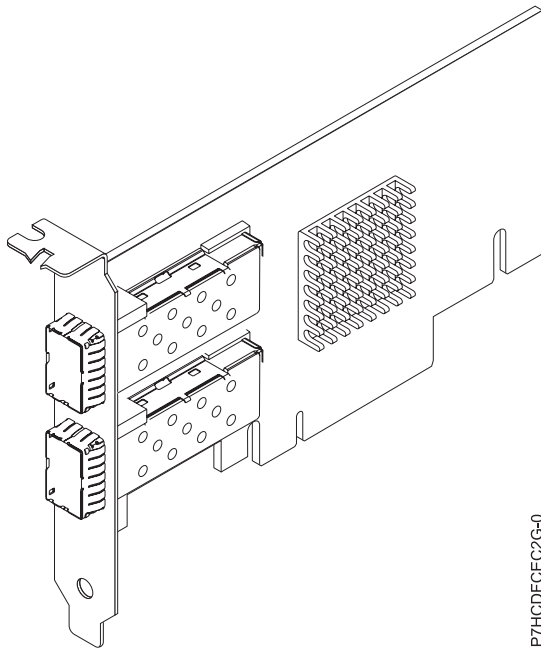Figure 41 on page 155 shows the adapter.

Figure 41. FC EC2G adapter

Specifications

Item   Description

Adapter FRU number

00E8224 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

For details, see "Cables" on page 156.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating system, depending on the system you are using:

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.

Note: OpenOnload and performance optimized drivers are available for download directly from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 42 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

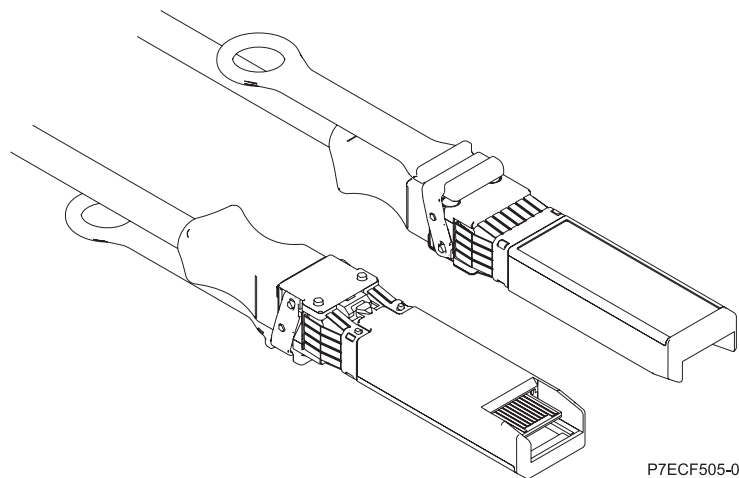See Table 55 for details about the feature codes.

P7ECF505-0

Figure 42. Top and bottom view of the cable

Table 55. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe 2-Port 10 GbE SFN6122F Adapter (FC EC2J; CCIN EC2G)

Learn about the specifications and operating system requirements for the feature code (FC) EC2J adapters.

Overview

The FC EC2J PCIe 2-Port 10 GbE SFN6122F adapter is a regular-height adapter.

The adapter is a PCIe generation-2 (PCIe2), dual-port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other

data center applications. The adapter improves network performance by instantiating protected virtual network interface controller (vNIC) interfaces for each running guest operating system or application, which gives it a direct pipeline to the Ethernet network. This architecture provides the most efficient way to maximize network and processor efficiency. The adapter supports Solarflare OpenOnload (http://support.solarflare.com/oem/ibmpower) for environments that require high performance and low latency. You can download the Solarflare NET drivers that support this adapter, from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

The two 10 Gb small form-factor pluggable (SFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Figure 43 shows the adapter.

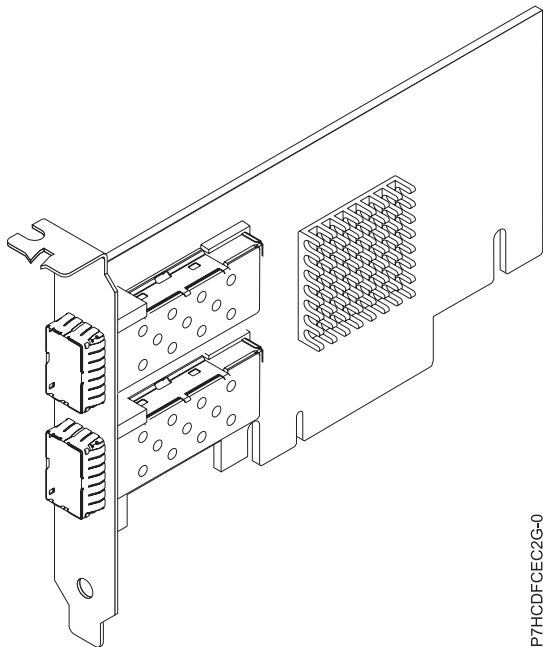*Figure 43. FC EC2J adapter*

Specifications

Item   Description
Adapter FRU number
        00E8224 (Designed to comply with RoHS requirement)
I/O bus architecture
        PCIe2 x8
Slot requirement
        For the slot priorities, see the PCI adapter placement topic collection for your system.
Cables
        For details, see "Cables" on page 158.
Voltage
        3.3 V

Form factor

Short

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Operating system or partition requirements

This adapter is supported for the following version of the operating system:

- Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.

Note: OpenOnload and performance optimized drivers are available for download directly from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

Cables

FC EC2J requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active Ethernet cables. For a view of the cable top and cable bottom, see Figure 44. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

For details about the cable feature codes, see Table 56.

P7ECF505-0

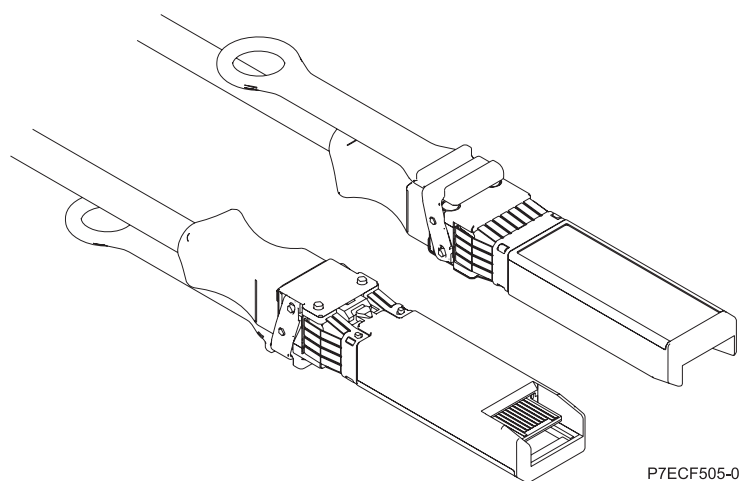*Figure 44. Top and bottom view of the cable*

Table 56. FC and part number for varying lengths of the cable

Cable length	1 m (3.28 ft)	3 m (9.84 ft)	5 m (16.4 ft)
FC	EN01	EN02	EN03
CCIN	EF01	EF02	EF03
Part number	46K6182	46K6183	46K6184

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 2-Port 10 GbE NIC and RoCE SR Adapter (FC EC2M; CCIN 57BE)

Learn about the specifications and operating system requirements for the feature code (FC) EC2M adapter.

Overview

The FC EC2N and EC2M are the same adapter. FC EC2N is a full-height adapter and FC EC2M is a low-profile adapter. The names of these two adapters are:
- FC EC2N: PCIe3 2-Port 10 GbE NIC and RoCE SR adapter
- FC EC2M: PCIe3 LP 2-Port 10 GbE NIC and RoCE SR adapter

This PCIe Gen3 adapter provides two 10 Gb SR optical fiber ports. The adapter is a converged network adapter supporting both NIC and IBTA RoCE standard. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency and minimize CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

The adapter has two preinstalled optical transceivers. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 45 on page 160 shows the FC EC2M adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  - AIX NIM and Linux Network Install are supported
  - IBTA RoCE v2 support
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
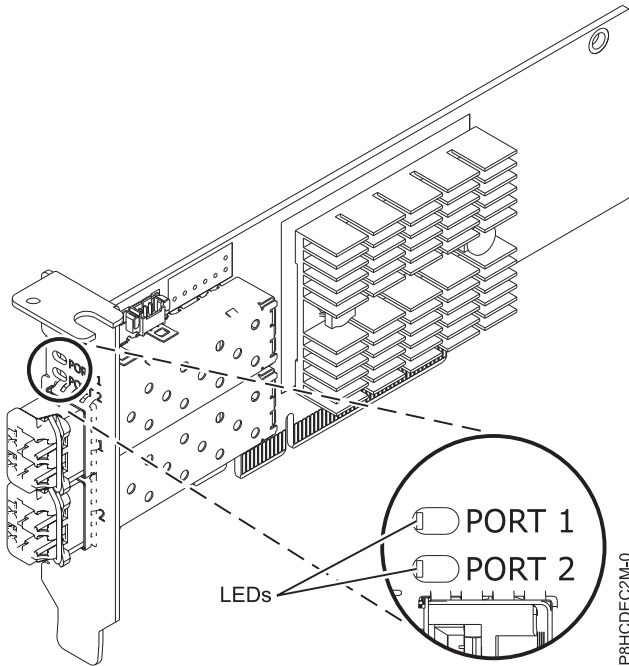
Figure 45. FC EC2M adapter

Specifications

Item   Description
Adapter FRU number
> 00RX875 (Designed to comply with RoHS requirement)
>
> Low-profile tailstock: 00RX872

I/O bus architecture
> PCIe3 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage
> 3.3 V

Form factor
> Short

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i supported only with VIOS on 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME
  - IBM i Version 7.1, Technology Refresh 9, or later supported only with VIOS. Only virtual ethernet NIC.
  - IBM i Version 7.2, Technology Refresh 1, or later supported only with VIOS. Only virtual ethernet NIC.
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

➧ IBM Prerequisite website

➧ Installing, removing, or replacing PCIe adapters

➧ PCIe adapter placement

➧ PCIe adapter information by feature type

PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EC2N; CCIN 57BE)

Learn about the specifications and operating system requirements for the feature code (FC) EC2N adapter.

Overview

The FC EC2N and EC2M are the same adapter. FC EC2N is a full-height adapter and FC EC2M is a low-profile adapter. The names of these two adapters are:
- FC EC2N: PCIe3 2-Port 10GbE NIC and RoCE SR adapter
- FC EC2M: PCIe3 LP 2-Port 10GbE NIC and RoCE SR adapter

This PCIe Gen3 adapter provides two 10 Gb SR optical fiber ports. The adapter is a converged network adapter supporting both NIC and IBTA RoCE standard. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency and minimize CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

The adapter has two preinstalled optical transceivers. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link

aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 46 on page 163 shows the FC EC2N adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  - AIX NIM and Linux Network Install are supported
  - IBTA RoCE v2 support
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
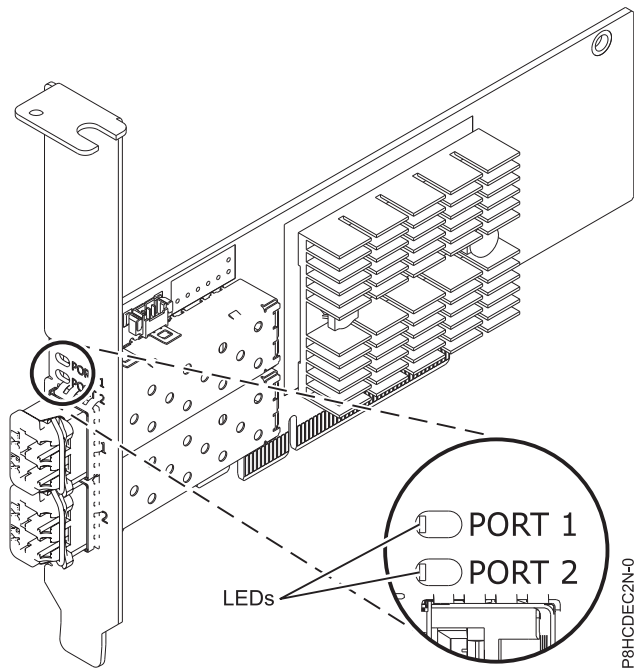
Figure 46. FC EC2N adapter

Specifications

Item   Description

Adapter FRU number

> 00RX875 (Designed to comply with RoHS requirement)

> Full-height tailstock part number

I/O bus architecture

> PCIe3 x8

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

> Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage

> 3.3 V

Form factor

> Short

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX

- AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
- AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe2 LP 2-port 10 GbE RoCE SR adapter (FC EC30; CCIN EC29)

Learn about the specifications and operating system requirements for the feature code (FC) EC30 adapters.

Overview

The FC EC29 and FC EC30 are the same adapter. FC EC29 is a low-profile adapter, and FC EC30 is a full-height adapter. The names of these two adapters are:
- FC EC29: PCIe2 LP 2-Port 10 GbE RoCE SR adapter
- FC EC30: PCIe2 2-Port 10 GbE RoCE SR adapter

The adapter is a PCIe generation-2 (PCIe2), dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

The adapter has a preinstalled optical transceiver. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number
> 00E1599

I/O bus architecture
> PCIe2 x8

Slot requirement
> For the slot priorities, see the PCI adapter placement topic collection for your system.

Cables
> Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage
> 3.3 V

Form factor
> Short

Maximum number
> For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Limitations
> This adapter cannot be used to boot an LPAR via AIX NIM or Linux Network Install. Systems that require installation from a network source must be configured with another Ethernet adapter that supports boot capability.

Operating system or partition requirements

This adapter is supported for the following versions of the operating system:

- AIX:
  - AIX Version 7.1, or later
  - AIX Version 6.1, or later
- Linux:
  - Red Hat Enterprise Linux Version 6.3 for POWER, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11 Service Pack 2, or later, with current maintenance updates available from SuSE.
- Firmware level 7.6, or later.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 low profile 2-port 56 Gb FDR InfiniBand Adapter x16 (FC EC32; CCIN 2CE7)

Learn about the specifications and operating system requirements for the feature code (FC) EC32 adapter.

Overview

The PCIe3 low profile 2-port 56 Gb FDR InfiniBand Adapter x16 provides high speed connectivity with other servers or InfiniBand switches. Each port maximum of 56Gb assumes no other system and/or switch bottlenecks are present. The x16 adapter allows full bandwidth in a PCIe Gen3 slot.

The two 56 Gb ports have QSFP+ connections which support industry standard FDR cables, either FDR DAC cables or FDR optical. One adapter can support either or both types of cable. The user can choose to cable up just one port if they desire.

The FC EC32 and EC33 are the same adapter. FC EC32 is a low-profile adapter, and FC EC33 is a full-height adapter. The names of these two adapters are:

- FC EC32: PCIe3 LP 2-port 56Gb FDR IB Adapter x16
- FC EC33: PCIe3 2-port 56Gb FDR IB Adapter x16

Figure 47. FC EC32 adapter

Note: The LEDs that are shown in Figure 47 indicate the following states:

- A lit solid amber LED (left LED) indicates a good physical link.
- A flashing amber LED (left LED) indicates a problem with the physical link.
- If neither the amber LED (left LED) or the green LED (right LED) is lit, then the physical link has not been established.
- The amber LED (left LED) turns off when the logical link is established.
- A lit solid green LED (right LED) indicates a valid logical (data activity) link without data transfer.
- A flashing green LED (right LED) indicates a valid logical link with data transfer.
- If only the amber LED (left LED) is lit and the green LED (right LED) is off, then the logical link has not been established.

Specifications

Item   Description
Adapter FRU number
        00RX852 (Designed to comply with RoHS requirement)

        Low-profile tailstock part number: 00ND499

I/O bus architecture
>   PCIe x16

Slot requirement
>   For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
>   priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
>   p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
>   No cables required.

Voltage
>   3.3 V

Form factor
>   Short

Maximum number
>   For details about the maximum number of adapters that are supported, see PCIe adapter
>   placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
>   p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux:
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 2-port 56 Gb FDR IB Adapter x16 (FC EC33; CCIN 2CE7)

Learn about the specifications and operating system requirements for the feature code (FC) EC33 adapter.

Overview

The PCIe3 2-port 56 Gb FDR IB Adapter x16 provides high speed connectivity with other servers or IB switches. Each port maximum of 56 Gb assumes no other system and/or switch bottlenecks are present. The x16 adapter allows full bandwidth in a PCIe Gen3 slot.

The two 56Gb ports have QSFP+ connections which support industry standard FDR cables, either FDR DAC cables or FDR optical. One adapter can support either or both types of cable. The user can choose to cable up just one port if they desire.

The FC EC33 and EC32 are the same adapter. FC EC33 is a full-height adapter, and FC EC32 is a low-profile adapter. The names of these two adapters are:

- FC EC33: PCIe3 2-port 56Gb FDR IB Adapter x16
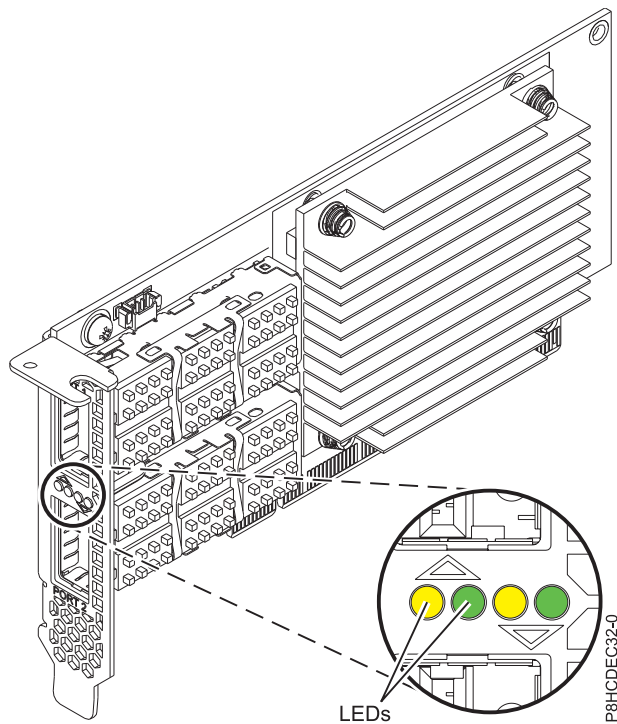- FC EC32: PCIe3 LP 2-port 56Gb FDR IB Adapter x16
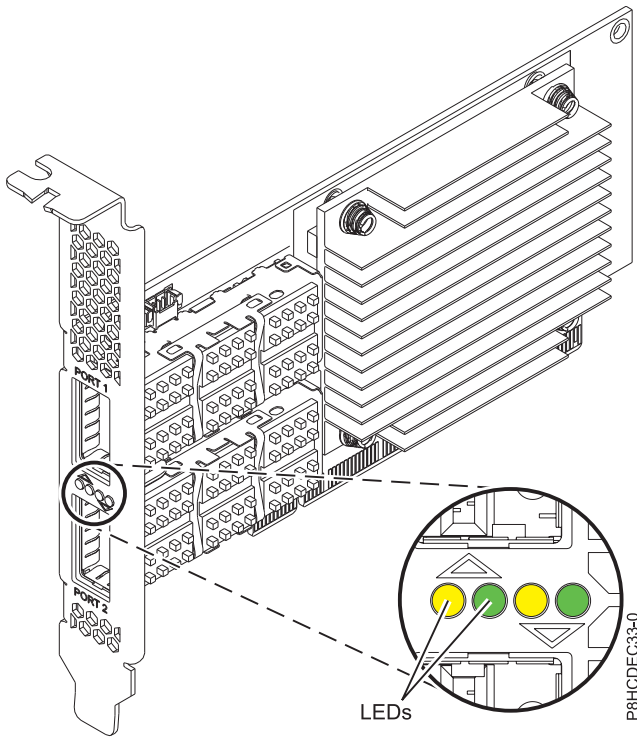
Figure 48. FC EC33 adapter

Note: The LEDs that are shown in Figure 48 indicate the following states:

- A lit solid amber LED (left LED) indicates a good physical link.
- A flashing amber LED (left LED) indicates a problem with the physical link.
- If neither the amber LED (left LED) or the green LED (right LED) is lit, then the physical link has not been established.
- The amber LED (left LED) turns off when the logical link is established.
- A lit solid green LED (right LED) indicates a valid logical (data activity) link without data transfer.
- A flashing green LED (right LED) indicates a valid logical link with data transfer.
- If only the amber LED (left LED) is lit and the green LED (right LED) is off, then the logical link has not been established.

Specifications

Item   Description
Adapter FRU number
  00RX852 (Designed to comply with RoHS requirement)

  Full-height tailstock
I/O bus architecture
  PCIe x16
Slot requirement
  For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
  No cables required.
Voltage
  3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux:
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LP 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC37; CCIN 57BC)

Learn about the specifications and operating system requirements for the feature code (FC) EC37 adapter.

Overview

The FC EC38 and EC37 are the same adapter. FC EC38 is a full-height adapter and FC EC37 is a low-profile adapter. The names of these two adapters are:

- FC EC38: PCIe3 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter
- FC EC37: PCIe3 LP 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter

The PCIe3 2-Port 10 GbE NIC and RoCE SR adapter is a PCIe generation-3 (PCIe3), full-height, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter provides two 10 Gb SFP+ ports for copper twinax cabling. These cables also include copper transceivers. The adapter is a converged network adapter supporting both NIC and IBTA RoCE standard. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency and minimize CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A copper transceiver is included with these cables. See "Cables" on page 171 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 49 on page 170 shows the FC EC37 adapter.

The adapter provides the following features:

- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  - AIX NIM and Linux Network Install are supported

- IBTA RoCE v2 support
- IEEE 802.3ae in the 10 GbE ports
- 802.3ab in the 1 GbE ports
- Ether II and IEEE 802.3 for encapsulated frames
- 802.1p for setting up priority levels in tagged VLAN frames
- 802.1Q for VLAN tagging
- 802.3x for flow control
- 802.3ad for load-balancing and failover
- IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
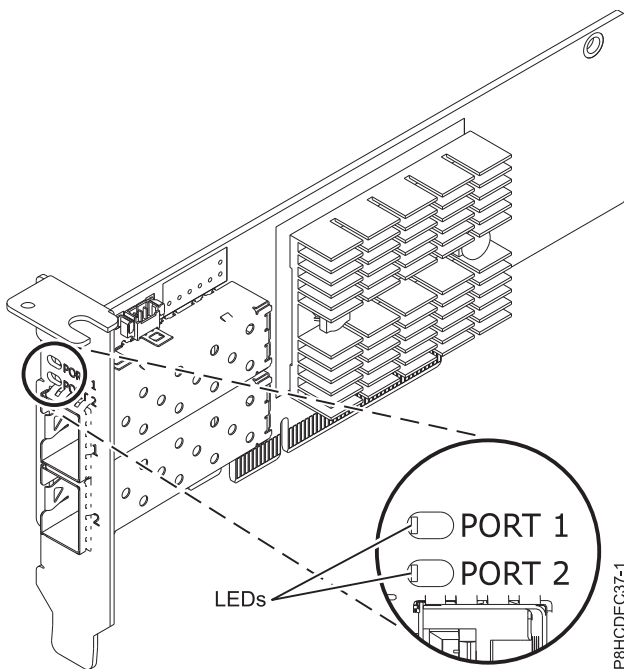

Figure 49. FC EC37 adapter

Specifications

Item   Description
Adapter FRU number
    00RX859 (Designed to comply with RoHS requirement)

    Low-profile tailstock: 00RX856
I/O bus architecture
    PCIe3 x8

Slot requirement

    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

    See "Cables" for details.

Voltage

    3.3 V

Form factor

    Short

Maximum number

    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 50 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

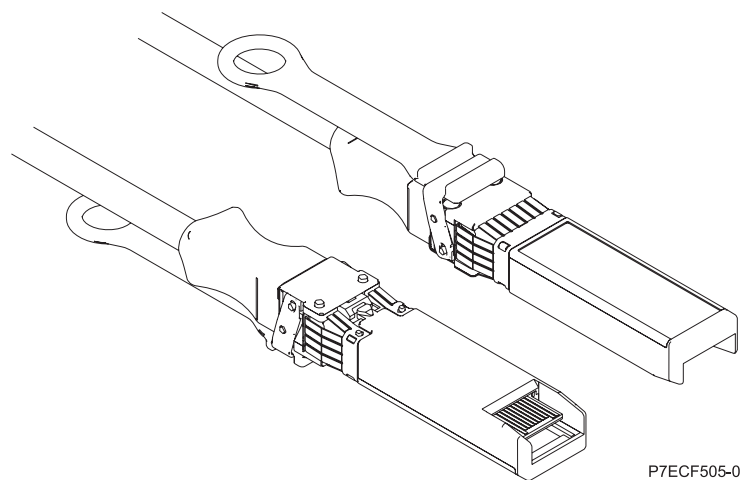See Table 57 for details about the feature codes.

P7ECF505-0

Figure 50. Top and bottom view of the cable

Table 57. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i supported only with VIOS on 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME
  - IBM i Version 7.1, Technology Refresh 9, or later supported only with VIOS. Only virtual ethernet NIC.
  - IBM i Version 7.2, Technology Refresh 1, or later supported only with VIOS. Only virtual ethernet NIC.
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EC38; CCIN 57BC)

Learn about the specifications and operating system requirements for the feature code (FC) EC38 adapter.

Overview

The FC EC38 and EC37 are the same adapter. FC EC38 is a full-height adapter and FC EC37 is a low-profile adapter. The names of these two adapters are:
- FC EC38: PCIe3 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter
- FC EC37: PCIe3 LP 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter

The PCIe3 2-port 10 GbE NIC and RoCE SFP+ Copper Adapter is a PCIe generation-3 (PCIe3), full-height, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter

provides two 10 Gb SFP+ ports for copper twinax cabling. These cables also include copper transceivers. The adapter is a converged network adapter supporting both NIC and IBTA RoCE standard. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency and minimize CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A copper transceiver is included with these cables. See "Cables" on page 174 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 51 on page 174 shows the FC EC38 adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  - AIX NIM and Linux Network Install are supported
  - IBTA RoCE v2 support
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 51. FC EC38 adapter

Specifications

Item   Description
Adapter FRU number
        00RX859 (Designed to comply with RoHS requirement)

        Full-height tailstock part number
I/O bus architecture
        PCIe3 x8
Slot requirement
        For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
        priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
        p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
        See "Cables" for details.
Voltage
        3.3 V
Form factor
        Full-height
Maximum number
        For details about the maximum number of adapters that are supported, see PCIe adapter
        placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
        p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet
cables. See Figure 52 on page 175 for a view of the cable top and cable bottom. These cables are
compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all
applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 58 for details about the feature codes.
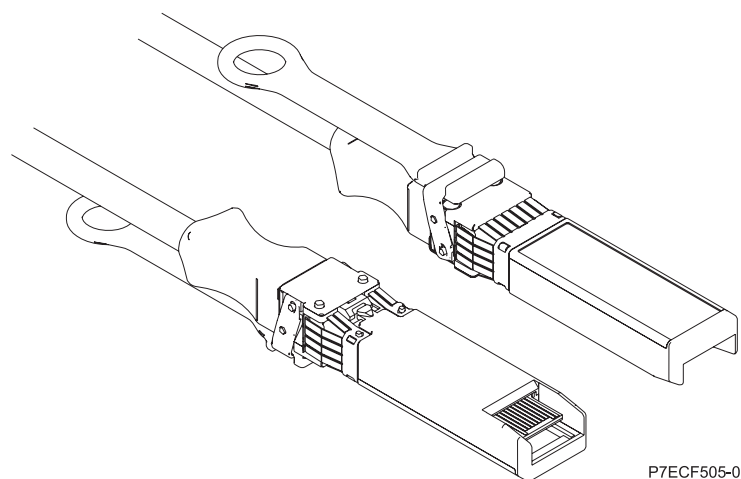
Figure 52. Top and bottom view of the cable

Table 58. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i supported only with VIOS on 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME

- IBM i Version 7.1, Technology Refresh 9, or later supported only with VIOS. Only virtual ethernet NIC.
- IBM i Version 7.2, Technology Refresh 1, or later supported only with VIOS. Only virtual ethernet NIC.
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3A; CCIN 57BD)

Learn about the specifications and operating system requirements for the feature code (FC) EC3A adapter.

Overview

The PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ Adapter is a low-profile, PCIe generation-3 (PCIe3), dual port, 40-Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter acts as a network interface controller (NIC) and uses the IBTA RDMA over Converged Ethernet (RoCE) protocols to provide efficient Remote Direct Memory Access (RDMA) services. The adapter delivers high-bandwidth and low-latency 40 GbE connectivity, reducing the load on the processor and efficiently using the memory access. This action off-loads the processor from networking tasks which improves the performance and scalability of the processor.

The adapter is optimized for enterprise data centers, high-performance computing, transaction databases, cloud computing, virtualization, storage, and other embedded environments. The adapter improves network performance by increasing available bandwidth to the processor and by providing enhanced performance. The adapter provides dedicated adapter resources and protection for virtual machines (VM). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

The two 40 Gb quad (4-channel) small form-factor pluggable (QSFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each QSFP+ port provides Ethernet connectivity with a nominal data rate of 40 gigabits per second (Gbps).

The adapter does not include transceivers. Use copper cables with QSFP+ 40G BASE-SR transceivers for short distances. See "Cables" on page 178 for more information about the cables.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

The adapter provides the following features:
- Data center bridging support (IEEE standard version CEE)
- T11.3 FC-BB-5 FCoE
- TCP/IP stateless offload in hardware
- Traffic steering across multiple cores
- Intelligent interrupt coalescence
- Advanced Quality of Service (QoS)

- RoHS-R6 compliant
- RDMA over Ethernet using uDAPL

The adapter provides Ethernet NIC support with the following features:
- 64-bit kernel environments
- multi-processor safe
- AIX Common Data Link Interface (CDLI) compliant
- Concurrent operation of NIC and RoCE device drivers while sharing the same physical port
- Standard frames (1518 bytes + 4 bytes for VLAN tag)
- Jumbo frames (9018 bytes + 4 bytes for VLAN tag)
- IPV4 or IPV6 transmit/receive TCP checksum offload
- IPV4 transmit TCP segmentation offload (commonly known as large send)
- IPV4 receive TCP segmentation aggregation (commonly known as large receive)
- Enhanced Error Handling (EEH) from PCI bus errors

Figure 53 shows the adapter.

P8HCDEC3A-0
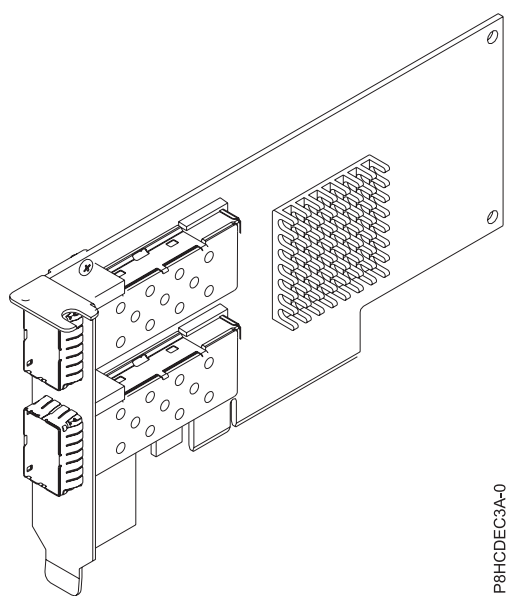
Figure 53. FC EC3A adapter

Specifications

Item   Description
Adapter FRU number
>   00FW105 (Designed to comply with RoHS requirement)

I/O bus architecture
>   PCIe3 x8

Slot requirement
>   For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
>   priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
>   p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
>   See "Cables" on page 178 for details.

Voltage

> 3.3 V

Form factor

> Short

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible QSFP+, 40 Gbps, copper, twinaxial, active, Ethernet cables for cabling over short distances. See Figure 54 for different views of the QSFP+ copper cable. For distances over 5 meters, use two optical QSFP+ SR transceivers (FC EB27) that attach to optical cables FC EB2J or FC EB2K. See Table 59 for details about the feature codes.

Do not mix copper and optical cables on the same adapter.

These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

P7ECF505-0
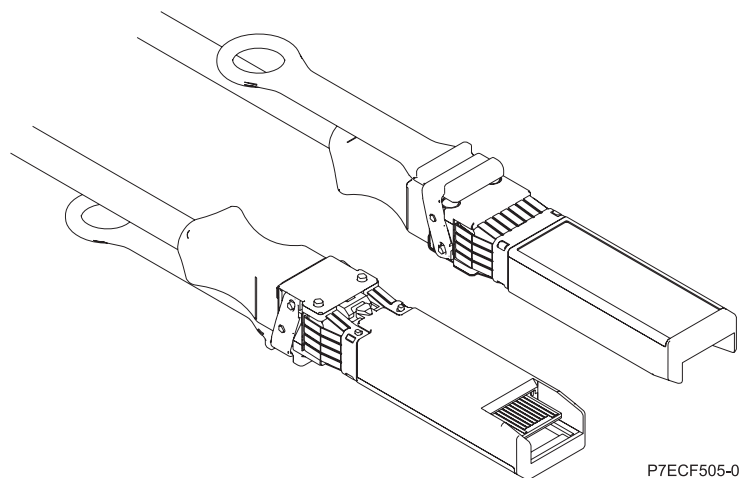
Figure 54. Top and bottom view of the cable

Table 59. Feature code and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
Copper cables			
1 m (3.28 ft)	EB2B		49Y7934
3 m (9.84 ft)	EB2H		49Y7935
5 m (16.4 ft)	ECBN		00D5809
Optical cables			
10 m (32.8 ft)	EB2J		41V2458
30 m (98.4 ft)	EB2K		45D6369
QSFP+ 40G BASE-SR transceiver	EB27		49Y7928

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server Version 12, or later
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - Ubuntu Server 14.04.3, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- Supported on Firmware level 8.1
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter (FC EC3B; CCIN 57BD)

Learn about the specifications and operating system requirements for the feature code (FC) EC3B adapter.

Overview

The PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter is a regular-height, PCIe generation-3 (PCIe3), dual port, 40-Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter acts as a network interface controller (NIC) and uses the IBTA RDMA over Converged Ethernet (RoCE) protocols to provide efficient Remote Direct Memory Access (RDMA) services. The adapter delivers high-bandwidth and low-latency 40 GbE connectivity, reducing the load on the processor and efficiently using the memory access. This action off-loads the processor from networking tasks which improves the performance and scalability of the processor.

The adapter is optimized for enterprise data centers, high-performance computing, transaction databases, cloud computing, virtualization, storage, and other embedded environments. The adapter improves

network performance by increasing available bandwidth to the processor and by providing enhanced performance. The adapter provides dedicated adapter resources and protection for virtual machines (VM). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

The two 40 Gb quad (4-channel) small form-factor pluggable (QSFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each QSFP+ port provides Ethernet connectivity with a nominal data rate of 40 gigabits per second (Gbps).

The adapter does not include transceivers. Use copper cables with QSFP+ 40G BASE-SR transceivers for short distances. See "Cables" on page 181 for more information about the cables.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

The adapter provides the following features:
- Data center bridging support (IEEE standard version CEE)
- T11.3 FC-BB-5 FCoE
- TCP/IP stateless offload in hardware
- Traffic steering across multiple cores
- Intelligent interrupt coalescence
- Advanced Quality of Service (QoS)
- RoHS-R6 compliant
- RDMA over Ethernet using uDAPL

The adapter provides Ethernet NIC support with the following features:
- 64-bit kernel environments
- multi-processor safe
- AIX Common Data Link Interface (CDLI) compliant
- Concurrent operation of NIC and RoCE device drivers while sharing the same physical port
- Standard frames (1518 bytes + 4 bytes for VLAN tag)
- Jumbo frames (9018 bytes + 4 bytes for VLAN tag)
- IPV4 or IPV6 transmit/receive TCP checksum offload
- IPV4 transmit TCP segmentation offload (commonly known as large send)
- IPV4 receive TCP segmentation aggregation (commonly known as large receive)
- Enhanced Error Handling (EEH) from PCI bus errors

Figure 55 on page 181 shows the adapter.

P8HCDEC3B-0
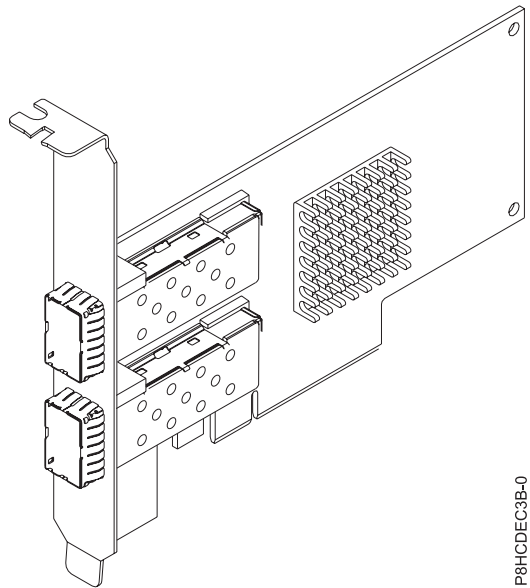
Figure 55. FC EC3B adapter

Specifications

Item   Description

Adapter FRU number

> 00FW105 (Designed to comply with RoHS requirement)

I/O bus architecture

> PCIe3 x8

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

> See "Cables" for details.

Voltage

> 3.3 V

Form factor

> Short

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible QSFP+, 40 Gbps, copper, twinaxial, active, Ethernet cables for cabling over short distances. See Figure 56 on page 182 for different views of the QSFP+ copper cable. For distances over 5 meters, use two optical QSFP+ SR transceivers (FC EB27) that attach to optical cables FC EB2J or FC EB2K. See Table 60 on page 182 for details about the feature codes.

Do not mix copper and optical cables on the same adapter.

These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

P7ECF505-0
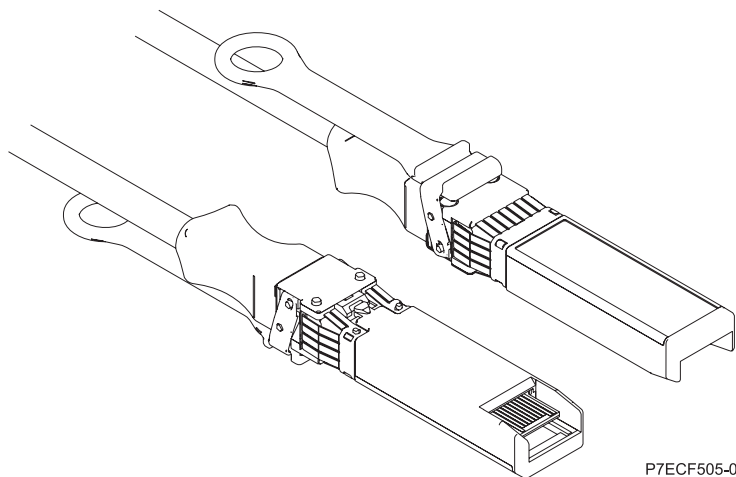
Figure 56. Top and bottom view of the cable

Table 60. Feature code and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
Copper cables			
1 m (3.28 ft)	EB2B		49Y7934
3 m (9.84 ft)	EB2H		49Y7935
5 m (16.4 ft)	ECBN		00D5809
Optical cables			
10 m (32.8 ft)	EB2J		41V2458
30 m (98.4 ft)	EB2K		45D6369
QSFP+ 40G BASE-SR transceiver	EB27		49Y7928

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* AIX
  – AIX 7.1, or later
  – AIX Version 6.1, or later
* Linux
  – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

- – The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- Supported on Firmware level 8.1

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter (FC EC3L and EC3M; CCIN 2CEC)

Learn about the specifications and operating system requirements for the feature code (FC) EC3L and EC3M adapter.

Overview

FC EC3L and EC3M are both the same adapter with different tail stock brackets. FC EC3L is a low-profile adapter and FC EC3M is a full-height adapter.

The PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter is a PCI Express (PCIe) generation 3 (Gen3), x16 adapter. The adapter provides two 100 Gb QSFP28 ports. The PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter supports both NIC (Network Interface Controller) and IBTA RoCE standards. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency. It also minimizes CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

Note: Each port maximum of 100 Gb assumes that no other system and or switch bottlenecks are present. The adapter allows full bandwidth for a single port in a PCIe3 slot and up to 128 Gb/s minus overheads for both ports.
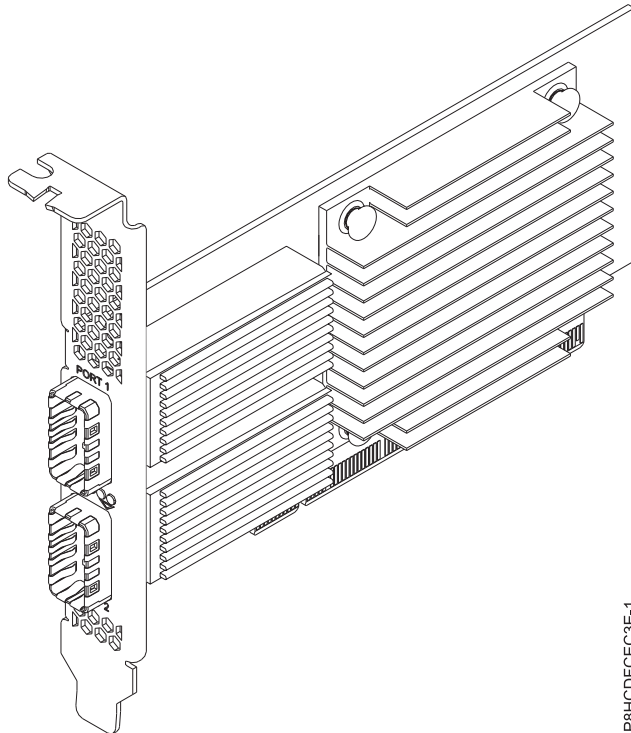
Figure 57. PCIe3 2-port 100 GbE (NIC and RoCE) QSFP28 Adapter

Specifications

Item   Description

Adapter FRU number

> 00WT078 (Designed to comply with RoHS requirement.)

I/O bus architecture

> PCIe3 x16

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Supported Systems

> POWER8® processor-based server

Cables

> For 100G, IBM® offers either Direct Attach Copper (DAC) cables up to 2 M or Active Optical Cables (AOC) up to 100 M. QSFP28 based transceivers are included on each end of these cables. For more information about adapter cabling, see the "Cable and Transceiver Matrix."

> **Note:** For 40G, IBM® offers DAC cables up to 5 M. QSFP+ base transceivers are included on each end of these cables. See FC EB2B, EB2H, and ECBN for a 1 M, 3 M, and 5 M copper cables.

Transceivers

> IBM® qualifies and supports QSFP28 optical transceiver (FC EB59) to install into the adapter. Customers can also use their own optical cabling and QSP28 optical transceiver for the other end. This is a 100Gbase-SR4 based active optical transceiver capable up to 100 M through the OM4 cable or 70 M through OM3 cable. Either one or both of the adapter's two QSP28 ports can be populated. When two ports are filled, both can have copper cables or optical cables. Additionally, one of the cables can be copper and the other can be optical. IBM® also offers QSFP+ optical transceiver (FC EB27) to install into the adapter and allowing the customer to use their own optical cabling and QSP28 optical transceiver for the other end.

Cable and Transceiver Matrix

Feature code	Description
EB59	100Gbase-SR4 Optical Transceiver MTP/MPO cable (purchased separately) • FC EB2J - 10 M • FC EB2K - 30 M
EB5J	QSFP28 Passive Copper 100 Gb Ethernet Cable - .5 M
EB5K	QSFP28 Passive Copper 100 Gb Ethernet Cable - 1 M
EB5L	QSFP28 Passive Copper 100 Gb Ethernet Cable - 1.5 M
EB5M	QSFP28 Passive Copper 100 Gb Ethernet Cable - 2 M
EB5R	QSFP28 AOC 100 Gb Ethernet Cable - 3 M
EB5S	QSFP28 AOC 100 Gb Ethernet Cable - 5 M
EB5T	QSFP28 AOC 100 Gb Ethernet Cable - 10 M
EB5U	QSFP28 AOC 100 Gb Ethernet Cable - 15 M
EB5V	QSFP28 AOC 100 Gb Ethernet Cable - 20 M
EB5W	QSFP28 AOC 100 Gb Ethernet Cable - 30 M
EB5X	QSFP28 AOC 100 Gb Ethernet Cable - 50 M
EB5Y	QSFP28 AOC 100 Gb Ethernet Cable - 100 M
EB2B	1 M Passive QSFP+ to QSFP+
EB2H	3 M Passive QSFP+ to QSFP+
ECBN	5 M Passive QSFP+ to QSFP+
EB27	QSFP+ 40G BASE-SR transceiver

Voltage

> 3.3 V

Form factor

> Short, low-profile (FC EC3L)

> Short, with full-height tailstock (FC EC3M)

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

> The adapter is based on the Mellanox ConnectX-4 adapter, which uses the ConnectX-4 EN Network Controller

> Ethernet only supported in Ethernet or RoCE mode

> PCIe3 compliant (1.1 and 2.0 compatible)

> RDMA over Converged Ethernet (RoCE)

> NIC and RoCE are concurrently supported

> RoCE supported on linux and AIX (7.2, and later)

> NIC supported on all OSes

> TCP/UDP/IP stateless offload

> LSO, LRO, and checksum offload

> NIM boot support

> Backward compatible with 40 Gb Ethernet when using compatible cables and transceivers

Improves performance and scalability by offloading the CPU from I/O networking tasks

Minimizes CPU overhead by more efficiently using memory access

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
* AIX:
  – AIX Version 7.2 with the 7200-01 Technology Level, or later (NIC and RoCE)
  – AIX Version 7.1 with the 7100-04 Technology Level and Service Pack 3 and APAR IV88680, or later (NIC only)
  – AIX Version 6.1 with the 6100-09 Technology Level and Service Pack 8 and APAR IV88679, or later (NIC only)
  – AIX Version 7.1 with the 7100-03 Technology Level and Service Pack 8, or later (planned availability January 27, 2017) (NIC only)
  – AIX Version 7.2 with the 7200-00 Technology Level and Service Pack 3, or later (planned availability January 27,2017) (NIC only)
* Linux:
  – Red Hat Enterprise Linux 7.2, little-endian, or later
  – Red Hat Enterprise Linux 7.2, big-endian, or later
  – SUSE Linux Enterprise Server 12 SP2, or later
  – Ubuntu Server 16.04.1, or later

  Important: Mellanox Open Fabric Enterprise Distribution (OFED) driver version 3.4-1.0.0.x, or later is required on all Linux Operating Systems.
* VIOS:
  – VIOS 2.2.5.0, or later

Related information:

⬊ IBM Prerequisite website

⬊ Installing, removing, or replacing PCIe adapters

⬊ PCIe adapter placement

⬊ PCIe adapter information by feature type

PCIe2 LP 3D Graphics Adapter x1 (FC EC41)

Learn about the features, requirements, installation notes, and troubleshooting tips for the PCIe2 LP 3D Graphics Adapter.

Overview

The PCIe2 LP 3D Graphics Adapter is a PCI Express (PCIe) adapter that accelerates and enhances the system unit video. The adapter has no hardware switches to set. Mode selection is made through the software. Figure 58 on page 187 shows the adapter and its connectors.
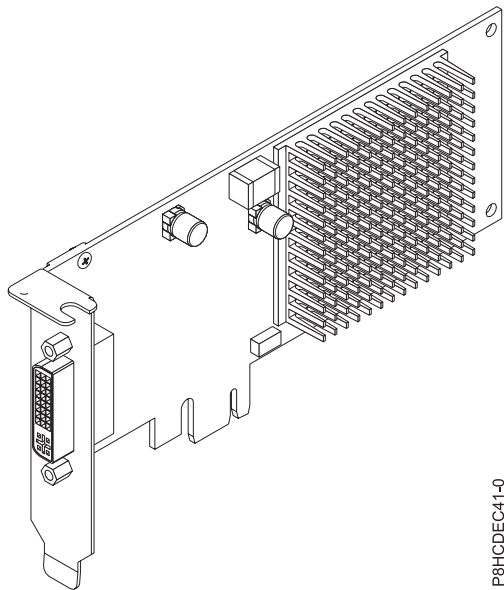
Figure 58. PCIe2 LP 3D Graphics Adapter

The following table shows the feature code, custom card identification number, and field-replaceable unit part number for the adapter.

Table 61. Adapter feature code, CCIN, and FRU part number

Feature code (FC)	Custom card identification number (CCIN)	Field-replaceable unit (FRU) part number
EC41	NA	00E3980* Cable part number: 00E3060
*Designed to comply with RoHS requirement		

This adapter provides the following features:

- Placed in a single PCIe slot.
- The adapter is regular-height and of half-length.
- Supports the single lane (x1) PCIe 2.1 bus interface.
- Provides 512 MB DDR3 graphics memory.
- Supports DVI or VGA outputs.
- Supports two 30 inches (76.2 cm) high-resolution displays.
- Provides a DMS-59 connector that can attach to any DMS-59 breakout cable.
- One analog monitor connected that supports a maximum resolution of up to 1920 x 1200.
- One digital monitor connected that supports a maximum resolution of up to 2560 x 1600.
- Display power management: Video Electronics Standards Association (VESA), Display Power Management Signaling (DPMS)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 12, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
  - M PowerKVM 3.1, or later
- Supported on Firmware level 7.8, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" for instructions. If you are installing only the device driver for this adapter, install the device driver software before you install the adapter.

Gathering tools and documentation

To install the adapter, make sure that you have access to the following items:
- The adapter
- The operating system documentation
- The system service guide for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The media containing the device driver software

Installing the adapter

This section explains how to install the adapter. If you are installing your operating system at this time, install your adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:
1. Determine the PCIe slot in which to place the adapter.

The PCIe2 3D Graphics Adapter has an x1 PCIe connector and can be placed in a PCIe x1, x4, x8, or x16 slot. See PCI adapter placement for information about the PCIe slots on your system unit.

2. Shut down the system unit and install the adapter by using the instructions in the Installing PCI adapters topic for your system.

3. Connect the monitor cable to the adapter.

   If necessary, you can use a DVI-59 dongle for connecting a VGA 15-pin connector on a monitor cable to the DVI connector on the adapter. For example, a DVI-59 dongle is needed to connect to a display (FC 3632), a rack-mounted 7316-TF4 console, or a KVM switch.

4. Start the system unit and the monitor.

5. When prompted, configure the adapter by following the online configuration instructions.

6. When **Select Display** (console) appears, press the number key on your keyboard for the monitor that is to be the default.

Troubleshooting

If you have video problems after the initial installation, follow these procedures to troubleshoot the problem:
- Check the cables.
- Check the device driver software installation.
- Check the adapter installation.

Checking the cables

1. Ensure the monitor cables are connected to the correct adapter.

2. If you have more than one video adapter, be sure that each adapter is connected to a monitor.

3. Verify that the connections are secure.

4. If no log-in prompt appears, restart the system unit.

Checking the device driver software installation

Verify that the device driver for the PCIe2 3D Graphics Adapter is installed.

Checking the adapter installation

Verify that the system unit recognizes the PCIe2 3D Graphics Adapter.

At the Linux command-line enter `lspci -vmm -k -d 1002:68f2`. If the PCIe2 3D Graphics Adapter is correctly installed, the following is an example of the data that appears:

```
Device: 0009:01:00.0
Class: VGA compatible controller
Vendor: Advanced Micro Devices, Inc. [AMD/ATI]
Device: Cedar GL [FirePro 2270]
SVendor: Advanced Micro Devices, Inc. [AMD/ATI]
SDevice: Device 0126
PhySlot: U78CB.001.WZS000T-P1-C2
Driver: radeon
```

If the adapter does not show up, verify your LPAR configuration. If the adapter does show up but you are experiencing issues related to this adapter, such as visual glitches, incorrect colors, no image displayed, slow or incorrect rendering, and other problems with the display, you can run the standalone diagnostics for the adapter available in the IBM Installation Toolkit for PowerLinux.

If the message indicates that the adapter is DEFINED instead of AVAILABLE, shut down the system unit and check the PCIe2 3D Graphics Adapter to ensure that it is installed correctly. If you continue to experience problems after following the steps in this section, contact service and support for assistance.

IBM Installation Toolkit for PowerLinux

To troubleshoot problems for the 3D Graphics adapter, you can use the IBM Installation Toolkit for PowerLinux, a stand-alone diagnostic toolkit for systems that have the 3D Graphics adapter installed.

To diagnose problems with the 3D graphics adapter installed in a system, and work with the IBM Installation Toolkit, complete the following steps:

1. Download the DVD ISO image from IBM Installation Toolkit website (http://www-304.ibm.com/webapp/set2/sas/f/lopdiags/installtools/home.html).
2. Create a DVD for the downloaded ISO image.
3. Insert the DVD in the system DVD drive and boot the system.

   Note: You can also use the NIM to boot the system.
4. Once the DVD has booted, select the 3D graphics diagnostics application.
5. Choose the option 2 - Wizard mode graphical (using X). The Graphical desktop is displayed.
6. Right-click on the desktop area, and click **IBM** > **PCIe2 3D Graphics Adapter**.
7. Follow the on-screen instructions to diagnose the problem with the 3D Graphics adapter and resolve the problem.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 3D Graphics Adapter x1 (FC EC42)
Learn about the features, requirements, installation notes, and troubleshooting tips for the PCIe2 3D Graphics Adapter.

Overview

The PCIe2 3D Graphics Adapter is a PCI Express (PCIe) adapter that accelerates and enhances the system unit video. The adapter has no hardware switches to set. Mode selection is made through the software. Figure 59 on page 191 shows the adapter and its connectors.
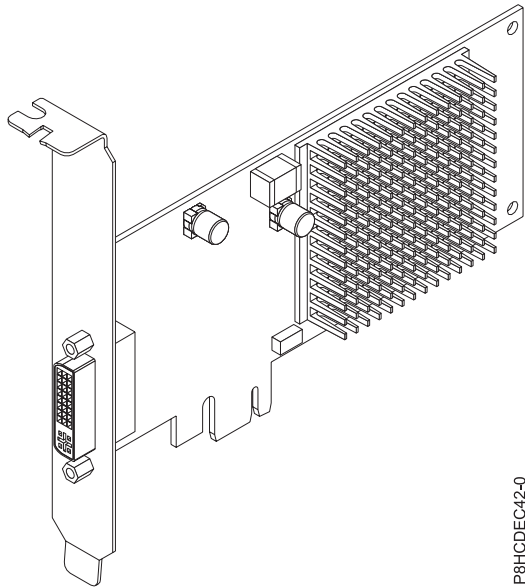
Figure 59. PCIe2 3D Graphics Adapter

The following table shows the feature code, custom card identification number, and field-replaceable unit part number for the adapter.

Table 62. Adapter feature code, CCIN, and FRU part number

Feature code (FC)	Custom card identification number (CCIN)	Field-replaceable unit (FRU) part number
EC42	NA	00E3980* Cable part number: 00E3060
*Designed to comply with RoHS requirement		

This adapter provides the following features:
- Placed in a single PCIe slot.
- The adapter is regular-height and of half-length.
- Supports the single lane (x1) PCIe 2.1 bus interface.
- Provides 512 MB DDR3 graphics memory.
- Supports DVI or VGA outputs.
- Supports two 30 inches (76.2 cm) high-resolution displays.
- Provides a DMS-59 connector that can attach to any DMS-59 breakout cable. With the DMS-59 dongle, one or two DVI cables can be connected to the adapter. Alternatively, the DVI connector can have a DVI to VGA converter connected to it to connect a VGA monitor to the adapter.
- One analog monitor that supports a maximum resolution of up to 1920 x 1200.
- One digital monitor that supports a maximum resolution of up to 2560 x 1600.
- Display power management: Video Electronics Standards Association (VESA), Display Power Management Signaling (DPMS)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 12, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
  - M PowerKVM 3.1, or later
- Supported on Firmware level 7.8, or later

Preparing for installation

If you are installing the operating system at this time, install the adapter before you install the operating system. See "Installing the adapter" for instructions. If you are installing only the device driver for this adapter, install the device driver software before you install the adapter.

Gathering tools and documentation

To install the adapter, make sure that you have access to the following items:
- The adapter
- The operating system documentation
- The system service guide for removing and replacing features
- The PCI adapter placement documentation
- A flat-blade screwdriver
- The media containing the device driver software

Installing the adapter

This section explains how to install the adapter. If you are installing your operating system at this time, install your adapter before you install the operating system. If the operating system is already installed and you need to install the device driver for this adapter, install the device driver software before you install the adapter.

Attention: Before you install an adapter, review the precautions in Handling static sensitive devices. Do not remove the adapter from its anti-static package until you are ready to place it in the system unit.

To install the adapter, follow these steps:
1. Determine the PCIe slot in which to place the adapter.

The PCIe2 3D Graphics Adapter has an x1 PCIe connector and can be placed in a PCIe x1, x4, x8, or x16 slot. See PCI adapter placement for information about the PCIe slots on your system unit.

2. Shut down the system unit and install the adapter by using the instructions in the Installing PCI adapters topic for your system.

3. Connect the monitor cable to the adapter.

   If necessary, you can use a DVI-59 dongle for connecting a VGA 15-pin connector on a monitor cable to the DVI connector on the adapter. For example, a DVI-59 dongle is needed to connect to a display (FC 3632), a rack-mounted 7316-TF4 console, or a KVM switch.

4. Start the system unit and the monitor.

5. When prompted, configure the adapter by following the online configuration instructions.

6. When **Select Display** (console) appears, press the number key on your keyboard for the monitor that is to be the default.

Troubleshooting

If you have video problems after the initial installation, follow these procedures to troubleshoot the problem:
- Check the cables.
- Check the device driver software installation.
- Check the adapter installation.

Checking the cables

1. Ensure the monitor cables are connected to the correct adapter.

2. If you have more than one video adapter, be sure that each adapter is connected to a monitor.

3. Verify that the connections are secure.

4. If no log-in prompt appears, restart the system unit.

Checking the device driver software installation

Verify that the device driver for the PCIe2 3D Graphics Adapter is installed.

Checking the adapter installation

Verify that the system unit recognizes the PCIe2 3D Graphics Adapter.

At the Linux command-line enter `lspci -vmm -k -d 1002:68f2`. If the PCIe2 3D Graphics Adapter is correctly installed, the following is an example of the data that appears:

```
Device: 0009:01:00.0
Class: VGA compatible controller
Vendor: Advanced Micro Devices, Inc. [AMD/ATI]
Device: Cedar GL [FirePro 2270]
SVendor: Advanced Micro Devices, Inc. [AMD/ATI]
SDevice: Device 0126
PhySlot: U78CB.001.WZS000T-P1-C2
Driver: radeon
```

If the adapter does not show up, verify your LPAR configuration. If the adapter does show up but you are experiencing issues related to this adapter, such as visual glitches, incorrect colors, no image displayed, slow or incorrect rendering, and other problems with the display, you can run the standalone diagnostics for the adapter available in the IBM Installation Toolkit for PowerLinux.

If the message indicates that the adapter is DEFINED instead of AVAILABLE, shut down the system unit and check the PCIe2 3D Graphics Adapter to ensure that it is installed correctly. If you continue to experience problems after following the steps in this section, contact service and support for assistance.

IBM Installation Toolkit for PowerLinux

To troubleshoot problems for the 3D Graphics adapter, you can use the IBM Installation Toolkit for PowerLinux, a stand-alone diagnostic toolkit for systems that have the 3D Graphics adapter installed.

To diagnose problems with the 3D graphics adapter installed in a system, and work with the IBM Installation Toolkit, complete the following steps:

1. Download the DVD ISO image from IBM Installation Toolkit website (http://www-304.ibm.com/webapp/set2/sas/f/lopdiags/installtools/home.html).
2. Create a DVD for the downloaded ISO image.
3. Insert the DVD in the system DVD drive and boot the system.

    Note: You can also use the NIM to boot the system.
4. Once the DVD has booted, select the 3D graphics diagnostics application.
5. Choose the option 2 - Wizard mode graphical (using X). The Graphical desktop is displayed.
6. Right-click on the desktop area, and click **IBM** > **PCIe2 3D Graphics Adapter**.
7. Follow the on-screen instructions to diagnose the problem with the 3D Graphics adapter and resolve the problem.

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe2 LP 4-Port USB 3.0 Adapter (FC EC45; CCIN 58F9)

Learn about the specifications for the feature code (FC) EC45 adapter.

The PCIe2 LP 4-Port USB 3.0 Adapter (FC EC45) is a PCI Express (PCIe) generation 2, low-profile, high-performance expansion adapter that provides the following features and support:

- The adapter is compliant with PCIe base specification revision 2.
- The adapter is a single-lane (1x) PCI Express with a throughput of 5 Gbps.
- The adapter is a single-slot, half-length short form factor, PCIe2 card.
- The adapter is FCC Class A compliant.
- The adapter provides four downstream, external, high-speed Universal Serial Bus (USB) 3.0 ports with Type A connectors.
- The USB ports are also compatible with USB specifications, revision 1.1 and 2.0 devices.
- The adapter supports the simultaneous operation of multiple USB 3.0, USB 2.0, and USB 1.1 devices.

    Restriction: When multiple keyboards are attached to the USB ports on the system or on the USB adapter, only one keyboard can be used while the partition is booting-up.
- The adapter provides 2k electrically erasable and programmable read-only memory (EEPROM) at 256 bytes.
- The provides supports integrated dual-speed USB transceivers.

Figure 60 on page 195 shows the adapter.

Figure 60. PCIe2 LP 4-Port USB 3.0 Adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

FRU number

00E2932(Designed to comply with Restriction of Hazardous Substances (RoHS) requirement.)

Low-profile tailstock part number: 00E2934

Bus architecture

PCIe 2.2 compliant

Busmaster

Yes

Card type

Short form factor, half-length

Maximum number and adapter slots

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Connector

Standard USB single pin-type series A receptacle

Wrap plug

None

Cables

Use USB cable (FC 4256) per port

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX

- AIX 7.1, or later
- AIX Version 6.1, or later
- IBM i
  - IBM i Version 7.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- Supported on Firmware level 8.1
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-Port USB 3.0 Adapter (FC EC46; CCIN 58F9)
Learn about the specifications for the feature code (FC) EC46 adapter.

The PCIe2 4-Port USB 3.0 Adapter (FC EC46) is a PCI Express (PCIe) generation 2, regular-height, high-performance expansion adapter that provides the following features and support:
- The adapter is compliant with PCIe base specification revision 2.
- The adapter is a single-lane (1x) PCI Express with a throughput of 5 Gbps.
- The adapter is a single-slot, half-length short form factor, PCIe2 card.
- The adapter is FCC Class A compliant.
- The adapter provides four downstream, external, high-speed Universal Serial Bus (USB) 3.0 ports with Type A connectors.
- The USB ports are also compatible with USB specifications, revision 1.1 and 2.0 devices.
- The adapter supports the simultaneous operation of multiple USB 3.0, USB 2.0, and USB 1.1 devices.

  Restriction: When multiple keyboards are attached to the USB ports on the system or on the USB adapter, only one keyboard can be used while the partition is booting-up.
- The adapter provides 2k electrically erasable and programmable read-only memory (EEPROM) at 256 bytes.
- The provides supports integrated dual-speed USB transceivers.

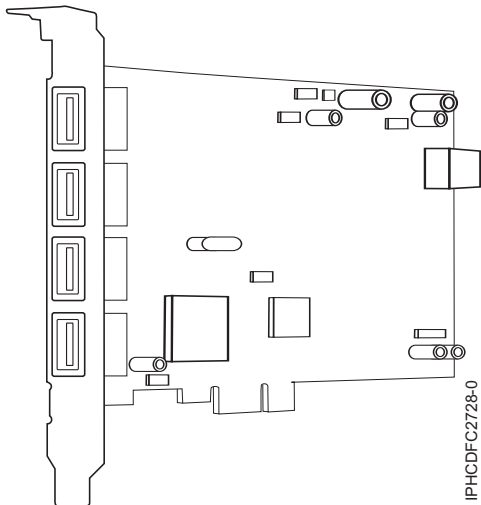Figure 61 on page 197 shows the adapter.

Figure 61. PCIe2 4-Port USB 3.0 Adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
FRU number
    00E2932 (Designed to comply with Restriction of Hazardous Substances (RoHS) requirement.)
Bus architecture
    PCIe 2.2 compliant
Busmaster
    Yes
Card type
    Short form factor, half-length
Maximum number and adapter slots
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Connector
    Standard USB single pin-type series A receptacle
Wrap plug
    None
Cables
    Use USB cable (FC 4256) per port

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later

- – AIX Version 6.1, or later
- IBM i
  - – IBM i Version 7.1, or later
- Linux
  - – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
- Supported on Firmware level 8.1

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

IBM Prerequisite website

Installing, removing, or replacing PCIe adapters

PCIe adapter placement

PCIe adapter information by feature type

PCIe3 x16 GPU Adapter (FC EC47; CCIN 2CE8)

Learn about the specifications and operating system requirements for the feature code (FC) EC47 adapter.

Overview

The PCIe gen3 x16 GPU Adapter is a double-wide, full-height, PCI express (PCIe) generation 3 (Gen3) graphics processing unit, compute intensive accelerator adapter. The adapter offers 12 GB of on-board memory and is optimized for compute-intensive applications. The PCIe gen3 x16 GPU Adapter uses power from the PCIe connector and auxiliary power source from the system it is placed in. For a graphic of the adapter, see Figure 62 on page 199.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.
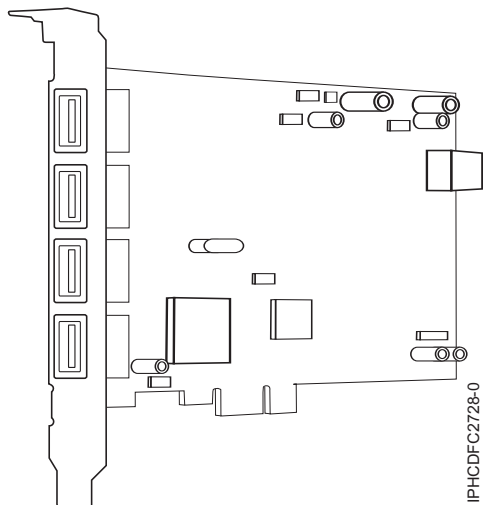
For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
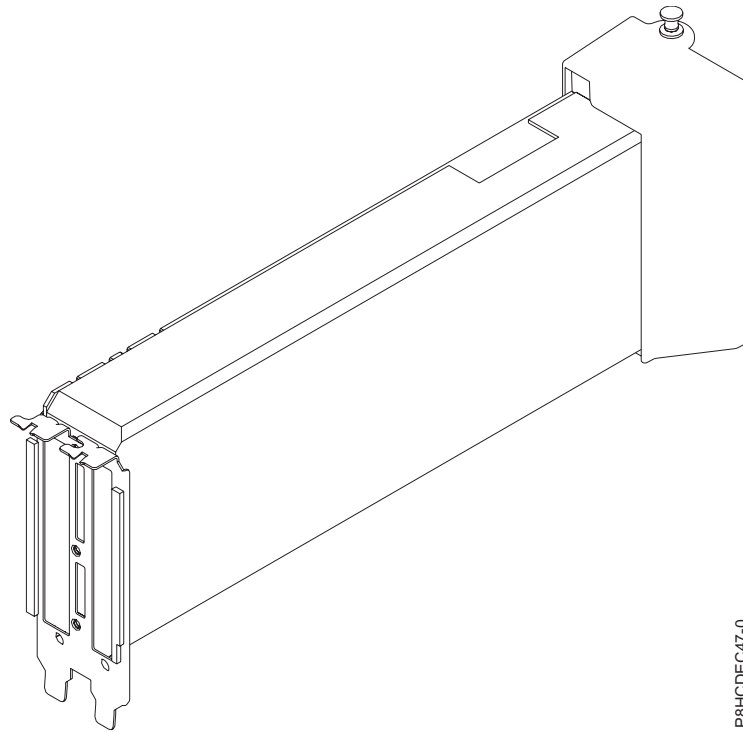
Figure 62. PCIe gen3 x16 GPU Adapter

Specifications

Item   Description

Adapter FRU number

01AF012 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

12 V

Form factor

Regular-height, full-length form factor

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating system, depending on the system you are using:

- Linux

- Red Hat Enterprise Linux 7.2, little endian, or later, with CUDA 7.5, or later
- Linux Ubuntu 14.04.2, or later, with CUDA 7.5, or later
- Nvidia driver support can be downloaded directly from Nvidia Driver Downloads (http://www.nvidia.com/Download/index.aspx?lang=en-us)
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe2 LP 3D Graphics Adapter x16 (FC EC51)

Learn about the specifications and operating system requirements for feature code (FC) EC51.

Overview

The PCIe2 LP 3D Graphics Adapter x16 is a PCI Express (PCIe) generation 2.1 (Gen2.1) x16 adapter. The adapter can only be used in a x16 PCIe (Gen2) slot in the system. The adapter accelerates and enhances the system unit video. It has no hardware switches to set and the mode selection is made through the software.

Important: FC EC51 is explicitly not enabled Petit boot since it is not kexec safe. The adapter will crash the kernel when trying to boot a host OS.
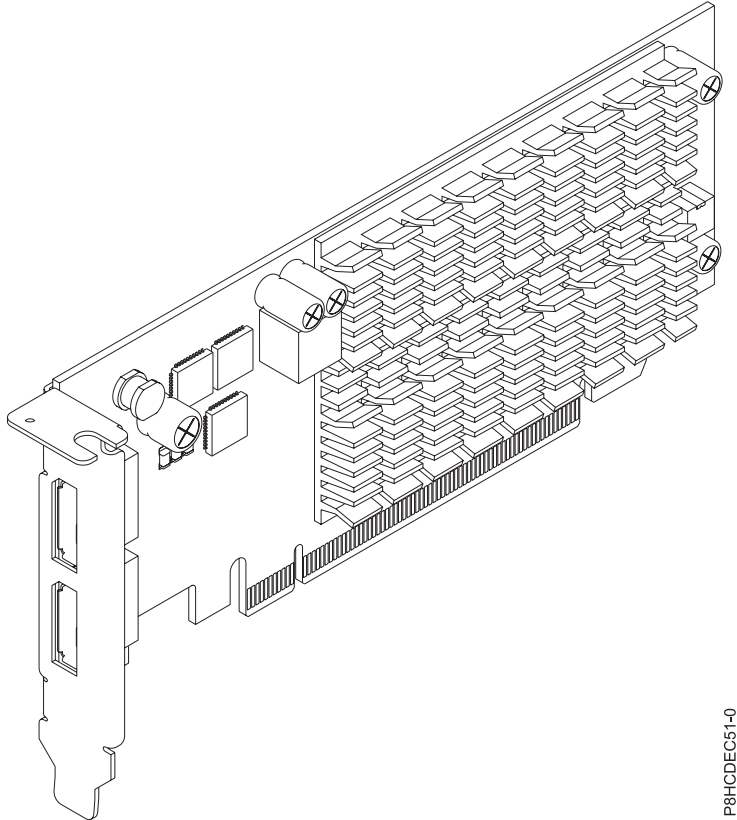
Figure 63. PCIe2 LP 3D Graphics Adapter x16 (FC EC51)

Specifications

Item   Description

Adapter FRU number

00WT180 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe 2.1

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Please note that display port cables are not included with this adapter. For a list of supported cables, see below.

Note: IBM does not support video cable lengths that exceed 3 meters.
- Display port to display port cable
- Display port to VGA cable
- Display port to DVI cable
- Display port to HDMI cable

Supported Systems

POWER8® processor-based system
- 8375-22A, 8284-21A, 8284-22A, 8247-21L, 8247-22L, and 8379-22L

Voltage

3.3 V, 12 V

Form factor

Short, with full-height tailstock

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

Not hot-pluggable

Passive cooling

Provides 512 MB DDR3 graphics memory

Supports display PORT outputs

Supports two 30 inches (76.2 cm) high-resolution displays

Provides two display port connectors that can attach to any display port cable

Video Electronics Standards Association (VESA) and Display Power Management Signaling (DPMS)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux 7.3, big-endian, or later
  - Red Hat Enterprise Linux 7.3, little-endian, or later
  - SUSE Linux Enterprise Server 12, service pack 2, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe3 1.6 TB NVMe Flash Adapter (FC EC54 and EC55; CCIN 58CB)

Learn about the specifications and operating system requirements for feature code (FC) EC54 and EC55 adapters.

Overview

FC EC54 and EC55 are both the same adapter with different feature codes. FC EC54 is a low-profile adapter and FC EC55 is a full-height adapter. See FC EC56 and EC57 for an adapter with more capacity.

The PCIe3 1.6 TB NVMe Flash Adapter is a PCI Express (PCIe) generation 3 (Gen3) x4 adapter. The adapter can be used in either a x8 or x16 PCIe (Gen3) slot in the system and uses Non-Volatile Memory Express (NVMe). NVMe is a high performance software interface that can read/write flash memory. Compared to a SAS or SATA SSD, the NVMe Flash adapter provides more read/write input/output operations per second (IOPS) and larger throughput (GB/sec). The NVMe Flash Adapter is read intensive and is not designed for high write intensive workloads. At about 8,760 to 17,000 TB of writes to the

adapter, it will be at its maximum projected write capability. The nature of the workload has a great impact on the maximum write capacity. If a high percentage of more sequentially oriented writes is used instead of random writes, the maximum write capacity will be closer to the larger value in the range. In the case of a high percentage of random writes, the maximum will be closer to the smaller value in the range. Writes past the adapter's maximum write capacity will continue to work for some period of time, but much more slowly. A Predictive Failure Analysis message will indicate that it is time to replace the adapter if enabled by the system administrator. After the warranty period, if the maximum write capability is achieved, the adapter's replacement is not covered under IBM maintenance. This adapter has protection against single Flash channel failures. To prevent the entire adapter from failing, software RAID should be used. For high value applications where the content in the adapter must be protected, additional NVMe Flash adapters with OS mirroring or software Redundant Array of Independent Disks (RAID) are recommended. This adapter is not supported in the PCIe Gen3 I/O drawer. For a graphic of the full-height adapter, see Figure 64.

Important: Before removing a NVMe Flash adapter, ensure that all data on the adapter or the array that contains the adapter is backed up. Restore the data after the adapter is replaced.

Figure 64. PCIe3 1.6 TB NVMe Flash Adapter (Full-height)

Important: The micro USB connector visible through the adapter tailstock has no function and cannot be used. Do not insert a cable of any kind into this port.

Specifications

Item   Description
Adapter FRU number
        00MH991 (Designed to comply with RoHS requirement)
I/O bus architecture
        PCIe3 x4
Slot requirement
        One PCIe x8 or x16 slot per adapter

Supported Systems

POWER8® processor-based system
- 8246-41A, 8246-42A, 8284-21A, 8284-22A, 8247-42L, 8247-21L, and 8247-22L
- 9119-MHE and 9119-MME
- 8335-GCA

Voltage

12 V

Form factor

Short, low-profile (FC EC54)

Short, with full-height tailstock (FC EC56)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

1.6 TB of low latency flash memory

Non-Volatile Write Buffer

Hot Plug Capable

NVMe Flash adapter maximum write capability

Determine whether the NVMe Flash adapter maximum write capability is depleted by completing the following steps:

1. Type the following command at the Linux command line and press Enter: `nvme smart-log /dev/nvmeX`, where nvmeX is the resource name of the NVMe Flash adapter.
2. If the critical_warning field is 1 (bit 0 is set) and the percentage_used field is 90% or greater, replace the NVMe Flash adapter.

Note: The replacement of depleted NVMe Flash adapters is covered during the system warranty period. After the warranty period has expired, the cost that is incurred for the replacement of depleted NVMe Flash adapters is not covered under maintenance contracts, and is the responsibility of the customer.

Service tools for Linux on Power servers

To obtain the utility to update firmware, format storage, and complete other service tasks, complete the following steps:

1. Go to Service and productivity tools and follow the instructions to download service tools.
2. Install the NVMe management command line interface (CLI).
   - For Red Hat Enterprise Linux (RHEL), type `yum install nvme-cli`.
   - For SUSE Linux Enterprise Server (SLES), type `zypper install nvme-cli`.
3. For more information about using the NVMe CLI, see the README file.

Unsupported Feature: Subsystem-Reset

The PCIe3 3.2 TB NVMe Flash Adapter does not support the **Subsystem-Reset** feature even though it appears as an available capability. This error is due to a card firmware limitation. Selecting the **Subsystem-Reset** can lead to command timeouts and must be avoided.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux 7.2, big-endian (Power VM), or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 2, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 1.6 TB NVMe Flash Adapter (FC EC54 and EC55; CCIN 58CB)
Learn about the specifications and operating system requirements for feature code (FC) EC54 and EC55 adapters.

Overview

FC EC54 and EC55 are both the same adapter with different feature codes. FC EC54 is a low-profile adapter and FC EC55 is a full-height adapter. See FC EC56 and EC57 for an adapter with more capacity.

The PCIe3 1.6 TB NVMe Flash Adapter is a PCI Express (PCIe) generation 3 (Gen3) x4 adapter. The adapter can be used in either a x8 or x16 PCIe (Gen3) slot in the system and uses Non-Volatile Memory Express (NVMe). NVMe is a high performance software interface that can read/write flash memory. Compared to a SAS or SATA SSD, the NVMe Flash adapter provides more read/write input/output operations per second (IOPS) and larger throughput (GB/sec). The NVMe Flash Adapter is read intensive and is not designed for high write intensive workloads. At about 8,760 to 17,000 TB of writes to the adapter, it will be at its maximum projected write capability. The nature of the workload has a great impact on the maximum write capacity. If a high percentage of more sequentially oriented writes is used instead of random writes, the maximum write capacity will be closer to the larger value in the range. In the case of a high percentage of random writes, the maximum will be closer to the smaller value in the range. Writes past the adapter's maximum write capacity will continue to work for some period of time, but much more slowly. A Predictive Failure Analysis message will indicate that it is time to replace the adapter if enabled by the system administrator. After the warranty period, if the maximum write capability is achieved, the adapter's replacement is not covered under IBM maintenance. This adapter has protection against single Flash channel failures. To prevent the entire adapter from failing, software RAID should be used. For high value applications where the content in the adapter must be protected,

additional NVMe Flash adapters with OS mirroring or software Redundant Array of Independent Disks (RAID) are recommended. This adapter is not supported in the PCIe Gen3 I/O drawer. For a graphic of the full-height adapter, see Figure 64 on page 203.

Important: Before removing a NVMe Flash adapter, ensure that all data on the adapter or the array that contains the adapter is backed up. Restore the data after the adapter is replaced.
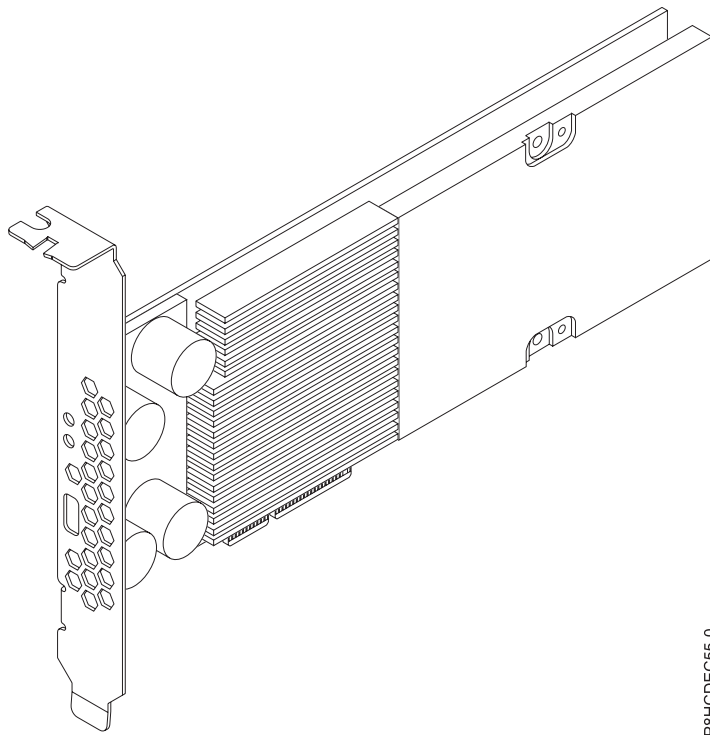

Figure 65. PCIe3 1.6 TB NVMe Flash Adapter (Full-height)

Important: The micro USB connector visible through the adapter tailstock has no function and cannot be used. Do not insert a cable of any kind into this port.

Specifications

Item   Description
Adapter FRU number
    00MH991 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe3 x4
Slot requirement
    One PCIe x8 or x16 slot per adapter
Supported Systems
    POWER8® processor-based system
    - 8246-41A, 8246-42A, 8284-21A, 8284-22A, 8247-42L, 8247-21L, and 8247-22L
    - 9119-MHE and 9119-MME
    - 8335-GCA
Voltage
    12 V
Form factor
    Short, low-profile (FC EC54)

    Short, with full-height tailstock (FC EC56)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

1.6 TB of low latency flash memory

Non-Volatile Write Buffer

Hot Plug Capable

NVMe Flash adapter maximum write capability

Determine whether the NVMe Flash adapter maximum write capability is depleted by completing the following steps:

1. Type the following command at the Linux command line and press Enter: `nvme smart-log /dev/nvmeX`, where nvmeX is the resource name of the NVMe Flash adapter.
2. If the critical_warning field is 1 (bit 0 is set) and the percentage_used field is 90% or greater, replace the NVMe Flash adapter.

Note: The replacement of depleted NVMe Flash adapters is covered during the system warranty period. After the warranty period has expired, the cost that is incurred for the replacement of depleted NVMe Flash adapters is not covered under maintenance contracts, and is the responsibility of the customer.

Service tools for Linux on Power servers

To obtain the utility to update firmware, format storage, and complete other service tasks, complete the following steps:

1. Go to Service and productivity tools and follow the instructions to download service tools.
2. Install the NVMe management command line interface (CLI).
   - For Red Hat Enterprise Linux (RHEL), type **`yum install nvme-cli`**.
   - For SUSE Linux Enterprise Server (SLES), type **`zypper install nvme-cli`**.
3. For more information about using the NVMe CLI, see the README file.

Unsupported Feature: Subsystem-Reset

The PCIe3 3.2 TB NVMe Flash Adapter does not support the **Subsystem-Reset** feature even though it appears as an available capability. This error is due to a card firmware limitation. Selecting the **Subsystem-Reset** can lead to command timeouts and must be avoided.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux 7.2, big-endian (Power VM), or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 2, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later

- – Ubuntu Server 16.04, or later
- – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- – The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

▶ IBM Prerequisite website

▶ Installing, removing, or replacing PCIe adapters

▶ PCIe adapter placement

▶ PCIe adapter information by feature type

PCIe3 3.2 TB NVMe Flash Adapter (FC EC56 and EC57; CCIN 58CC)

Learn about the specifications and operating system requirements for feature code (FC) EC56 and EC57 adapters.

Overview

FC EC56 and EC57 are both the same adapter with different feature codes. FC EC56 is a low-profile adapter and FC EC57 is a full-height adapter. See FC EC54 and EC55 for an adapter with less capacity.

The PCIe3 3.2 TB NVMe Flash Adapter is a PCI Express (PCIe) generation 3 (Gen3) x4 adapter. The adapter can be used in either a x8 or x16 PCIe Gen3 slot in the system and uses Non-Volatile Memory Express (NVMe). NVMe is a high performance software interface that can read/write flash memory. Compared to a SAS or SATA SSD, the NVMe Flash adapter provides more read/write input/output operations per second (IOPS) and larger throughput (GB/sec). The NVMe Flash Adapter is read intensive and is not designed for high write intensive workloads. At about 17,000 to 35,000 TB of writes to the adapter, it will be at its maximum projected write capability. The nature of the workload has a great impact on the maximum write capacity. If a high percentage of more sequentially oriented writes is used instead of random writes, the maximum write capacity will be closer to the larger value in the range. In the case of a high percentage of random writes, the maximum will be closer to the smaller value in the range. Writes past the adapter's maximum write capacity will continue to work for some period of time, but much more slowly. A Predictive Failure Analysis message will indicate that it is time to replace the adapter if enabled by the system administrator. After the warranty period, if the maximum write capability is achieved, the adapter's replacement is not covered under IBM maintenance. This adapter has protection against single Flash channel failures. To prevent the entire adapter from failing, software RAID should be used. For high value applications where the content in the adapter must be protected, additional NVMe Flash adapters with OS mirroring or software Redundant Array of Independent Disks (RAID) are recommended. This adapter is not supported in the PCIe Gen3 I/O drawer. For a graphic of the full-height adapter, see Figure 66 on page 209.

Important: Before removing a NVMe Flash adapter, ensure that all data on the adapter or on the array that contains the adapter is backed up. Restore the data after the adapter is replaced.
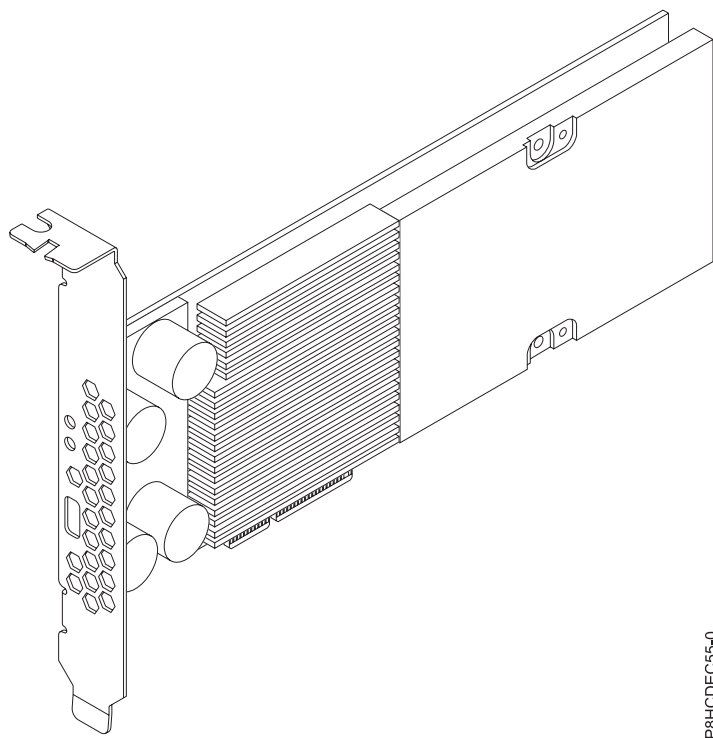
Figure 66. PCIe3 3.2 TB Full-height NVMe Flash Adapter (Full-height)

Important: The micro USB connector visible through the adapter tailstock has no function and cannot be used. Do not insert a cable of any kind into this port.

Specifications

Item   Description
Adapter FRU number
     00MH993 (Designed to comply with RoHS requirement)
I/O bus architecture
     PCIe3 x4
Slot requirement
     One PCIe x8 or x16 slot per adapter
Supported Systems
     POWER8® processor-based system
- 8246-41A, 8246-42A, 8284-21A, 8284-22A, 8247-42L, 8247-21L, and 8247-22L
- 9119-MHE and 9119-MME
- 8335-GCA

Voltage
     12 V
Form factor
     Short, low-profile (FC EC56)

     Short, with full-height tailstock (FC EC57)
Maximum number
     For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Attributes provided
     3.2 TB of low latency flash memory

     Non-Volatile Write Buffer

Hot Plug Capable

NVMe Flash adapter maximum write capability

Determine whether the NVMe Flash adapter maximum write capability is depleted by completing the following steps:
1. Type the following command at the Linux command line and press Enter: `nvme smart-log /dev/nvmeX`, where nvmeX is the resource name of the NVMe Flash adapter
2. If the critical_warning field is 1 (bit 0 is set) and the percentage_used field is 90% or greater, replace the NVMe Flash adapter.

Note: The replacement of depleted NVMe Flash adapters is covered during the system warranty period. After the warranty period has expired, the cost that is incurred for the replacement of depleted NVMe Flash adapters is not covered under maintenance contracts, and is the responsibility of the customer.

Service tools for Linux on Power servers

To obtain the utility to update firmware, format storage, and complete other service tasks, complete the following steps:
1. Go to Service and productivity tools and follow the instructions to download service tools.
2. Install the NVMe management command line interface (CLI).
   - For Red Hat Enterprise Linux (RHEL), type `yum install nvme-cli`.
   - For SUSE Linux Enterprise Server (SLES), type `zypper install nvme-cli`.
3. For more information about using the NVMe CLI, see the README file.

Unsupported Feature: Subsystem-Reset

The PCIe3 3.2 TB NVMe Flash Adapter does not support the **Subsystem-Reset** feature even though it appears as an available capability. This error is due to a card firmware limitation. Selecting the **Subsystem-Reset** can lead to command timeouts and must be avoided.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux 7.2, big-endian (PowerVM), or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 2, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

- IBM Prerequisite website

- Installing, removing, or replacing PCIe adapters

- PCIe adapter placement

- PCIe adapter information by feature type

PCIe3 3.2 TB NVMe Flash Adapter (FC EC56 and EC57; CCIN 58CC)

Learn about the specifications and operating system requirements for feature code (FC) EC56 and EC57 adapters.

Overview

FC EC56 and EC57 are both the same adapter with different feature codes. FC EC56 is a low-profile adapter and FC EC57 is a full-height adapter. See FC EC54 and EC55 for an adapter with less capacity.

The PCIe3 3.2 TB NVMe Flash Adapter is a PCI Express (PCIe) generation 3 (Gen3) x4 adapter. The adapter can be used in either a x8 or x16 PCIe Gen3 slot in the system and uses Non-Volatile Memory Express (NVMe). NVMe is a high performance software interface that can read/write flash memory. Compared to a SAS or SATA SSD, the NVMe Flash adapter provides more read/write input/output operations per second (IOPS) and larger throughput (GB/sec). The NVMe Flash Adapter is read intensive and is not designed for high write intensive workloads. At about 17,000 to 35,000 TB of writes to the adapter, it will be at its maximum projected write capability. The nature of the workload has a great impact on the maximum write capacity. If a high percentage of more sequentially oriented writes is used instead of random writes, the maximum write capacity will be closer to the larger value in the range. In the case of a high percentage of random writes, the maximum will be closer to the smaller value in the range. Writes past the adapter's maximum write capacity will continue to work for some period of time, but much more slowly. A Predictive Failure Analysis message will indicate that it is time to replace the adapter if enabled by the system administrator. After the warranty period, if the maximum write capability is achieved, the adapter's replacement is not covered under IBM maintenance. This adapter has protection against single Flash channel failures. To prevent the entire adapter from failing, software RAID should be used. For high value applications where the content in the adapter must be protected, additional NVMe Flash adapters with OS mirroring or software Redundant Array of Independent Disks (RAID) are recommended. This adapter is not supported in the PCIe Gen3 I/O drawer. For a graphic of the full-height adapter, see Figure 66 on page 209.

Important: Before removing a NVMe Flash adapter, ensure that all data on the adapter or on the array that contains the adapter is backed up. Restore the data after the adapter is replaced.
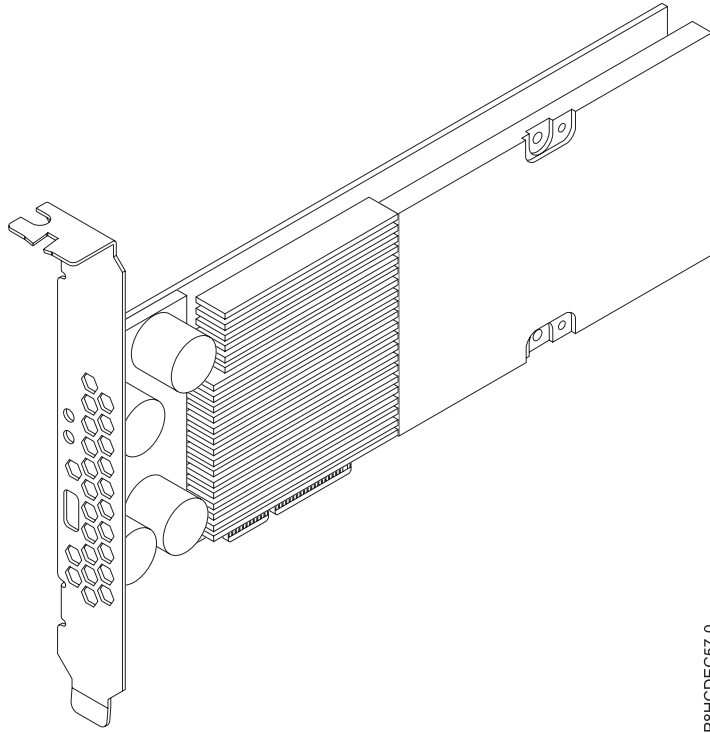
Figure 67. PCIe3 3.2 TB Full-height NVMe Flash Adapter (Full-height)

Important: The micro USB connector visible through the adapter tailstock has no function and cannot be used. Do not insert a cable of any kind into this port.

Specifications

Item   Description

Adapter FRU number

> 00MH993 (Designed to comply with RoHS requirement)

I/O bus architecture

> PCIe3 x4

Slot requirement

> One PCIe x8 or x16 slot per adapter

Supported Systems

> POWER8® processor-based system
> * 8246-41A, 8246-42A, 8284-21A, 8284-22A, 8247-42L, 8247-21L, and 8247-22L
> * 9119-MHE and 9119-MME
> * 8335-GCA

Voltage

> 12 V

Form factor

> Short, low-profile (FC EC56)
>
> Short, with full-height tailstock (FC EC57)

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

> 3.2 TB of low latency flash memory
>
> Non-Volatile Write Buffer

Hot Plug Capable

NVMe Flash adapter maximum write capability

Determine whether the NVMe Flash adapter maximum write capability is depleted by completing the following steps:

1. Type the following command at the Linux command line and press Enter: `nvme smart-log /dev/nvmeX`, where nvmeX is the resource name of the NVMe Flash adapter

2. If the critical_warning field is 1 (bit 0 is set) and the percentage_used field is 90% or greater, replace the NVMe Flash adapter.

Note: The replacement of depleted NVMe Flash adapters is covered during the system warranty period. After the warranty period has expired, the cost that is incurred for the replacement of depleted NVMe Flash adapters is not covered under maintenance contracts, and is the responsibility of the customer.

Service tools for Linux on Power servers

To obtain the utility to update firmware, format storage, and complete other service tasks, complete the following steps:

1. Go to Service and productivity tools and follow the instructions to download service tools.

2. Install the NVMe management command line interface (CLI).
   - For Red Hat Enterprise Linux (RHEL), type **`yum install nvme-cli`**.
   - For SUSE Linux Enterprise Server (SLES), type **`zypper install nvme-cli`**.

3. For more information about using the NVMe CLI, see the README file.

Unsupported Feature: Subsystem-Reset

The PCIe3 3.2 TB NVMe Flash Adapter does not support the **Subsystem-Reset** feature even though it appears as an available capability. This error is due to a card firmware limitation. Selecting the **Subsystem-Reset** can lead to command timeouts and must be avoided.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- Linux
  - Red Hat Enterprise Linux 7.2, big-endian (PowerVM), or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 2, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➜ IBM Prerequisite website

➜ Installing, removing, or replacing PCIe adapters

➜ PCIe adapter placement

➜ PCIe adapter information by feature type

PCIe3 x16 GPU Adapter (FC EC4B; CCIN 2CE9)

Learn about the specifications and operating system requirements for the feature code (FC) EC4B adapter.

Overview

The PCIe gen3 x16 GPU Adapter is a double-wide, full-height, PCI express (PCIe) generation 3 (Gen3) graphics processing unit, compute intensive accelerator adapter. The adapter offers 12 GB of on-board memory and is optimized for compute-intensive applications. I uses power from the PCIe connector and auxiliary power source from the system it is placed in. For the graphic of the adapter, see Figure 68.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
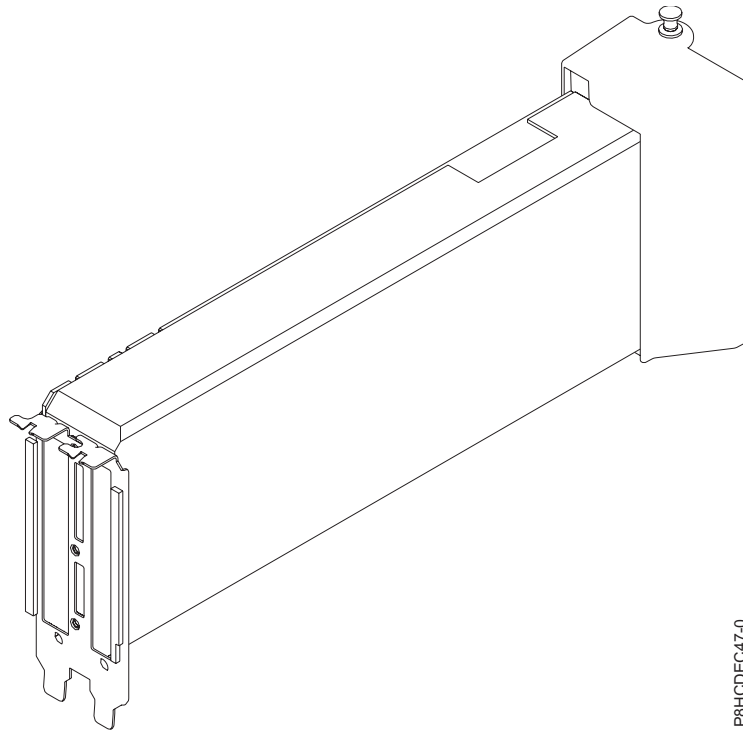
Figure 68. PCIe gen3 x16 GPU Adapter

Specifications

Item   Description
Adapter FRU number
      00RR999 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe3 x16

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Auxiliary power cable part number 00RR588 connects from the 8-pin cable connector on the PCIe gen3 x16 GPU Adapter to the power distribution board connector on the system backplane.

Voltage

12 V

Form factor

Regular-height, full-length form factor

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating system, depending on the system you are using:

- Linux
  - Linux Ubuntu 14.04.2, or later, with CUDA 7.5, or later
  - Red Hat Enterprise Linux 7.2, little endian, or later, with CUDA 7.5, or later
  - Nvidia driver support can be downloaded directly from Nvidia Driver Downloads (http://www.nvidia.com/Download/index.aspx?lang=en-us)
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).

Related information:

⤷ IBM Prerequisite website

⤷ Installing, removing, or replacing PCIe adapters

⤷ PCIe adapter placement

⤷ PCIe adapter information by feature type

PCIe3 cable adapter (FC EJ05; CCIN 2B1C)

Learn about the specifications and operating system requirements for the feature code (FC) EJ05 adapter.

Overview

FC EJ05 is a double-wide, low-profile PCIe3 cable adapter. The adapter provides two optical ports for the attachment of two active optical cables (AOC). One adapter supports the attachment of one PCIe3 6-slot fanout module in a EMX0 PCIe Gen3 I/O expansion drawer.

Figure 69 on page 216 shows the adapter.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Figure 69. PCIe3 cable adapter FC EJ05

Note: The LEDs that are shown in Figure 69 indicate the following states:

- The green LED indicates link status. If the green LED is on, at least one PCIe link is in the trained state.
- The amber LED indicates FRU identify. If the amber LED is on, it will blink at 2 Hz, and indicates that the adapter is in the identify function state.

Specifications

Item   Description

Adapter FRU number

000RR809 (Designed to comply with RoHS requirement).

I/O bus architecture

PCIe3 x16.

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

12 V.

Form factor

Low profile, double-wide adapter.

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Related information:

➥ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

## PCIe3 Optical Cable Adapter (FC EJ07; CCIN 6B52)

Learn about the specifications and operating system requirements for the feature code (FC) EJ07 adapter.

Overview

The PCIe3 Optical Cable Adapter is a double-wide, low-profile, PCIe generation-3 (PCIe3) adapter. The adapter provides two optical ports for the attachment of two active optical cables (AOC). One adapter supports the attachment of one PCIe3 6-slot fanout module in a EMX0 PCIe Gen3 I/O expansion drawer.

Figure 70 shows the adapter.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
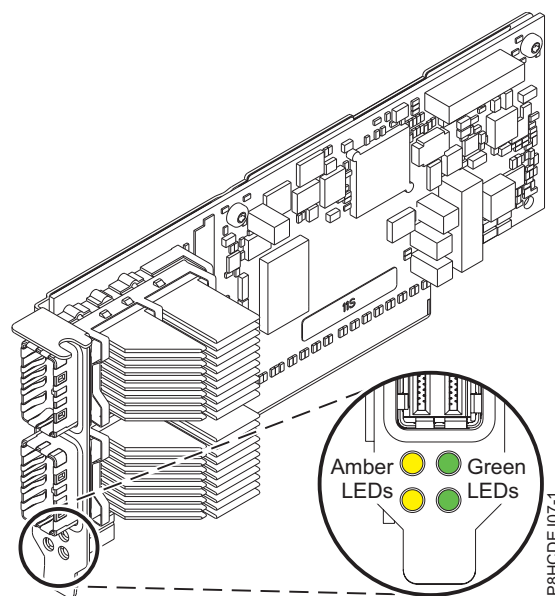
Figure 70. PCIe gen3 x16 GPU adapter

Note: The LEDs that are shown in Figure 70 indicate the following states:
- The green LED indicates link status. If the green LED is on, at least one PCIe link is in the trained state.
- The amber LED indicates FRU identify. If the amber LED is on, it will blink at 2 Hz, and indicates that the adapter is in the identify function state.

Specifications

Item   Description
Adapter FRU number
    000TK704 (Designed to comply with RoHS requirement).
I/O bus architecture
    PCIe3 x16.

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

12 V.

Form factor

Regular-height, full-length form factor.

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 cable adapter (FC EJ08; CCIN 2CE2)

Learn about the specifications and operating system requirements for the feature code (FC) EJ08 adapter.

Overview

FC EJ08 is a full-height, half-length PCIe3 cable adapter. The adapter provides two optical ports for the attachment of two active optical cables (AOC). One adapter supports the attachment of one PCIe3 6-slot fanout module in a EMX0 PCIe Gen3 I/O expansion drawer.

Figure 71 on page 219 shows the adapter.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
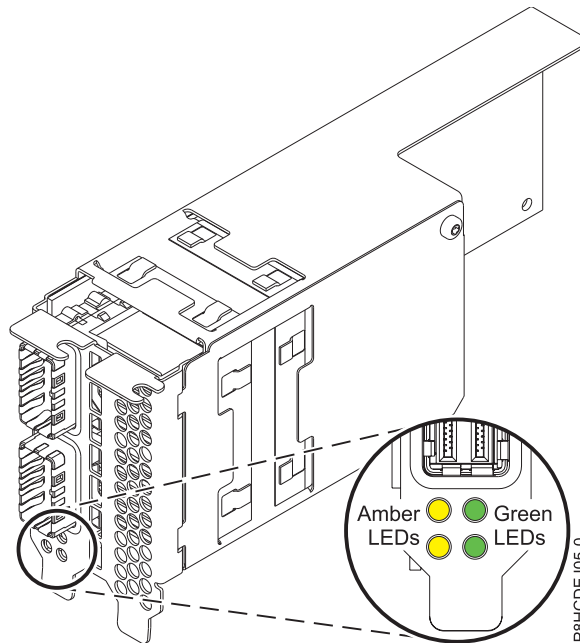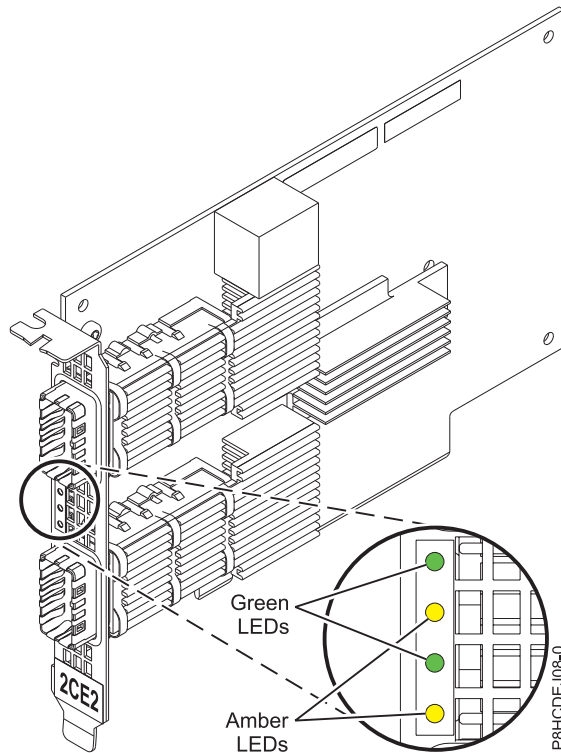
Figure 71. PCIe3 cable adapter FC EJ08

Note: The LEDs that are shown in Figure 71 indicate the following states:

- The green LED indicates link status. If the green LED is on, at least one PCIe link is in the trained state.
- The amber LED indicates FRU identify. If the amber LED is on, it will blink at 2 Hz, and indicates that the adapter is in the identify function state.

Specifications

Item   Description

Adapter FRU number

041T9901 (Designed to comply with RoHS requirement).

I/O bus architecture

PCIe3 x16.

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

12 V.

Form factor

Full-height, half-length.

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Related information:

⯈ IBM Prerequisite website

⯈ Installing, removing, or replacing PCIe adapters

PCIe3 RAID SAS quad-port 6 Gb Adapter (FC EJ0J; CCIN 57B4)

Learn about the specifications and operating system requirements for the feature code (FC) EJ0J adapter.

Overview

The PCIe3 RAID SAS quad-port 6 Gb Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter that has a low-profile, short-form factor, but packaged for full height installation. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk and SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 72 on page 221 shows the PCIe3 RAID SAS quad-port 6 Gb Adapter.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2 capability, and system level mirroring via the operating system. The adapter provides both single and dual RAID controller configurations. Dual controller configurations (dual storage IOA) must run RAID. JBOD (512 byte) functionality is supported only in a single controller configuration based on the operating system. Best performance is achieved when multiple RAID sets are configured and optimized under a pair of adapters in a high availability, multi-initiator RAID configuration (dual storage IOA) which allows for an Active-Active mode of operation.

The adapter support a maximum of 98 attached disk devices that depends on the drive enclosure attached. A maximum of 48 devices can be solid-state devices (SSDs). Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS disk devices and 3 Gbps for SAS tape devices. This adapter supports RAID and non-RAID DASD, and SAS tape devices. Specific device attachment support rules apply. This adapter supports the multi-initiator and high availability (dual storage IOA) configurations in AIX, IBM i, and Linux partitions.. This adapter enables configuring the SAS drives as dedicated hot-spares with equal or higher capacity.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 72 on page 221 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
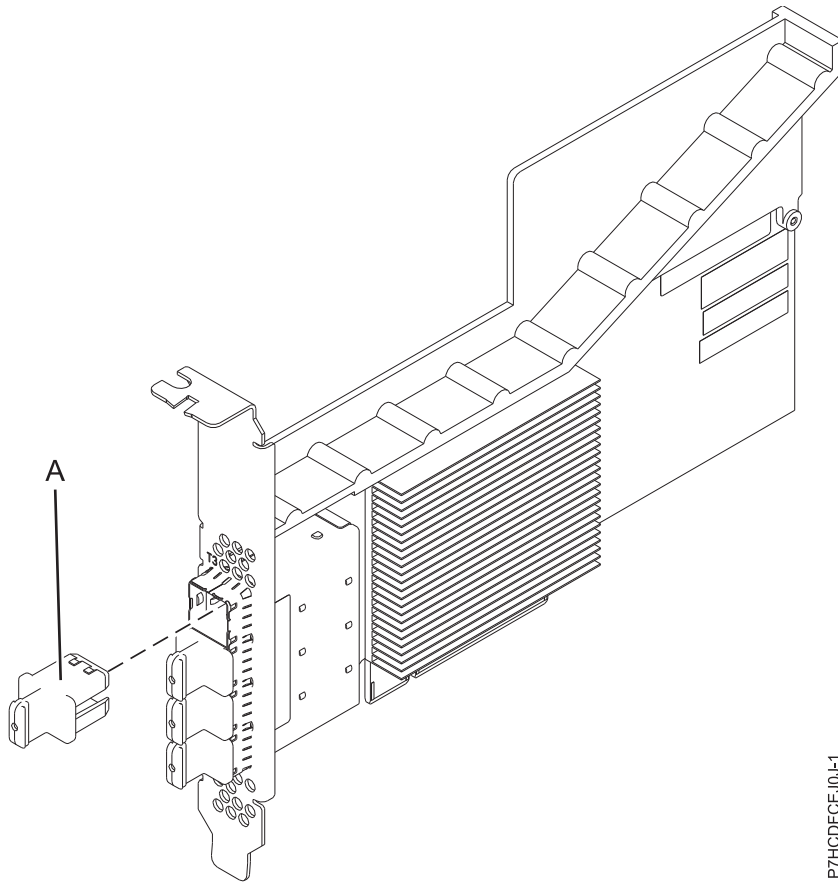
Figure 72. PCIe3 RAID SAS adapter

Specifications

Item   Description

Adapter FRU number

000FX846 (Designed to comply with RoHS requirement)

Connector plug part number

00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture

PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement

One available PCIe x8 slot per adapter.

Cables

Specific X, YO, AA, or AT SAS cable features with new narrow HD connectors are used to attach to the other adapter or disk expansion drawers.

SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. Specific AE1 or YE1 SAS cable features are required for SAS Tape attachment. See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile but packaged for full-height installations.

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS device enclosures
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)
- RAID 0, 5, 6, or 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is supported in a single controller configuration only.
- Concurrent firmware update
- Removable media device (SAS Tape) are supported in a single controller configuration only and cannot be combined with disk devices attached to the same adapter. Removable media is not supported in multi-initiator and high availability (dual storage IOA) configurations
- Support for multi-initiator and high availability or single controller configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- Supported on Firmware level 7.8, or later.

This adapter requires the following drivers:

- AIX: devices.pciex.14104a03.device driver package

Other important requirements for adapter installation

- If you are attaching a new or existing FC 5887 to an FC EJ0J adapter, verify that the latest System Enclosure Services (SES) code is applied to the FC 5887 before attaching to the FC EJ0J adapter, see the IBM Prerequisites website.
- If you are migrating existing SAS disk enclosures and devices from existing previous PCIe SAS adapters to PCIe2 or PCIe3 SAS adapters, an automatic sector conversion takes place for use with the new adapters. For information about the migrating procedures, see Upgrading the adapter in the POWER7 IBM Knowledge Center.

Related information:

IBM Prerequisite website

→ Installing, removing, or replacing PCIe adapters

→ PCIe adapter placement

→ PCIe adapter information by feature type

PCIe3 12 GB Cache RAID SAS quad-port 6 Gb Adapter (FC EJ0L; CCIN 57CE)

Learn about the specifications and operating system requirements for the feature code (FC) EJ0L adapters.

Overview

The PCI Express (PCIe) generation 3, 12 GB Cache RAID SAS quad-port 6 Gb Adapter is a large cache PCIe3 SAS adapter that provides high-performance capabilities and supports the attachment of serial-attached SCSI (SAS) disks and SAS solid-state drives (SSDs) through four mini SAS high-density (HD) connectors. The feature code (FC) EJ0L has up to a 12 GB write-cache via compression. The adapter is a 64 bit, 3.3 V, bootable SAS adapter that supports RAID levels 0, 5, 6, 10, 5T2, 6T2, and 10T2 as well as system level mirroring via the operating system. The adapter must be installed in pairs and must be used in a high availability, multi-initiator RAID configuration with two adapters in dual-controller mode (dual storage IOA configuration). Two FC EJ0L adapters provide additional performance and adapter redundancy with mirrored write-cache data and mirrored RAID parity footprints between the adapters. If the FC EJ0L pairing is broken, then the write cache is disabled. Integrated flash memory with capacitors provides protection of the write cache in case of power failure, without the need for batteries as were used with some previous large cache adapters.

Figure 73 on page 224 shows the PCIe3 12 GB Cache RAID SAS quad-port 6 Gb adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
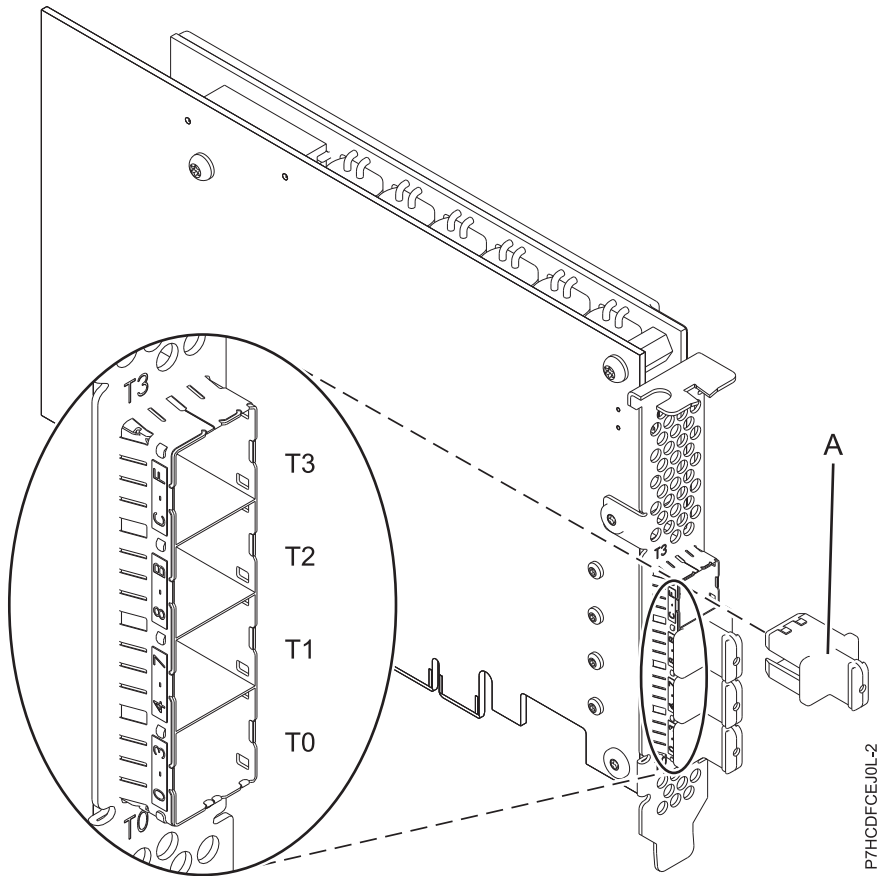
Figure 73. PCIe3 12 GB Cache RAID SAS 6 Gb Adapter

To provide the highest bandwidth between two paired feature EJ0L adapters for the mirroring of cache data and parity update footprints, two SAS Adapter-to-Adapter (AA) cables are required by default on the third and fourth adapter ports (T2, T3) until maximum device quantity attachment is required. When all connectors are attaching SAS drives, the communication between the adapter pair is performed through the SAS fabric via the I/O drawers and cabling.

The FC EJ0L is a single wide, full-height, short adapter. Figure 73 shows the FC EJ0L adapter. Every FC EJ0L requires another FC EJ0L on this server, or on another server, which pairs with the SAS RAID adapter and enables cache functionality and the other multi-initiator high availability (dual storage IOA) functions. Best performance is achieved when multiple RAID sets are configured and optimized under a pair of adapters in a high availability, multi-initiator RAID configuration (dual storage IOA) which allows for an Active-Active mode of operation.

Systems running the AIX or Linux operating systems support either having both EJ0L features in the same system or partition, or in two separate systems or partitions. Systems running the IBM i operating system do not support the pairing of adapters on different servers or different partitions, so both the EJ0L features must be installed on the same system and partition. The dual controllers support the Easy Tier® function that enables the controllers to automatically move hot data to attached SSDs and cold data to attached HDDs in the AIX or Linux systems.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
> 00FX840 (Designed to comply with RoHS requirement)

Connector plug part number
> 00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

**I/O bus architecture**
> PCIe 3.0 but downward compatible to 2.0 and 1.0

Slot requirement
> One PCIe x8 slot per adapter.
>
> Adapters are installed in pairs.
>
> For higher availability, place adapters in separate enclosures where supported.

Cables
> Specific X , YO, AA, or AT SAS cable features with new narrow HD connectors are used to attach to the other adapter or expansion drawers.
>
> SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage
> 3.3 V

Form factor
> Short, full-height

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Attributes provided
> - Support of the SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP).
> - Provides RAID 0, RAID 5, RAID 6, and RAID 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is not supported except for the initial formatting to 528 bytes of new devices, as required.
> - Double looping of the I/O enclosure system connection is suggested to enhance performance when more than four adapters are installed in either FC 5803 or FC 5873.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
- SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.1, or later
  - IBM i Version 6.1, or later
- Supported on Firmware level 7.8, or later.

This adapter requires the following drivers:
- AIX: devices.pci.14104A0 device driver package

Other important requirements for adapter installation

- If you are attaching a new or existing FC 5887 to an FC EJ0L adapter, verify that the latest System Enclosure Services (SES) code is applied to the FC 5887 before attaching to the FC EJ0L adapter, see the IBM Prerequisites website.
- If you are migrating existing SAS disk enclosures and devices from existing previous PCIe SAS adapters to PCIe2 or PCIe3 SAS adapters, an automatic sector conversion takes place for use with the new adapters. For information about the migrating procedures, see Upgrading the adapter in the POWER7 IBM Knowledge Center.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 RAID SAS quad-port 6 Gb LP Adapter (FC EJ0M; CCIN 57B4)

Learn about the specifications and operating system requirements for the feature code (FC) EJ0M adapter.

Overview

The PCIe3 RAID SAS quad-port 6 Gb LP Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter that has a low-profile and short-form factor. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS hard disk drives (HDDs) and solid-state devices (SSDs) by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. The adapter does not have write cache. Figure 74 on page 227 shows the PCIe3 RAID SAS quad-port 6 Gb LP Adapter.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability, and system level mirroring via the operating system. The adapter provides both single and dual RAID controller configurations. Dual controller configurations (dual storage IOA) must run RAID. JBOD (512 byte) functionality is supported only in a single controller configuration based on the operating system. Best performance is achieved when multiple RAID sets are configured and optimized under a pair of adapters in a high availability, multi-initiator RAID configuration (dual storage IOA) which allows for an Active-Active mode of operation.

The adapter supports a maximum of 96 attached disk devices that depends on the drive enclosure attached. A maximum of 48 devices can be solid-state devices (SSDs). Externally attached devices are

designed to run at a maximum data rate of 6 Gbps for SAS disk devices. This adapter supports RAID and non-RAID DASD. Specific device attachment support rules apply. This adapter supports the multi-initiator and high availability (dual storage IOA) configurations in AIX, IBM i, and Linux partitions. This adapter enables configuring the SAS drives as dedicated hot-spares with equal or higher capacity.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 74 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
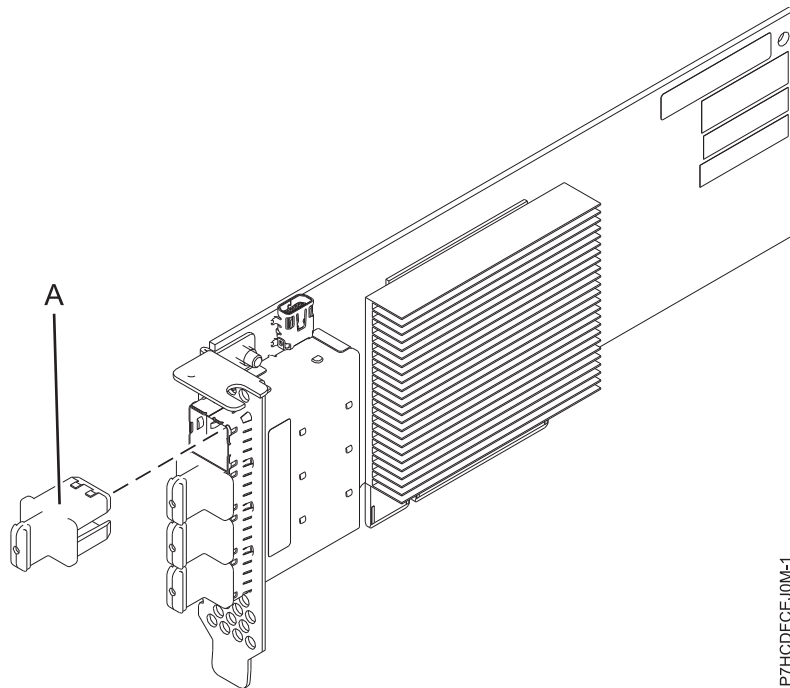
Figure 74. PCIe3 RAID SAS quad-port 6 Gb LP Adapter

Specifications

Item   Description
Adapter FRU number
    000MH910 (Designed to comply with RoHS requirement)
Connector plug part number
    00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)
I/O bus architecture
    PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.
Slot requirement
    One available PCIe x8 slot per adapter.
Cables
    Specific X, YO, AA, or AT SAS cable features with new narrow HD connectors are used to attach to the other adapter or disk expansion drawers.

    SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage

    3.3 V

Form factor

    Short, low-profile but packaged for full-height installations.

Maximum number

    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS device enclosures
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)
- RAID 0, 5, 6, or 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is supported in a single controller configuration only.
- Concurrent firmware update
- Support for multi-initiator and high availability or single controller configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.1, or later
  - AIX 6.1, Technology Level 6, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- Supported on Firmware level 7.8, or later.

This adapter requires the following drivers:

- AIX: devices.pci.14104A0 device driver package

Other important requirements for adapter installation

- If you are attaching a new or existing FC 5887 to an FC EJ0M adapter, verify that the latest System Enclosure Services (SES) code is applied to the FC 5887 before attaching to the FC EJ0M adapter, see the IBM Prerequisites website.

- If you are migrating existing SAS disk enclosures and devices from existing previous PCIe SAS adapters to PCIe2 or PCIe3 SAS adapters, an automatic sector conversion takes place for use with the new adapters. For information about the migrating procedures, see Upgrading the adapter in the POWER7 IBM Knowledge Center.

Related information:

⬆ IBM Prerequisite website

⬆ Installing, removing, or replacing PCIe adapters

⬆ PCIe adapter placement

⬆ PCIe adapter information by feature type

PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EJ0N and FC EJ0S; CCIN 57D7)

Learn about the specifications and operating system requirements for the PCIe3 x8 SAS RAID internal adapter 6 Gb (CCIN 57D7) that is integrated with the base function storage backplane (FC EJ0N) in the 8247-42L, 8286-41A, or 8286-42A. Adding of another PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EJ0S) enables the base function storage backplane (FC EJ0N) to be configured as a split storage backplane in the 8247-42L, 8286-41A, or 8286-42A.

Overview

The PCIe3 x8 SAS RAID internal adapter 6 Gb is an internal PCI Express (PCIe) generation 3 (Gen3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter that is integrated in the 8247-42L, 8286-41A, or 8286-42A. The PCIe3 x8 SAS RAID internal adapter 6 Gb is a composite feature of the base function storage backplane (FC EJ0N). The adapter contains the SAS RAID controller and SAS Expander ports. The PCIe3 x8 SAS RAID internal adapter 6 Gb is preinstalled in the dedicated internal PCIe3, x8 slot P1-C14 in the 8247-42L, 8286-41A, or 8286-42A. The internal adapter has a data read or write speed of 6 Gbps.

Adapter caching

The PCIe3 x8 SAS RAID internal adapter 6 Gb does not have a non-volatile write cache. However, Linux customers can take advantage of a volatile adapter write cache of up to 1 Gb (compressed) for improved performance. This support is available with the 2.4.10 version of iprutils available from the IBM Linux Power Tools Repository (http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/yum.html) and with the latest adapter firmware available from the Fix Central website (http://www.ibm.com/support/fixcentral/)

Single adapter configuration

This configuration of the storage backplane in the 8247-42L, 8286-41A, or 8286-42A with one PCIe3 x8 SAS RAID internal adapter 6 Gb supports 12 numbers of 6.35 cm (2.5 inches), small form-factor (SFF) hard disk drives (HDDs), or solid-state drives (SSDs). FC EJ0N also supports a slim DVD bay. The PCIe3 x8 SAS RAID internal adapter 6 Gb supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. Two mini-SAS HD cables connect the PCIe3 x8 SAS RAID internal adapter 6 Gb to the two SAS ports on the storage backplane. This configuration with one PCIe3 x8 SAS RAID internal adapter 6 Gb does not split the disks in the storage backplane.

Two adapters configuration

To enable the split storage backplane, another PCIe3 x8 SAS RAID internal adapter 6 Gb (FC EJ0S) must be installed in the other dedicated internal PCIe3 x8 slot P1-C15. The same backplane as in FC EJ0N is used in the split storage backplane configuration. The two mini-SAS HD cables connect each of the PCIe3 x8 SAS RAID internal adapter 6 Gb to the two SAS ports on the storage backplane. The 12 drives are then split into 2 sets of 6 drives (HDDs or SSDs), each controlled by one PCIe3 x8 SAS RAID internal

adapter 6 Gb. The split storage backplane configuration supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. The preinstalled PCIe3 x8 SAS RAID internal adapter 6 Gb in slot P1-C14 controls drives, D7-D12, and D27 (slim DVD bay) on the direct access storage device (DASD) backplane. A PCIe3 x8 SAS RAID internal adapter 6 Gb in the other dedicated internal slot P1-C15, controls drives D1-D6 on the DASD backplane. The split storage backplane does not support the mixing of HDDs and SSDs in the same RAID. For more information regarding SAS RAID configurations with the PCIe3 x8 SAS RAID internal adapter 6 Gb, see SAS RAID configurations for system models 8286-41A or 8286-42A with feature code EJ0S(http://www.ibm.com/support/knowledgecenter/POWER8/p8ecr/p8ecr_82x_84x_sasraidconfig2.htm).

Systems running the AIX or Linux operating system support both adapters RAID controllers that are owned by the same or different partitions. The controllers provide RAID 0, RAID 5, RAID 6, and RAID 10 configurations for systems that are running the AIX or Linux operating system. AIX or Linux also provide mirroring (logical volume manager (LVM)) capabilities.

Systems running the IBM i operating system do not support the two adapters if they are owned by the same partition.

P2

P1

P8EBJ601-0
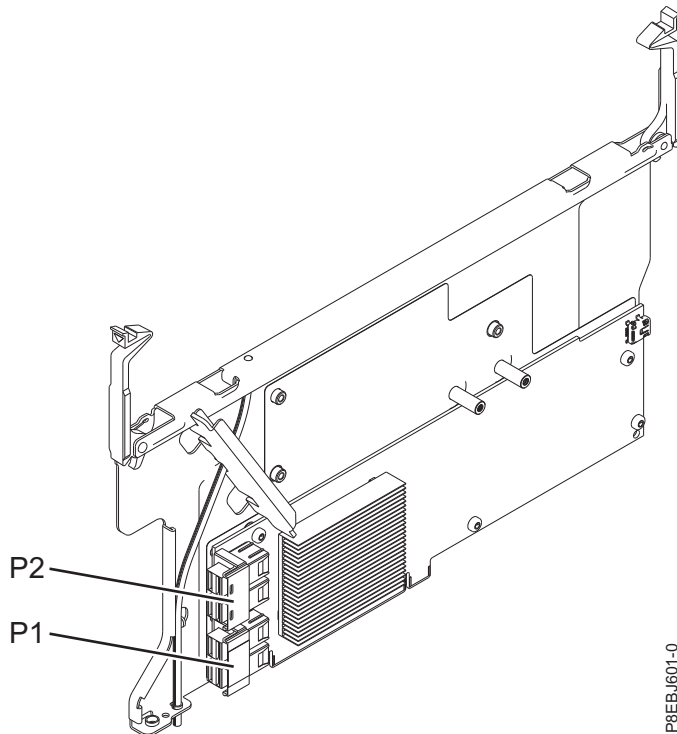
Figure 75. PCIe3 x8 SAS RAID internal adapter 6 Gb

Specifications

Item   Description
Adapter FRU number
    00MH908 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe3 x8
Slot requirement
    Internal PCIe3 slot with x16 connector and x8 bus signaling per adapter.

    Base function configuration: adapter is pre-installed in slot P1-C14.

Split storage backplane configuration: second adapter is installed in slot P1-C15.

Cables

Two mini-SAS HD cables supplied with the adapter.

Voltage

12 V

Form factor

Pre-installed in slot P1-C14

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
    - AIX 7.1, Technology Level 3, Service Pack 2, or later
    - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
- Bare Metal Systems (Indicated by FC EC16)
    - Red Hat Enterprise Linux Version 7.2, little-endian, or later
    - Ubuntu Server 16.04, or later
    - Ubuntu Server 14.04.3, or later
- IBM PowerKVM 3.1 Systems (Indicated by FC EC40)
    - Virtualized resources to Red Hat Linux, SUSE Linux, and Ubuntu Server
- Other environments
-
    - Red Hat Enterprise Linux Version 7, or later
    - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
    - SUSE Linux Enterprise Server 12, or later
    - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
    - Ubuntu Server 16.04, or later
    - Ubuntu Server 14.04.3, or later
    - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).
- IBM i
    - IBM i Version 7.2 or later
    - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 x8 cache SAS RAID internal adapter 6 Gb (FC EJ0P; CCIN 57D8) in the 8247-42L, 8286-41A, or 8286-42A

Learn about the specifications and operating system requirements for the PCIe3 x8 cache SAS RAID internal adapter 6 Gb (CCIN 57D8) that is integrated with the expanded function disk drive backplane (feature code (FC) EJ0P) in the 8247-42L, 8286-41A, or 8286-42A.

Overview

The PCIe3 x8 cache SAS RAID internal adapter 6 Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter integrated in the 8247-42L, 8286-41A, or 8286-42A. The PCIe3 x8 cache SAS RAID internal adapter 6 Gb is a composite feature of the expanded function disk drive backplane (FC EJ0P). The adapter contains the SAS RAID controller and SAS Expander ports.

A pair of the internal adapters is pre-installed in the dedicated internal PCIe3, x8 slots P1-C14 and P1-C15 in the 8247-42L, 8286-41A, or 8286-42A. The expanded function storage feature (FC EJ0P) provides the following features:

- An expanded function disk drive backplane (CCIN 2B0F) that provides slots for 18 numbers of 6.35 cm (2.5 inches) SFF disks and 8 numbers of 1.8 inches SSDs. This backplane also supports a slim DVD media bay.
- A pair of the PCIe3 cache SAS RAID internal adapters (CCIN 57D8) that are installed in the slots P1-C14 and P1-C15.
- A pair of backup power supply cards (also called capacitor card) and card cage that is installed in the slots P1-C14-C1 and P1-C15-C1.
- Two mini-SAS HD cables that attach to the expanded function disk drive backplane.

Note: FC EJ0Z provides a mini-SAS HD cable with two external SAS ports that is installed in the system rear bulkhead in the slot P1-C11. The SAS YO cable that is used to attach a FC 5887 disk drive enclosure to the rear SAS ports of system models 8286-41A or 8286-42A must not exceed the maximum supported length of 3 meters.

Alternatively, you can upgrade your system that has the base function disk drive backplane FC EJ0N to an expanded function system by ordering the expanded function disk drive backplane feature (FC EJ0P).

The PCIe3 x8 cache SAS RAID internal adapter 6 Gb has a data read-write speed of 6 Gbps and a real write cache of 2 GB. With a 4:1 cache compression, this adapter provides an increased cache of 8 GB and increases the storage system performance. The write cache contents are protected against power loss with flash memory and super capacitors and removes the need for cache battery.

The two mini-SAS HD cables in FC EJ0Z connect each of the PCIe3 x8 cache SAS RAID internal adapter 6 Gb to the two SAS ports on the storage backplane. The internal adapters supports both the drives (SFF and SSDs) to be used in a RAID configuration. The supported RAID configurations include: RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2. The second PCIe3 x8 cache SAS RAID internal adapter 6 Gb in slot P1-C15 controls the slim DVD bay. The expanded function disk drive backplane does not support the split disk feature configuration.

Each of the internal adapters provide a mini-SAS HD connector that attach to the mini-SAS HD cable (YO) and provided with two external SAS ports on the other end. In the 8247-42L, 8286-41A, or 8286-42A, the external SAS ports are installed in slot P1-C11. The external SAS port is used to attach the FC 5887 drive enclosure. Only one 5887 drive enclosure is supported by the internal adapter pair.

Note: The SAS YO cable that is used to attach a FC 5887 disk drive enclosure to the rear SAS ports of system models 8286-41A or 8286-42A must not exceed the maximum supported length of 3 meters.

Systems running the AIX or Linux operating system support both adapters RAID controllers owned by the same or different partitions. AIX or Linux also provide mirroring (logical volume manager (LVM)) capabilities. The dual controllers support the Easy Tier function that enables the controllers to automatically move hot data to attached SSDs and cold data to attached HDDs in the AIX or Linux systems.

Systems running the IBM i do not support the two adapters if they are owned by different partitions.

Figure 76 shows the PCIe3 x8 cache SAS RAID internal adapter 6 Gb.

P1

P8EBJ600-0
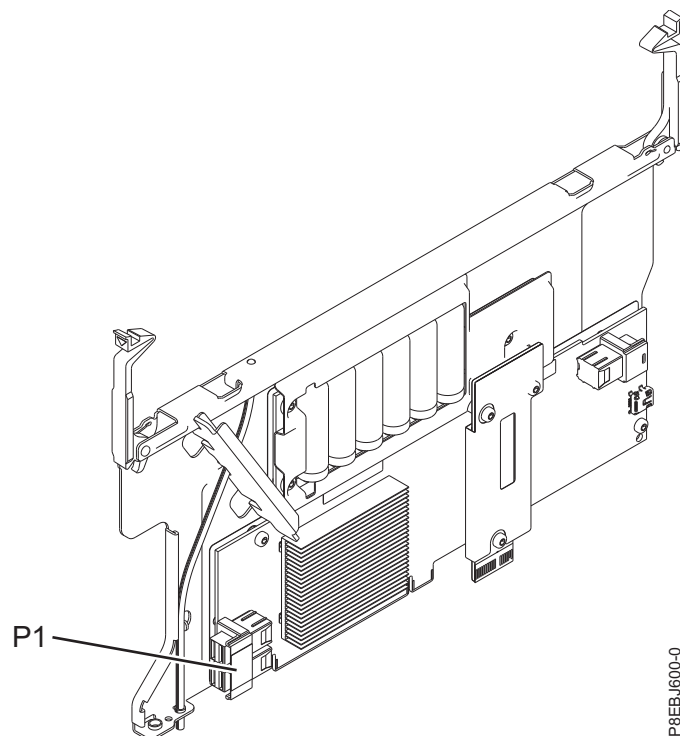
Figure 76. PCIe3 x8 cache SAS RAID internal adapter 6 Gb

Specifications

Item   Description
Adapter FRU number
    00MA020
Adapter CCIN number
    57D8
I/O bus architecture
    PCIe3 x8
Slot requirement

Internal PCIe3 slot with x16 connector and x8 bus signalling per adapter.

Expanded function configuration: Two adapters are installed in slot P1-C14 and P1-C15.
Cables

Two mini-SAS HD cables is supplied with the adapter. Additional SAS cable (YO) with mini-SAS connectors and external SAS ports can be attached to the internal adapters provided by FC EJ0Z.

Note: The SAS YO cable that is used to attach a FC 5887 disk drive enclosure to the rear SAS ports of system models 8286-41A or 8286-42A with must not exceed the maximum supported length of 3 meters.

Voltage
          12 V

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
* AIX
    – AIX 7.1, Technology Level 3, Service Pack 2, or later
    – AIX 6.1, Technology Level 9, Service Pack 2, or later
* Linux
    – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
    – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
    – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
* IBM i
    – IBM i Version 7.2 or later
    – IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 x8 SAS RAID internal adapter 6Gb (FC EJ0T and FC EJ0V; CCIN 57D7)
Learn about the specifications and operating system requirements for the PCIe3 x8 SAS RAID internal adapter 6Gb (CCIN 57D7) that is integrated with the storage backplane (feature code (FC) EJ0T) in the 8284-21A or 8284-22A. Adding of another PCIe3 x8 SAS RAID internal adapter 6Gb (FC EJ0V) enables the storage backplane to be configured as a split storage backplane in the 8284-21A or 8284-22A.

Overview

The PCIe3 x8 SAS RAID internal adapter 6Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter that is integrated in the 8284-21A or 8284-22A. The PCIe3 x8 SAS RAID internal adapter 6Gb is part of a composite feature of the storage backplane FC EJ0T. The adapter contains the SAS RAID controller. The PCIe3 x8 SAS RAID internal adapter 6Gb is preinstalled in the dedicated internal PCIe3, x8 slot P1-C14 in the 8284-21A or 8284-22A. The internal adapter has a data read or write speed of 6 Gbps. The PCIe3 x8 SAS RAID internal adapter 6Gb does not have a write cache.

Single adapter configuration

This configuration of the storage backplane in the 8284-21A or 8284-22A with one PCIe3 x8 SAS RAID internal adapter 6Gb supports 12 numbers of 2.5 inches, small form-factor (SFF) hard disk drives (HDDs), or solid-state drives (SSDs). FC EJ0T also supports a slim DVD bay. The PCIe3 x8 SAS RAID internal adapter 6Gb supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. Two mini-SAS HD cables connect the PCIe3 x8 SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. This configuration with one PCIe3 x8 SAS RAID internal adapter 6Gb does not split the disks in the storage backplane.

Two adapters configuration

To enable the split storage backplane, another PCIe3 x8 SAS RAID internal adapter 6Gb (FC EJ0V) must be installed in the other dedicated internal PCIe3, x8 slot P1-C15. The same backplane as in FC EJ0T is used in the split storage backplane configuration. The two mini-SAS HD cables connect each of the PCIe3 x8 SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. The 12 drives are then split into two sets of six drives (HDDs or SSDs), each controlled by one PCIe3 x8 SAS RAID internal adapter 6Gb. The split storage backplane configuration supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. The PCIe3 x8 SAS RAID internal adapter 6Gb in slot P1-C14 controls the slim DVD bay. The split storage backplane does not support the mixing of HDDs and SSDs in the same RAID set.

Figure 77 shows the PCIe3 x8 SAS RAID internal adapter 6Gb.

Figure 77. PCIe3 x8 SAS RAID internal adapter 6Gb

Specifications

Item   Description
Adapter CCIN number
 57D7
Adapter FRU number
 00MH906 (Designed to comply with RoHS requirement)
I/O bus architecture
 PCIe3 x8
Slot requirement
 Internal PCIe3 slot with x16 connector and x8 bus signaling per adapter.

 Base configuration: Adapter is preinstalled in slot P1-C14.

 Split storage backplane configuration: Second adapter is installed in slot P1-C15.
Cables
 Two mini-SAS HD cables that are supplied with the adapter.
Voltage
 12 V

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 x8 cache SAS RAID internal adapter 6Gb (FC EJ0U; CCIN 57D8)

Learn about the specifications and operating system requirements for the high-function PCIe3 x8 cache SAS RAID internal adapter 6Gb (CCIN 57D8) that is integrated with the composite storage backplane (feature code (FC) EJ0U) in the 8284-21A or 8284-22A.

Overview

The expanded function PCIe3 x8 cache SAS RAID internal adapter 6Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter integrated in the 8284-21A or 8284-22A. The PCIe3 x8 cache SAS RAID internal adapter 6Gb is part of a composite feature of the high-function storage backplane (FC EJ0U). The adapter contains the SAS RAID controller and SAS Expander ports.

A pair of these high-function internal adapters is pre-installed in the dedicated internal PCIe3, x8 slots P1-C14 and P1-C15 in the 8284-21A or 8284-22A. The high-function composite storage feature (FC EJ0U) provides the following features:

- A high-function storage backplane (CCIN 2B5A) that provides slots for 8 numbers of 2.5 inches small form-factor (SFF) hard disk drives (HDDs) or solid-state drives (SDDs)and 6 of 1.8 inches SSDs. This backplane also supports a slim DVD media bay.
- A pair of the high-function PCIe3 cache SAS RAID internal adapters (CCIN 57D8) that are installed in the slots P1-C14 and P1-C15.
- A pair of backup power supply cards and card cage that are installed in the slots P1-C14-C1 and P1-C15-C1.
- Two mini-SAS HD cables that attach to the high-function storage backplane.
- A mini-SAS HD cable with two external SAS ports that is installed in the system rear bulkhead in the slot P1-C8.

Alternatively, you can upgrade your system that has the storage backplane FC EJ0T to a high-function system by ordering the composite high-function storage backplane feature (FC EJ0U).

The PCIe3 x8 cache SAS RAID internal adapter 6Gb has a data read-write speed of 6 Gbps and a real write cache of 2 GB. With a 4:1 cache compression, this high-function adapter provides an increased cache of 8 GB and increases the storage system performance. The write cache contents are protected against power loss with flash memory and super capacitors and removes the need for cache battery.

The two mini-SAS HD cables connect each of the PCIe3 x8 cache SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. The high-function internal adapters supports both the drives (SFF and SSDs) to be used in a Dual Storage IOA RAID configuration. The supported RAID configurations include: RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2. The second PCIe3 x8 cache SAS RAID internal adapter 6Gb in slot P1-C15 also controls the slim DVD bay. The high-function storage backplane does not support the split storage backplane configuration.

Each of the internal adapters provide a rear mini-SAS HD connector that attach to the mini-SAS HD cable and provided with two external SAS ports on the other end. In the 8284-21A or 8284-22A, the external SAS ports are installed in slot P1-C8. The external SAS port is used to attach the FC 5887 drive enclosure. Only one 5887 drive enclosure is supported by the high-function internal adapter pair.

Systems running the AIX or Linux operating system support both adapters RAID controllers owned by the same or different partitions. AIX or Linux also provide mirroring (logical volume manager (LVM)) capabilities. The dual controllers support the Easy Tier function that enables the controllers to automatically move hot data to attached SSDs and cold data to attached HDDs in the AIX or Linux systems.

Systems running the IBM i operating system do not support the two adapters being owned by different partitions, nor the Easy Tier function.

Figure 78 shows the PCIe3 x8 cache SAS RAID internal adapter 6Gb.
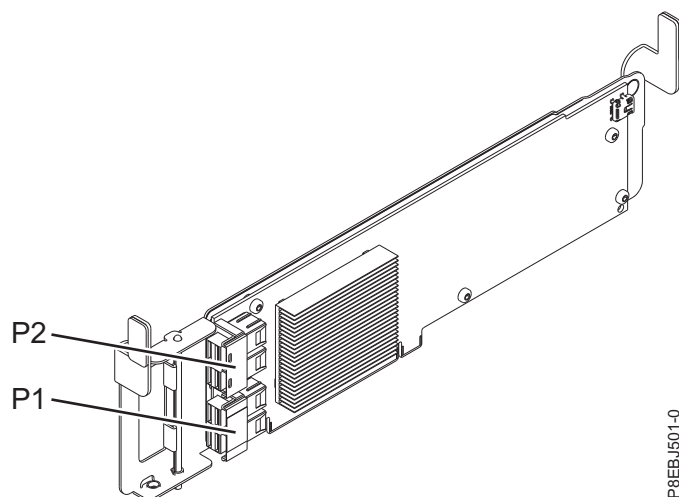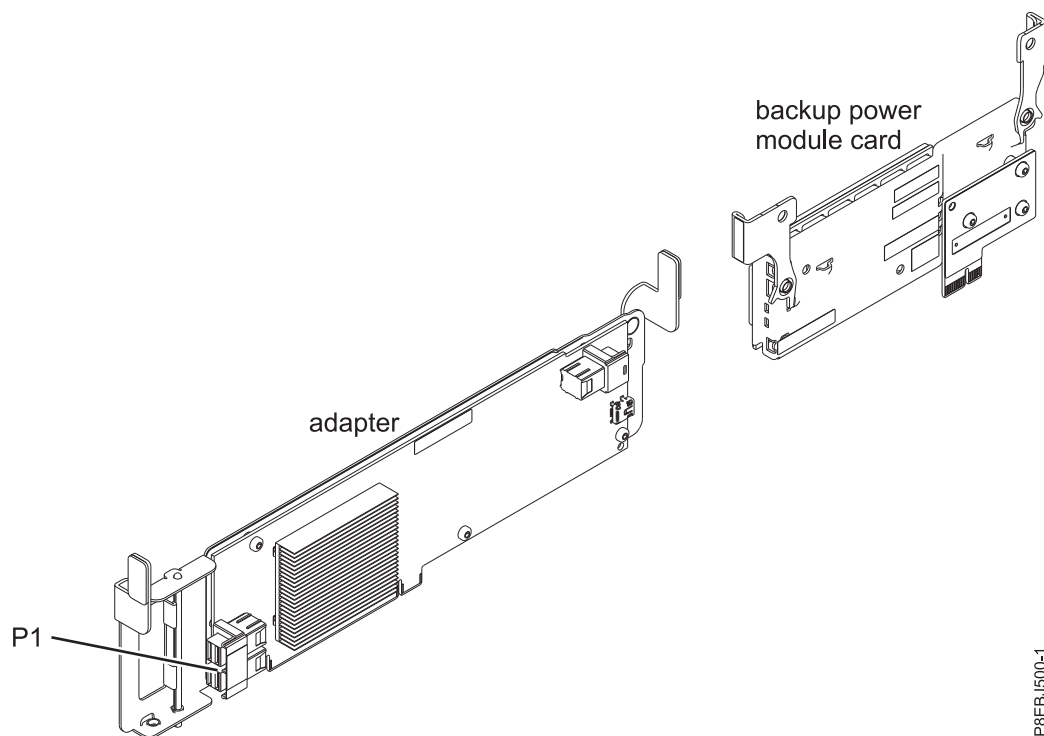

Figure 78. PCIe3 x8 cache SAS RAID internal adapter 6Gb

Specifications

Item   Description

Adapter CCIN number
    57D8

Adapter FRU number
    00MA025 (Designed to comply with RoHS requirement)

I/O bus architecture
    PCIe3 x8

Slot requirement
    Internal PCIe3 slot with x16 connector and x8 bus signalling per adapter.

    High-function configuration: Two adapters are installed in slot P1-C14 and P1-C15.

Cables
    Two mini-SAS HD cables supplied with the adapter. Additional SAS cable with mini-SAS HD
    connectors and external SAS ports can be attached to the high-function internal adapters.

Voltage
    12 V

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system
you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red
    Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red
    Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates
    available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates
    available from SUSE.
  - SUSE Linux Enterprise Server 12, or later, with current maintenance updates available from SUSE
  - Ubuntu Server 14.04.3
  - Ubuntu Server 16.04
- IBM i
  - IBM i Version 7.1, or later
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe3 4 x8 SAS Port Adapter (FC EJ10; CCIN 57B4)
Learn about the specifications and operating system requirements for the feature code (FC) EJ10 adapter.

Overview

The PCIe3 4 x8 SAS Port Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter that has a low-profile, short-form factor, but packaged for full height installation. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS DVD or SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 79 shows the PCIe3 4 x8 SAS Port Adapter.

A maximum of four DVD or tape drives can be attached per adapter by using four AE1 cables (FC ECBY). A maximum of eight DVD or tape drives can be attached by using four YE1 cables (ECBZ).

Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS tape devices.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 79 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.

Figure 79. PCIe3 4 x8 SAS Port Adapter

Specifications

Item   Description

Adapter FRU number

00RR793 for 8408-44E or 8408-E8E and 00MH959 for all other machine type models (Designed to comply with RoHS requirement)

Note: FRU number 00MH959 cannot be migrated to an 8408-E8E system.

Connector plug part number

00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture

PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement

One available PCIe x8 slot per adapter.

Cables

Specific AE1 or YE1 SAS cable features with new narrow HD connectors are used to attach the adapter to SAS devices.

SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached.See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile but packaged for full-height installations.

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS devices
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)
- Concurrent firmware update
- Removable media device (DVD and SAS tape) are supported in a single controller configuration only and cannot be combined with disk devices attached to the same adapter. Removable media is not supported in multi-initiator and high availability (dual storage IOA) configurations
- Support single controller configurations only

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
- IBM i
  - IBM i Version 7.2 or later

– IBM i Version 7.1, or later
- Supported on Firmware level 7.8, or later.

This adapter requires the following drivers:
- AIX: devices.pci.14104A0 device driver package

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LP 4 x8 SAS Port Adapter (FC EJ11; CCIN 57B4)

Learn about the specifications and operating system requirements for the feature code (FC) EJ11 adapter.

Overview

The PCIe3 LP 4 x8 SAS Port Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter is a low-profile, short-form factor adapter. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS DVD or SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 80 on page 242 shows the PCIe3 LP 4 x8 SAS Port Adapter.

A maximum of four DVD or tape drives can be attached per adapter by using four AE1 cables (FC ECBY). A maximum of eight DVD or tape drives can be attached by using four YE1 cables (ECBZ).

Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS tape devices.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 80 on page 242 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
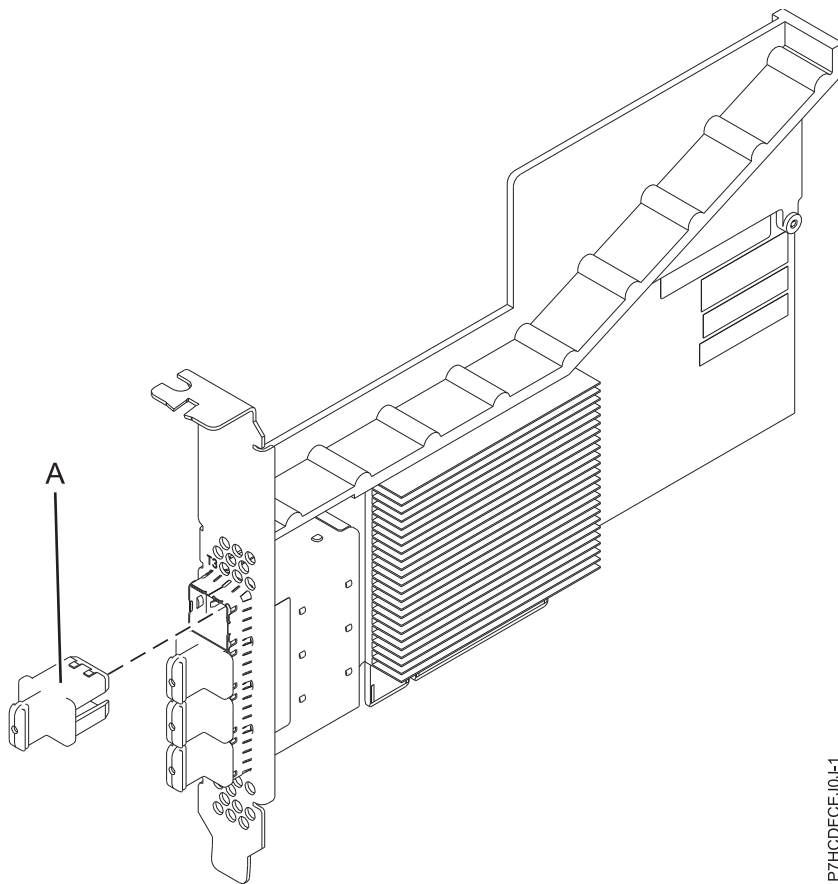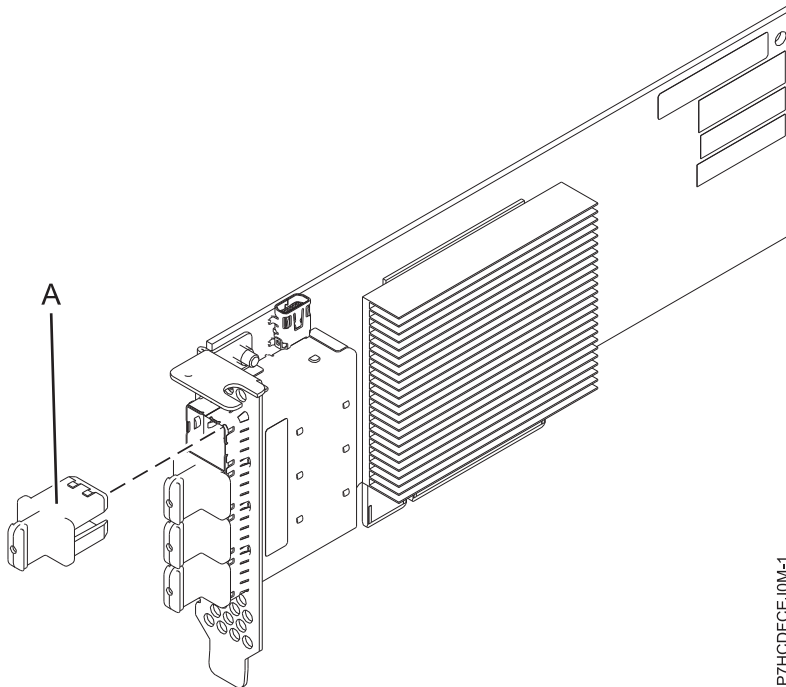
Figure 80. PCIe3 LP 4 x8 SAS Port Adapter

Specifications

Item   Description

Adapter FRU number

000MH910 (Designed to comply with RoHS requirement)

Connector plug part number

00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture

PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement

One available PCIe x8 slot per adapter.

Cables

Specific AE1 or YE1 SAS cable features with new narrow HD connectors are used to attach the adapter to SAS devices.

SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached.See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS devices
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)
- Concurrent firmware update

- Removable media device (DVD and SAS tape) are supported in a single controller configuration only and cannot be combined with disk devices attached to the same adapter. Removable media is not supported in multi-initiator and high availability (dual storage IOA) configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- Supported on Firmware level 7.8, or later.

This adapter requires the following drivers:
- AIX: devices.pci.14104A0 device driver package

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 FPGA Compression Accelerator Adapter (FC EJ12; CCIN 59AB)
Learn about the specifications and operating system requirements for the feature code (FC) EJ12 adapter.

Overview

FC EJ12 and EJ13 are both the same adapter with different feature codes. FC EJ12 is a full-height adapter and FC EJ13 is a low-profile adapter. See "CAPI Compression Accelerator Adapter (FC EJ1A and EJ1B; CCIN 2CF0)" on page 261 for compression accelerator adapters with greater compression acceleration and CPU load reduction.

The PCIe3 FPGA Compression Adapter is a PCI Express (PCIe) generation 3 (Gen3), x8 adapter. The adapter can be used in either a x8 or x16 PCIe Gen3 slot in the system. The PCIe3 FPGA Compression

Accelerator Adapter implements the well-defined, open standard DEFLATE compressed data format. This data format is widely accepted through zlib, gzip, Java and other applications. Within the gzip and zip file formats, the adapter is the standard for compressed data exchange. The adapter's high compression bandwidth reduces the latency for a single compression job significantly. Its aggregate throughput allows the adapter to keep pace with common I/O traffic and offers reduced data for storage and network traffic. Additionally, the adapter has no impact on most I/O traffic and in some cases will have a positive effect. The adapter also enables good standard compression in cases where software overhead prevents it.

The following are examples of typical applications that can benefit from compression acceleration:
- Store or transmit large amounts of data that average over 100 MB/s
- Expensive storage with high storage bandwidth, where the accelerator's compression ratio, compared to fast software compression, yields significant savings
- Applications that need a high average throughput of data compressed
- Handling high peak throughput of data when software compression is limited
- When low latency for individual compression streams is required and it is more difficult to run in parallel on many CPUs
- When the standard DEFLATE compression format is required for interchange as used in gzip, zlib, zip, or JAR (Software compression methods such as LZ4 or LZS with lower compression ratios and high bandwidth on CPUs are not an option in that case)
- Compression or a mix of compression and decompression is the main bottleneck.

Note: Decompression alone can sometimes still be done in software with many cores in parallel. The adapter supports full speed decompression for all compliant compressed input regardless of whether it was compressed by hardware or software.

Figure 81. PCIe3 FPGA Compression Accelerator Adapter

Specifications

Item   Description
Adapter FRU number
          000NK006 (Designed to comply with RoHS requirement)

I/O bus architecture
>   PCIe3 x8

Slot requirement
>   One PCIe x8 or x16 slot

Voltage
>   3.3 V, 12 V

Form factor
>   Full-height (FC EJ12) and short, low-profile (FC EJ13)

Maximum number
>   For details about the maximum number of adapters that are supported, see PCIe adapter
>   placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
>   p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided
>   High throughput compression that saves storage and I/O bandwidth with little or no overhead
>
>   CPU offload and PCIe interface with negligible software load frees up CPU cores for higher value
>   computation or licensed software
>
>   Lower power consumption by offloading the CPU intensive compression to an FPGA
>
>   Widely used zlib and gzip standard format for data interchange
>
>   Up to 1.8 GB/s compression and decompression throughput
>
>   3-25x speed up achievable
>
>   Compression ratio near software zlib and gzip
>
>   Multiple uses including genomics, data center, cloud, and backup solutions

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system
you are using:

* AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, or later
* Linux
  - Red Hat Enterprise Linux 7.2, and later include the GenWQE Linux drive
  - Red Hat Enterprise Linux 7.1, or later

    Important: See Generic Work Queue Engine (GenWQE) introduction for instructions about installing
    the driver.
  - Red Hat Enterprise Linux 7, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/
    lopdiags/info/LinuxAlerts.html).
  - For additional information regarding firmware level and additional software installations, see Fix
    Central.
  - To use the PCIe3 FPGA Compression Accelerator Adapter, the following software packages must be
    downloaded at the IBM Service and Productivity Tools website (http://www14.software.ibm.com/
    webapp/set2/sas/f/lopdiags/home.html):
    - genwqe-zlib: Hardware accelerated zlib
    - genwqe-tools: Tools to analyze adapter functionality plus hardware accelerated genwqe_gzip and
      genwqe_gunzip

– For details on how the adapter can be used to accelerate your application, please refer to the Generic Work Queue Engine (GenWQE) Application Programming Guide published on IBM developerWorks (http://www.ibm.com/developerworks/).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 FPGA Compression Accelerator Adapter (FC EJ13; CCIN 59AB)

Learn about the specifications and operating system requirements for the feature code (FC) EJ13 adapter.

Overview

FC EJ12 and EJ13 are both the same adapter with different feature codes. FC EJ12 is a full-height adapter and FC EJ13 is a low-profile adapter. See "CAPI Compression Accelerator Adapter (FC EJ1A and EJ1B; CCIN 2CF0)" on page 261 for compression accelerator adapters with greater compression acceleration and CPU load reduction.

The PCIe3 FPGA Compression Adapter is a PCI Express (PCIe) generation 3 (Gen3), x8 adapter. The adapter can be used in either a x8 or x16 PCIe Gen3 slot in the system. The PCIe3 FPGA Compression Accelerator Adapter implements the well-defined, open standard DEFLATE compressed data format. This data format is widely accepted through zlib, gzip, Java and other applications. Within the gzip and zip file formats, the adapter is the standard for compressed data exchange. The adapter's high compression bandwidth reduces the latency for a single compression job significantly. Its aggregate throughput allows the adapter to keep pace with common I/O traffic and offers reduced data for storage and network traffic. Additionally, the adapter has no impact on most I/O traffic and in some cases will have a positive effect. The adapter also enables good standard compression in cases where software overhead prevents it.

The following are examples of typical applications that can benefit from compression acceleration:
- Store or transmit large amounts of data that average over 100 MB/s
- Expensive storage with high storage bandwidth, where the accelerator's compression ratio, compared to fast software compression, yields significant savings
- Applications that need a high average throughput of data compressed
- Handling high peak throughput of data when software compression is limited
- When low latency for individual compression streams is required and it is more difficult to run in parallel on many CPUs
- When the standard DEFLATE compression format is required for interchange as used in gzip, zlib, zip, or JAR (Software compression methods such as LZ4 or LZS with lower compression ratios and high bandwidth on CPUs are not an option in that case)
- Compression or a mix of compression and decompression is the main bottleneck.

Note: Decompression alone can sometimes still be done in software with many cores in parallel. The adapter supports full speed decompression for all compliant compressed input regardless of whether it was compressed by hardware or software.
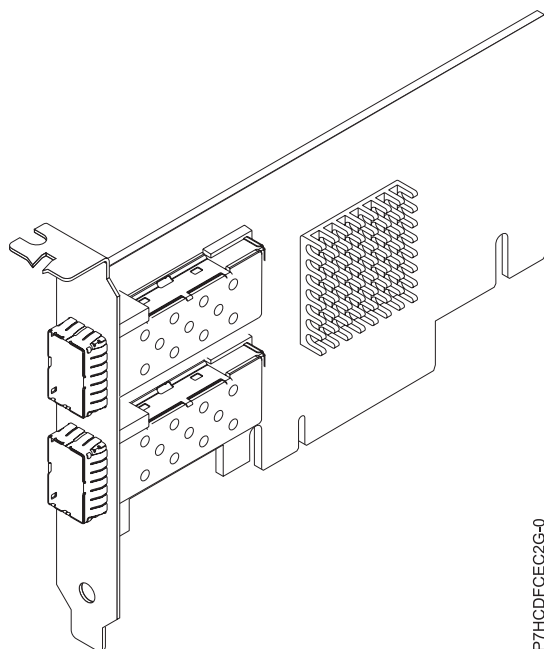
Figure 82. PCIe3 FPGA Compression Accelerator Adapter

Specifications

Item   Description

Adapter FRU number

      000NK006 (Designed to comply with RoHS requirement)

I/O bus architecture

      PCIe3 x8

Slot requirement

      One PCIe x8 or x16 slot (Low-profile)

Voltage

      3.3 V, 12 V

Form factor

      Full-height (FC EJ12) and short, low-profile (FC EJ13)

Maximum number

      For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

      High throughput compression that saves storage and I/O bandwidth with little or no overhead

      CPU offload and PCIe interface with negligible software load frees up CPU cores for higher value computation or licensed software

      Lower power consumption by offloading the CPU intensive compression to an FPGA

      Widely used zlib and gzip standard format for data interchange

      Up to 1.8 GB/s compression and decompression throughput

      3-25x speed up achievable

      Compression ratio near software zlib and gzip

      Multiple uses including genomics, data center, cloud, and backup solutions

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
* AIX
  – AIX 7.1, Technology Level 3, Service Pack 2, or later
  – AIX 6.1, Technology Level 9, or later
* Linux
  – Red Hat Enterprise Linux 7.2, and later include the GenWQE Linux drive
  – Red Hat Enterprise Linux 7.1, or later

    Important: See Generic Work Queue Engine (GenWQE) introduction (https://www.ibm.com/support/knowledgecenter/linuxonibm/liabt/liabtkickoff.htm) on how to install the driver.
  – Red Hat Enterprise Linux 7, or later
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  – For additional information regarding firmware level and additional software installations, see Fix Central (http://www.ibm.com/support/fixcentral/).
  – To use the PCIe3 FPGA Compression Accelerator Adapter, the following software packages must be downloaded at the IBM Service and Productivity Tools website (http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html):
    - genwqe-zlib: Hardware accelerated zlib
    - genwqe-tools: Tools to analyze adapter functionality plus hardware accelerated genwqe_gzip and genwqe_gunzip
  – For details on how the adapter can be used to accelerate your application, please refer to the Generic Work Queue Engine (GenWQE) Application Programming Guide published on IBM developerWorks (http://www.ibm.com/developerworks/).

Related information:

⇨ IBM Prerequisite website

⇨ Installing, removing, or replacing PCIe adapters

⇨ PCIe adapter placement

⇨ PCIe adapter information by feature type

PCIe3 12 GB Cache RAID + SAS Adapter Quad-port 6 Gb x8 (FC EJ14; CCIN 57B1)
Learn about the specifications and operating system requirements for the feature code (FC) EJ14 adapters.

Overview

The PCIe3 4-port 12 GB Cache RAID + SAS Adapter is a PCI Express (PCIe) generation 3, x8, single-wide, full-height, short form-factor adapter that provides high-performance capabilities and supports the attachment of SAS hard disk drive (HDD) and SAS solid-state drive (SDD). A pair of FC EJ14 adapters are required to provide additional performance, mirrored write cache data and adapter redundancy. If the FC EJ14 pairing is broken, then the write cache is disabled. Integrated flash memory with super capacitors provides protection of the write cache without batteries in case of power failure. FC EJ14 effectively provides up to 12 GB of write cache that uses compression of 4 GB of physical cache.

The adapter provides four Mini-SAS HD (high density) narrow connectors for the attachment of SAS drives in the 5887 disk drive enclosure (IBM EXP24S SFF Gen2-bay Drawer) as shown in Figure 83 on page 250. Specific SAS cables with HD narrow connectors are used to attach to the 5887 disk drive enclosure. To provide the highest bandwidth, two AA SAS cables with HD narrow connectors are used to

attach the two paired FC EJ14 adapters on the third and fourth adapter ports (T2, T3) to communicate status and cache content information. Both AA SAS cables are required unless 3 or 4 ports are being used to attach the SAS drives. When all connectors are attaching SAS drives, the communication between the adapter pair is performed through the SAS fabric by way of the disk enclosures and cabling. A maximum of 96 SAS devices are supported using four 5887 disk drive enclosure. The SAS devices can be all HDDs or can have up to 48 SSD + 48 HDDs (HDDs must be on the 3rd and 4th ports). They can have a maximum of 72 SSDs with no HDDs and must have an AA cable on the top port. If there are over 48 SSDs, then no HDDs can be attached.

The adapter provides RAID 0, RAID 5, RAID 6, RAID 10, RAID 5T2, RAID 6T2, RAID 10T2, and OS mirroring (LVM) for the AIX, Linux, and VIOS operating systems. Under the IBM i operating system, the adapter provides RAID 5, RAID 6, OS mirroring, and data spreading. RAID 10 is supported by IBM i Version 7.2 or later.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Figure 83 on page 250 shows the PCIe3 12 GB Cache RAID + SAS quad-port 6 Gb adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
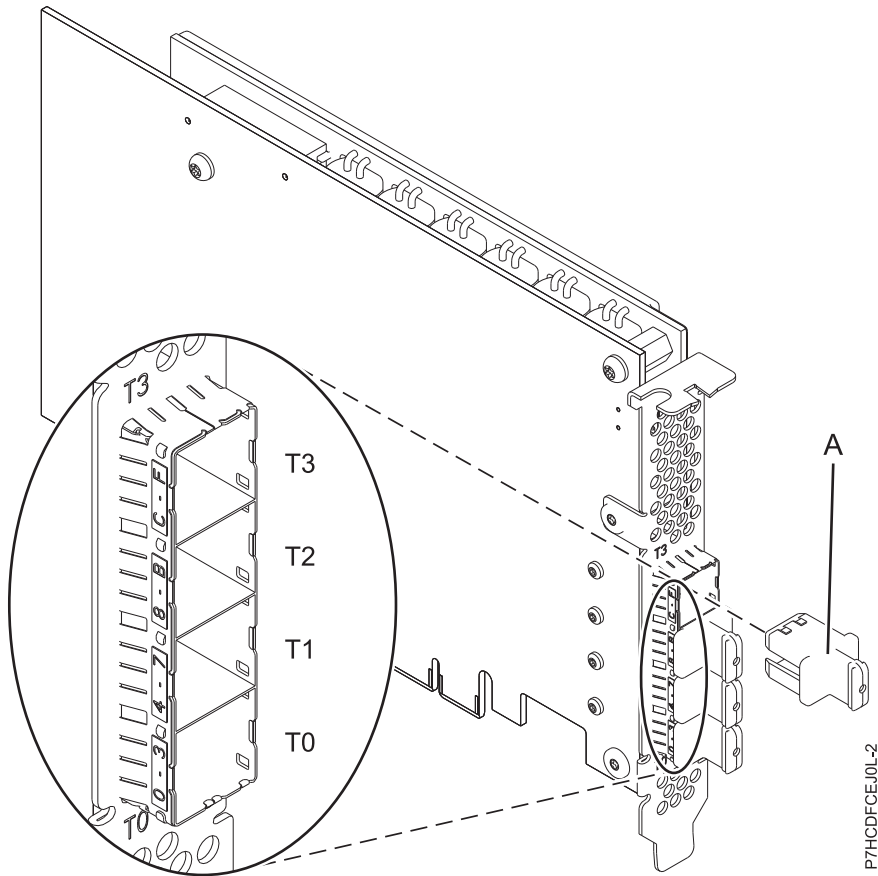
Figure 83. PCIe3 12 GB Cache RAID + SAS 6 Gb Adapter

Specifications

Item   Description

Adapter FRU number

01DH742 (Designed to comply with RoHS requirement)

Connector plug part number

00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed)

I/O bus architecture

PCIe 3.0 (compatible with 2.0 and 1.0)

Slot requirement

One PCIe x8 slot per adapter

Adapters are installed in pairs

For higher availability, place adapters in separate enclosures where supported

Cables

Specific X, YO, or AT SAS cable features with new narrow HD connectors are used to attach to the 5887 disk drive enclosure.

SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Supported Systems

Power 8 processor-based server

Voltage

3.3 V

Form factor

Short, full-height

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system

Attributes provided

Full high PCIe3 four port x8 adapter with up to 12 GB write cache

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Bare Metal Systems (Not supported)
  - PowerKVM 3.1 Systems or PowerKVM 2.1 (Not Supported)
  - Other environments
    - Red Hat Enterprise Linux 7.2, big-endian, or later
    - Red Hat Enterprise Linux 7.2, little-endian, or later
    - Red Hat Enterprise Linux 6.8 or later
    - SUSE Linux Enterprise Server 12, Service Pack 1, or later
    - SUSE Linux Enterprise Server 11, Service Pack 4, or later
    - Ubuntu Server 16.04, or later
    - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
    - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- IBM i
  - IBM i Version 7.3, or later
  - IBM i Version 7.2, Technology Refresh 4, or later
- VIOS
  - VIOS 2.2.3.51, or later

Related information:

IBM Prerequisite website

Installing, removing, or replacing PCIe adapters

PCIe adapter placement

PCIe adapter information by feature type

PCIe3 LP CAPI Fibre Channel Flash Accelerator Adapter (FC EJ16)

Learn about the specifications and operating system requirements for the feature code (FC) EJ16 adapter.

Overview

FC EJ16, EJ17, and EJ18 are electronically identical, but have different tailstock brackets.

The PCIe3 LP CAPI Accelerator Adapter (FC EJ16) is a short, low-profile, PCI express (PCIe) generation 3 (Gen3) x8 adapter. This adapter acts as a co-processor for the POWER8 processor, and is designed to offload CPU access to external Fibre Channel flash storage.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.

The adapter provides the following features:
* The adapter requires a direct-attach, point-to-point 8Gb Fibre Channel link to external storage.
* The adapter includes a programmable CAPI Fibre Channel offload Accelerator Functional Unit (AFU).
* The adapter requires one or more 4096-byte sector logical unit numbers (LUNs) to be provisioned. The adapter and its accompanying software libraries will not function with 512-byte sector LUNs.
* The adapter requires both 3.3 V and 12 V power to be available in the PCIe slot.
* The adapter must be plugged into a direct host-bus PCIe slot to function.
* A maximum of one adapter per processor is supported in the system.

Figure 84. PCIe3 LP CAPI Fibre Channel Flash Accelerator Adapter

Software requirements

The software requirements for the FC EJ16 adapter follow:
* The adapter requires that additional software packages for the IBM Data Engine for NoSQL are installed for CAPI Flash exploitation.
* Software packages and adapter microcode must be installed as a matched pair.

- Software packages are available for download on the Fix Central website (http://www.ibm.com/support/fixcentral/) under EJ16 feature code.
- Functionality of the adapter is dependent on operating system and software library versions.
- Installation of mismatched adapter microcode and operating system or software libraries might result in warning messages in the Linux syslog during boot, such as `Back Level AFU`.
- Linux kernel 3.x supports virtual LUN use cases. Linux kernel 4.2, or later is required to fully exploit CAPI Flash functionality such as fine-grained multipathing, multiple LUN support, and persistent storage.

Specifications

Item   Description
Adapter FRU number
    00NK025 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe3 x16
Slot requirement
    One PCIe x16 low-profile slot
Voltage
    3.3 V and 12 V
Form factor
    Short, low-profile
Maximum number

    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux

    – Linux Ubuntu 14.10, RHEL 7.2, or later.

      Note: To run the following commands, you must have Linux Kernel 4.2.x, or later.

    – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Create a host in IBM FlashSystem storage

Use this command to create a host in IBM FlashSystem storage by using Flash World Wide Port Names (WWPN).

Note: To run this command, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To create a host in IBM FlashSystem® storage, complete the following steps:

    a. Log into the Linux system console as the root user.

    b. To list all adapters to determine the ACPI Flash World Wide Port Names (WWPN) for each present accelerator's ports, enter the following command:

    `lspci |grep 'IBM Device 04cf'`

    An output similar to the following example is displayed:

    ```
    0000:01:00.0 Processing accelerators: IBM Device 04cf [rev 01]
    0002:01:00.0 Processing accelerators: IBM Device 04cf [rev 01]
    ```

c. From the output list, select an adapter using the identifiers in the left column. To read the World Wide Port Names (WWPN) for the first adapter listed, enter the following command:

`lspci -s 0000.01:00.0 -vv |grep -e V6`

An output similar to the following example is displayed:

```
lspci -s 0000:01:00.0 -vv |grep -e V5 -e V6
[V5] Vendor specific: 5005076069800230
[V6] Vendor specific: 5005076069800231
```

d. Find the WWPNs in the output.

Note: In the example above, the WWPNs of the adapter are: 5005076069800230 and 5005076069800231.

e. Use the WWPNs to create a new host or hosts in the IBM FlashSystem GUI or command-line interface.

Control access to the Accelerator

Use this command to enable an account to control access to the accelerator.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To control access to the accelerator, complete the following step:

Note: By default, installation of the IBM Data Engine for NoSQL software libraries creates a `cxl` user and adds `Udev` rules to restrict read and write access to the accelerator's volumes to members of the `cxl` system.

a. To enable an account to read and write to the accelerator, add the account to the `cxl` by entering the following command:

`sudo usermod -a -G cxl userid`

View the status of the Accelerator

Use this command to view the status of each accelerator adapter's logical unit numbers (LUN). The libraries of the IBM DataEngine for NoSQL software include scripts that display the status of the volumes mapped to the accelerator.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To view the status of each accelerator adapter's LUN, enter the following command:

`sudo /opt/ibm/capikv/bin/cxlfstatus`

Notes:

- Volumes may be in either `legacy` or `superpipe` mode. The default mode is legacy.
- Volumes must be in `superpipe` mode for exploitation by the CAPI Flash `block` or `arkdb` APIs.

Table 63. Coherent Accelerator Interface (CXL) Flash device

Device	SCSI	Block	Mode	LUN WWID
sg9:	33:0:0:0	sdc	legacy	60050768218b08182000000000400006e
sg10:	33:1:0:0	sdd	superpipe	60050768218b0818200000000600006f
sg11:	34:0:0:0	sde	superpipe	60050768218b08182000000007000070

Table 63. Coherent Accelerator Interface (CXL) Flash device (continued)

Device	SCSI	Block	Mode	LUN WWID
sg12:	34:1:0:0	sdf	superpipe	60050768218b0818200000000300006d

Table 63 on page 254 shows two accelerators, each with two ports, and a single volume mapped to each port's WWPN. One volume is in `legacy` mode, and three volumes are in `superpipe` mode. The WWID for each volume in the IBM FlashSystem are displayed for convenience of administration. This matches the WWID shown in the IBM FlashSystem GUI or CLI (`ibm@power8:~$ sudo /opt/ibm/capikv/bin/cxlfstatus`)

Set the mode for a volume

Use this command to set the mode for a volume.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To set the mode for a volume, enter the following command:

   `sudo /opt/ibm/capikv/bin/cxlfsetlunmode <LUN> <Mode>`

   •

   Notes:

   An output similar to the following example is displayed:

   –

   ```
   ibm@power8:~$ /opt/ibm/capikv/bin/cxlfsetlunmode
   60050768218b0818200000000400006e 1
   INFO: Adding LUN 60050768218b0818200000000400006e to Super IO table. SUCCESS
   ```
   – LUN modes might be 0 for `legacy` mode, or 1 for `superpipe` mode.
   – After a LUN is set to `superpipe` mode, all paths to that volume will also be set to `superpipe` mode.
   – As shown in Table 63 on page 254, each volume might be in either `legacy` or `superpipe` mode.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 CAPI Fibre Channel Flash Accelerator Adapter (FC EJ17)
Learn about the specifications and operating system requirements for the feature code (FC) EJ17 adapter.

Overview

FC EJ16, EJ17, and EJ18 are electronically identical, but have different tailstock brackets.

The PCIe3 LP CAPI Accelerator Adapter (FC EJ17) is a short, full-height, PCI express (PCIe) generation 3 (Gen3) x8 adapter. This adapter acts as a co-processor for the POWER8 processor, and is designed to offload CPU access to external Fibre Channel flash storage.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.

The adapter provides the following features:

- The adapter requires a direct-attach, point-to-point 8Gb Fibre Channel link to external storage.
- The adapter includes a programmable CAPI Fibre Channel offload Accelerator Functional Unit (AFU).
- The adapter requires one or more 4096-byte sector logical unit numbers (LUNs) to be provisioned. The adapter and its accompanying software libraries will not function with 512-byte sector LUNs.
- The adapter requires both 3.3 V and 12 V power to be available in the PCIe slot.
- The adapter must be plugged into a direct host-bus PCIe slot to function.
- A maximum of one adapter per processor is supported in the system.

Figure 85. PCIe3 CAPI Fibre Channel Flash Accelerator Adapter

Software requirements

The software requirements for the FC EJ17 adapter follow:

- The adapter requires that additional software packages for the IBM Data Engine for NoSQL are installed for CAPI Flash exploitation.
- Software packages and adapter microcode must be installed as a matched pair.
- Software packages are available for download on the Fix Central website (http://www.ibm.com/support/fixcentral/) under EJ17 feature code.
- Functionality of the adapter is dependent on operating system and software library versions.
- Installation of mismatched adapter microcode and operating system or software libraries results in a log in the AIX system error log. The log will indicate that the firmware needs to be updated.
- AIX 7.2 supports virtual LUN use cases. AIX 7.2, or later is required to fully exploit CAPI Flash functionality such as fine-grained multipathing, multiple LUN support, and persistent storage.

Specifications

Item   Description

Adapter FRU number
>00NK025 (Designed to comply with RoHS requirement)

I/O bus architecture
>PCIe3 x16

Slot requirement
>One CAPI-capable PCIe x16 full height slot.

Voltage
>3.3 V and 12 V

Form factor
>Short, full-height

Maximum number

>For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* AIX
  – AIX 7.2, or later

Create a host in IBM FlashSystem storage

Use this command to create a host in IBM FlashSystem storage by using Flash World Wide Port Names (WWPN).

Note: To run this command, you must have AIX 7.2, or later.

1. To create a host in IBM FlashSystem storage, complete the following steps:

   a. Log in to the AIX system console as the root user.

   b. To list all CAPI flash adapters to determine the CAPI Flash World Wide Port Names (WWPN) for each present accelerator's ports, enter the following command:

   `lsdev -C|grep cflash`

   An output similar to the following example is displayed:

   ```
   cflash0 Available 00-4800000 CAPI Flash Adapter (1410f0041410f004)
   cflash1 Available 00-4800001 CAPI Flash Adapter (1410f0041410f004)
   ```

   c. From the output list, select an adapter that uses the name (that is, **`cflash0`**) in the left column. To read the World Wide Port Names (WWPN) for the first adapter that is listed, enter the following command:

   `lscfg -vl cflash0 | grep "Network Address"`

   An output similar to the following example is displayed:

   ```
   Network Address .................. 5005076069800230
   Network Address .................. 5005076069800231
   ```

   d. Find the WWPNs in the output.

   Note: In the example above, the WWPNs of the adapter are: 5005076069800230 and 5005076069800231.

   e. Use the WWPNs to create a new host or hosts in the IBM FlashSystem GUI or command-line interface.

   f. After you create LUNS on the IBM FlashSystem storage, run **cfgmgr** on AIX. To view the LUNS, enter the following command:

```
lsdev -Cc disk |grep CAPI
```
An output similar to the following example is displayed:
```
hdisk1 Available 00-48000000 MPIO CAPI Flash Disk
hdisk2 Available 00-48000000 MPIO CAPI Flash Disk
hdisk3 Available 00-48000000 MPIO CAPI Flash Disk
hdisk4 Available 00-48000000 MPIO CAPI Flash Disk
```

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP CAPI Fibre Channel Flash Accelerator Adapter (FC EJ18)

Learn about the specifications and operating system requirements for the feature code (FC) EJ18 adapter.

Overview

FC EJ16, EJ17, and EJ18 are electronically identical, but have different tailstock brackets.

The PCIe3 LP CAPI Accelerator Adapter (FC EJ16) is a short, low-profile, PCI express (PCIe) generation 3 (Gen3) x8 adapter. This adapter acts as a co-processor for the POWER8 processor, and is designed to offload CPU access to external Fibre Channel flash storage.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.

The adapter provides the following features:
- The adapter requires a direct-attach, point-to-point 8Gb Fibre Channel link to external storage.
- The adapter includes a programmable CAPI Fibre Channel offload Accelerator Functional Unit (AFU).
- The adapter requires one or more 4096-byte sector logical unit numbers (LUNs) to be provisioned. The adapter and its accompanying software libraries will not function with 512-byte sector LUNs.
- The adapter requires both 3.3 V and 12 V power to be available in the PCIe slot.
- The adapter must be plugged into a direct host-bus PCIe slot to function.
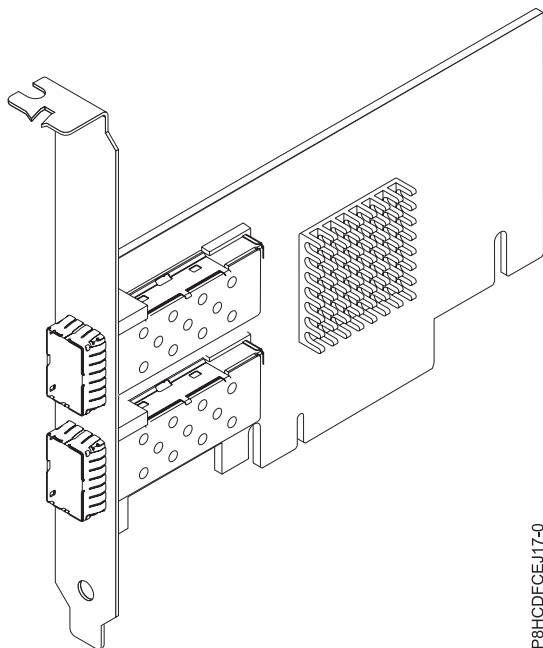- A maximum of one adapter per processor is supported in the system.

P7HCDFCEC2G-0

Figure 86. PCIe3 LP CAPI Fibre Channel Flash Accelerator Adapter

Software requirements

The software requirements for the FC EJ18 adapter follow:

- The adapter requires that additional software packages for the IBM Data Engine for NoSQL are installed for CAPI Flash exploitation.
- Software packages and adapter microcode must be installed as a matched pair.
- Software packages are available for download on the Fix Central website (http://www.ibm.com/support/fixcentral/) under EJ18 feature code.
- Functionality of the adapter is dependent on operating system and software library versions.
- Installation of mismatched adapter microcode and operating system or software libraries results in a log in the AIX system error log. The log will indicate that the firmware needs to be updated.
- AIX 7.2 supports virtual LUN use cases. AIX 7.2, or later is required to fully exploit CAPI Flash functionality such as fine-grained multipathing, multiple LUN support, and persistent storage.

Specifications

Item   Description
Adapter FRU number
    00NK025 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe3 x16
Slot requirement
    One CAPI-capable PCIe x16 low-profile slot.
Voltage
    3.3 V and 12 V
Form factor
    Short, low-profile
Maximum number

    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.2, or later.

Create a host in IBM FlashSystem storage

Use this command to create a host in IBM FlashSystem storage by using Flash World Wide Port Names (WWPN).

Note: To run this command, you must have AIX 7.2, or later.

1. To create a host in IBM FlashSystem storage, complete the following steps:
   a. Log in to the AIX system console as the root user.
   b. To list all CAPI flash adapters to determine the CAPI Flash World Wide Port Names (WWPN) for each present accelerator's ports, enter the following command:

   `lsdev -C|grep cflash`

   An output similar to the following example is diplayed:
   ```
   cflash0 Available 00-4800000 CAPI Flash Adapter (1410f0041410f004)
   cflash1 Available 00-4800001 CAPI Flash Adapter (1410f0041410f004)
   ```
   c. From the output list, select an adapter that uses the name (that is, **cflash0**) in the left column. To read the World Wide Port Names (WWPN) for the first adapter that is listed, enter the following command:

   `lscfg -vl cflash0 | grep "Network Address"`

   An output similar to the following example is displayed:
   ```
   Network Address .................. 5005076069800230
   Network Address .................. 5005076069800231
   ```
   d. Find the WWPNs in the output.

   Note: In the example above, the WWPNs of the adapter are: 5005076069800230 and 5005076069800231.

   e. Use the WWPNs to create a new host or hosts in the IBM FlashSystem GUI or command-line interface.
   f. After you create LUNS on the IBM FlashSystem storage, run **cfgmgr** on AIX. To view the LUNS, enter the following command:

   `lsdev -Cc disk |grep CAPI`

   An output similar to the following example is displayed:
   ```
   hdisk1 Available 00-48000000 MPIO CAPI Flash Disk
   hdisk2 Available 00-48000000 MPIO CAPI Flash Disk
   hdisk3 Available 00-48000000 MPIO CAPI Flash Disk
   hdisk4 Available 00-48000000 MPIO CAPI Flash Disk
   ```

Related information:

➔ IBM Prerequisite website

➔ Installing, removing, or replacing PCIe adapters

➔ PCIe adapter placement

➔ PCIe adapter information by feature type

CAPI Compression Accelerator Adapter (FC EJ1A and EJ1B; CCIN 2CF0)

Learn about the specifications and operating system requirements for feature code (FC) EJ1A and EJ1B adapters.

Overview

FC EJ1A and EJ1B are both the same adapter with different feature codes. FC EJ1A is a full-height adapter and FC EJ1B is a low-profile adapter. See "PCIe3 FPGA Compression Accelerator Adapter (FC EJ12; CCIN 59AB)" on page 243 and "PCIe3 FPGA Compression Accelerator Adapter (FC EJ13; CCIN 59AB)" on page 246 for additional compression accelerator adapters.

The PCIe3 CAPI Compression Accelerator Adapter is a PCI Express (PCIe) generation 3 (Gen3) x8 adapter. The adapter can be used in either a x8 or x16 PCIe3 slot in the system. The CAPI Compression Accelerator Adapter implements the well-defined, open standard DEFLATE compressed data format. This data format is widely accepted through zlib, gzip, Java, and other applications. Within the gzip and zip file formats, the adapter is the standard for compressed data exchange. The adapter's high compression bandwidth reduces the latency for a single compression job significantly. Its aggregate throughput allows the adapter to keep pace with common I/O traffic and offers reduced data for storage and network traffic. Additionally, the adapter has no impact on most I/O traffic and in some cases will have a positive effect. The adapter also enables good standard compression in cases where software overhead prevents it. To achieve the best performance gain, strive for data block sizes larger than 64 KB, or combine smaller blocks before sending them to hardware. The accelerated zlib library has a selectable buffering feature built-in as well. For a graphic of the full-height adapter, see Figure 87 on page 262

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power on.

The following are examples of typical applications that can benefit from compression acceleration:
- Store or transmit large amounts of data that average over 100 MB/s
- Applications that need a high average throughput of data compressed
- Handling high peak throughput of data when software compression is limited
- When low latency for individual compression streams is required and it is more difficult to run in parallel on many CPUs
- When the standard DEFLATE compression format is required for interchange as used in gzip, zlib, zip, or JAR (Software compression methods such as LZ4 or LZS with lower compression ratios and high bandwidth on CPUs are not an option in that case)
- Compression or a mix of compression and decompression is the main bottleneck (Decompression alone can sometimes still be done in software with many cores in parallel)

  Note: The adapter supports full speed decompression for all compliant compressed input regardless of whether it was compressed by hardware or software.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
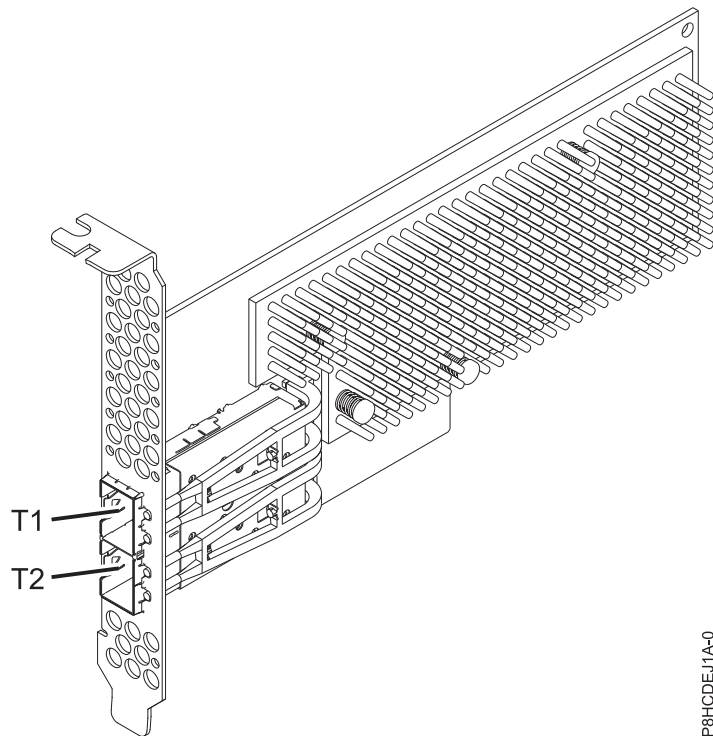
Figure 87. CAPI Compression Accelerator Adapter (Full-height)

Specifications

Item   Description

Adapter FRU number

00WT173 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe3 x8

Slot requirement

One PCIe x8 or x16 CAPI enabled slot per adapter

Supported Systems

POWER8® processor-based server

- 8247-21L, 8247-22L, and 8247-42L
- 8335-GCA and 8335-GTA
- 8348-21C

Voltage

12 V

Form factor

Short, with full-height tailstock (FC EJ1A)

Short, low-profile (FC EJ1B)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

High throughput compression that saves storage and I/O bandwidth with little or no overhead

CPU offload and CAPI interface with negligible software load frees up CPU cores for higher value computation or licensed software

Lower power consumption by offloading the CPU intensive compression to an FPGA

Widely used zlib and gzip standard format for data interchange

Up to 2 GB/s compression and decompression throughput

4-30x speed up achievable

Compression ratio near software zlib and gzip

Multiple uses including genomics, data center, cloud, and backup solutions

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux 7.2 LE, or later
  - Ubuntu 14.04.5, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - For additional information regarding firmware level and additional software installations, see Fix Central.
    - See the specific firmware level for 8335-GCA and GTA at Fix Central (8335-GCA and GTA).
    - See the specific firmware level for 8348-21C at Fix Central (8348-21C).
  - To use the CAPI Compression Accelerator Adapter, the following software packages must be downloaded at the IBM Service and Productivity Tools website (http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html):
    - genwqe-zlib: Hardware accelerated zlib
    - genwqe-tools: Tools to analyze adapter functionality plus hardware accelerated genwqe_gzip and genwqe_gunzip
  - For details on how the adapter can be used to accelerate your application, please refer to the CAPI Compression Accelerator Adapter user's guide published on IBM developerWorks (http://www.ibm.com/developerworks/).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe Cryptographic Coprocessor (FC EJ27, FC EJ28, and FC EJ29; CCIN 4765)

Learn about the specifications for the PCIe Cryptographic Coprocessor.

The PCIe Cryptographic Coprocessor adapters (feature codes (FC) EJ27, FC EJ28, and FC EJ29) provide the secure-key cryptographic accelerator and the Cryptographic Coprocessor functions in a single PCIe card. The coprocessor functions are targeted to banking and finance applications. The financial personal identification number (PIN) processing and Euro pay, Mastercard, Visa (EMV) credit card functions are provided. EMV is a standard for the integrated-chip based credit cards. The secure-key accelerator functions are targeted to improving the performance of Secure Sockets Layer (SSL) transactions. The FC EJ27, FC EJ28, and FC EJ29 provide the security and performance required to support emerging digital signature applications. The host application access to the cryptographic services of the FC EJ27, FC EJ28,

and FC EJ29 are by the Common Cryptographic Architecture (CCA) application programming interfaces (APIs) and by the Public-Key Cryptographic Standards (PKCS11). The FC EJ27, FC EJ28, and FC EJ29 provide secure storage of cryptographic keys in a tamper-resistant hardware security module, which is designed to meet FIPS PUB 140-2 on security requirements.

The FC EJ27, FC EJ28, and FC EJ29 are the same adapter but the different FCs indicate if a blind-swap cassette is used and the type of the cassette.

- FC EJ27 is not a blind-swap cassette
- FC EJ28 is a generation-3 blind-swap cassette
- FC EJ29 is a generation-4 blind-swap cassette

IBM PCIe Cryptographic adapter highlights:

- PCIe 4x standard height - half length
- Integrated Dual PPC processors
- ASIC (Accelerator engines)
- Supports the Common Cryptographic Architecture (CCA) application programming interfaces (APIs) and the Public-Key Cryptographic Standards (PKCS11) on the single firmware load.
- 3072, 4096 bit RSA CRT HW (including routing)
- SHA 256 required HW or firmware within secure module (including routing)
- Secure Key AES 128, 192, 256 bit keys
- Fast path – symmetric and asymmetric (secure and clear key)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Specifications and requirements

FRU number:
45D7948

RoHS compliant with server exemption

Placement information
To view information about the PCI adapter placement rules, see the PCI adapter placement topic collection for your system.

I/O bus architecture
PCI Express v1.1a

Storage

Shipping and storage temperature below -35°C ± 60°C (-31°F ± 140°F) or above 1°C ± 60°C (33.8°F ± 140°F) limits.

Operation (ambient in system)

This component collects and controls all the sensors to prevent the physical penetration and any abnormal environmental condition within its wide operational range of 10°C ± 35°C (50°F ± 95°F).

Tamper protection range
Outside of the tamper protection range limits of -38°C ±3°C (-41.8°F to -31°F) to +90°C ± 2°C (190.4°F to 197.6°F), the card will be permanently disable.

Handling requirements
Each PCIe Cryptographic Coprocessor includes a certified device key. This electronic key, which is stored in the adapter's battery-powered and protected memory, digitally signs status messages to confirm that the PCI Cryptographic Coprocessor is genuine and that no tampering has occurred.

If any of the secure module's tamper sensors are triggered by tampering or by accident, the PCIe Cryptographic Coprocessor erases all data in the protected memory, including the certified device key. Incorrect removal of the batteries triggers the tamper sensors and destroys the certified device keys. The PCI Cryptographic Coprocessor cannot operate without the certified device keys. To protect the keys, follow the guidelines given in the documentation provided with the coprocessor.

Attention: The batteries keep the coprocessor powered on even when it is not installed in a system. When handling, installing, or removing the adapter, do not let the adapter circuits come in contact with any conductive surface or tools. Doing so can render the adapter permanently inoperable.

Do not remove the batteries of the adapter. Data in the protected memory is lost when battery power is removed. For information about replacing the batteries, see the Installation Manual at the IBM Cryptocard website at http://www-03.ibm.com/security/cryptocards/.

Attention: While installing the coprocessor, observe the following precautions:
- The coprocessor is always powered by the batteries, even when it is not installed in the system.
- The battery power is necessary to keep the coprocessor operational.
- The loss of battery power or a voltage drop triggers a tamper event and permanently renders the coprocessor inoperable.
- Any short on the battery power distribution circuits causes a voltage drop and a tamper event.
- Do not lay the coprocessor on or cause the coprocessor to come in contact with any conductive surface.
- Do not strike the coprocessor circuits with metal or conductive tools.
- Use static-protective measures at all times when handling the coprocessor.

Related information:

➩ IBM Prerequisite website

➩ Installing, removing, or replacing PCIe adapters

⇥ PCIe adapter placement

⇥ PCIe adapter information by feature type

PCIe3 1.92 TB CAPI NVMe Flash Accelerator Adapter (FC EJ1K; CCIN 58CD)

Learn about the specifications and operating system requirements for the feature code (FC) EJ1K adapter.

Overview

The PCIe3 CAPI NVMe Flash Accelerator Adapter with 1.92 TB Flash Storage is a PCI Express (PCIe) generation 3 (Gen3) x8 adapter. The adapter must be placed in a POWER8® CAPI-capable PCIe3 x16 slot in the system. The PCIe3 CAPI NVMe Flash Accelerator Adapter acts as a co-processor for the POWER8® processor, and is designed to offload CPU access to built-in NVMe-attached flash storage. If the maximum write capability is achieved, the adapter's replacement or any NVMe M.2 module's replacement is not covered under IBM warranty or maintenance. In order for the adapter to function properly, all of the administration prerequisites must be satisfied and critical activities completed.

Important: Graphics processing units (GPUs) and Coherent Accelerator Processor Interface (CAPI) adapters cannot be replaced with the power turned on.

Additional information about the adapter:
- The adapter contains a CAPI accelerator and is connected to two NVMe drives.
- Each NVMe drive is presented as a separate volume to the operating system.
- Each volume is 960 GB totaling 1920 GB (1.92 TB) of flash per adapter.
- The adapter requires volumes to be formatted as 4096-byte sector drives.
- The adapter and its accompanying software libraries will not function with 512-byte sector drives.
- The adapter must be plugged into a direct host-bus PCIe CAPI-capable slot to function.
- Functionality of the adapter depends on operating system and software versions.
- Each of the two NVMe drives on the adapter has a separate drive life or durability meter.
- Linux kernel 4.4 or later is required to enable the adapter.
- Enabled applications must extend or leverage the IBM CAPI Flash libraries. For more information, programming guides, or sample code, see https://github.com/open-power/capiflash/ (https://github.com/open-power/capiflash)
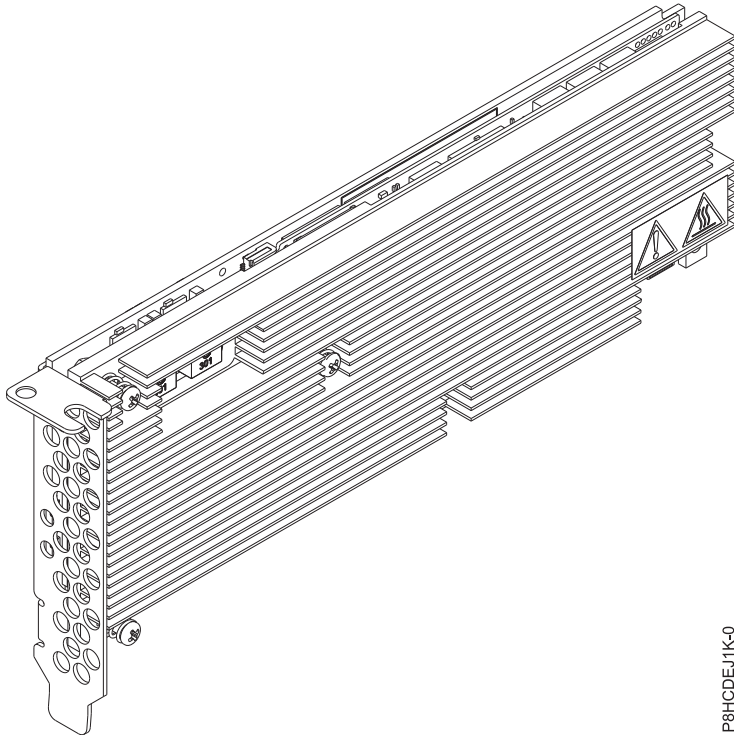
Figure 88. CAPI NVMe Flash Accelerator Adapter with 1.92 TB Flash Storage

Specifications

Item   Description

Adapter FRU number

01DH749 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe3 x8

Slot requirement

One CAPI-capable PCIe3 x16 slot

Supported Systems

POWER8® processor-based system

- 8335-GCA
- 8335-GTB
- 8247-21L and 8247-22L

Voltage

3.3 V, 12 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

Delivers high IOP and low CPU access to flash memory

Designed for read intensive workloads with light write activity

Two 960 GB M.2 NVMe modules with a write capacity of approximately 1,370 TB

Administering the adapter

Administration of the CAPI NVMe Flash accelerator adapters uses common software utilities with the CAPI Fibre Channel Accelerator (FC EJ16).

In order for the adapter to function properly, the following prerequisites must be met:
- The system firmware and operating system are installed and the virtualization configuration is complete.
- The IBM Data Engine for NoSQL User Libraries and AFU microcode are installed in the system default location /opt/ibm/capikv.
- One or more CAPI NVMe Flash accelerator adapters are plugged into CAPI-capable slots.
- The CAPI NVMe Flash accelerator adapter microcode is updated.

Checking Drive Write Durability or "Drive Endurance"

Each adapter contains two volumes of 960 GB. Each volume is a separate drive, with its own dedicated controller logic and write endurance. Each drive is warranted to a specific number of write cycles during its lifetime. Administrators must check the drive endurance meters built-in to each drive periodically.

Important: If any single drive on the CAPI NVMe Flash accelerator adapter write endurance indicator reaches 100%, the CAPI NVMe Flash accelerator adapter has exceeded its warranted life, and should be replaced.

To read the endurance indicator built-in to each drive on the adapter:
1. Find the drive's SCSI sgX identifier from cxlfstatus:

    username@hostname:~$ sudo /opt/ibm/capikv/bin/cxlfstatus

    [sudo] password for ubuntu:

    CXL Flash Device Status

    Output similar to the following example is displayed:

    Found 0601 0000:01:00.0 U78C9.001.RST0013-P1-C7

Device	SCSI	Block	Mode	LUN WWID
sg2:	1:0:0:0	sdb	legacy	60025380025382463300116000000000
sg3:	1:1:0:0	sdc	legacy	60025380025382463300116000000000

    Found 0601 0002:01:00.0 U78C9.001.RST0013-P1-C6

Device	SCSI	Block	Mode	LUN WWID
sg4:	2:0:0:0	sdd	legacy	60025380025382462300037000000000
sg5:	2:1:0:0	sde	legacy	60025380025382462300036000000000

2. To read the drive's endurance indicator, use the sg utilities **sg_logs**:

    uusername@hostname:/opt/ibm/capikv/afu$ sudo sg_logs –a /dev/sg2

    [sudo] password for ubuntu:

    IBM SAMSUNG MZ1LV960 301Q

    Output similar to the following example is displayed:

Supported log pages [0x0]:	
0x00	Supported log pages
0x0d	Temperature

Supported log pages [0x0]:	
0x11	Solid state media
0x2f	Informational exceptions (SMART)
0x19	General statistics and performance

- Temperature page [0xd]:
     Current temperature = 38 °C
     Reference temperature = 84 °C
- Solid state media page [0x11]:
     Percentage used endurance indicator: 12%

Important: The replacement of depleted NVMe Flash adapters is covered during the system warranty period. After the warranty period has expired, the cost that is incurred for the replacement of depleted CAPI NVMe Flash accelerator adapters is not covered under maintenance contracts, and is the responsibility of the customer.

Control access to the CAPI NVMe Flash accelerator

Use this command to enable an account to control access to the accelerator.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To control access to the CAPI NVMe Flash accelerator, complete the following step:

   Note: By default, installation of the IBM Data Engine for NoSQL software libraries creates a `cxl` user and adds `Udev` rules to restrict read and write access to the accelerator's volumes to members of the `cxl` system.

   a. To enable an account to read and write to the accelerator, add the account to the `cxl` by entering the following command:

      `sudo usermod -a -G cxl userid`

View the status of the CAPI NVMe flash accelerator

Use this command to view the status of each CAPI NVMe Flash accelerator adapter's logical unit numbers (LUN). The libraries of the IBM DataEngine for NoSQL software include scripts that display the status of the volumes mapped to the accelerator.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To view the status of each accelerator adapter's LUN, enter the following command:

   `sudo /opt/ibm/capikv/bin/cxlfstatus`

   Notes:
   - Volumes may be in either `legacy` or `superpipe` mode. The default mode is `legacy`.
   - Volumes must be in `superpipe` mode for exploitation by the CAPI Flash `block` or `arkdb` APIs.

Table 64. Coherent Accelerator Interface (CXL) Flash device

Device	SCSI	Block	Mode	LUN WWID
sg9:	33:0:0:0	sdc	legacy	60050768218b0818200000000400006e

Table 64. Coherent Accelerator Interface (CXL) Flash device (continued)

Device	SCSI	Block	Mode	LUN WWID
sg10:	33:1:0:0	sdd	superpipe	60050768218b0818200000000600006f
sg11:	34:0:0:0	sde	superpipe	60050768218b08182000000007000070
sg12:	34:1:0:0	sdf	superpipe	60050768218b0818200000000300006d

Table 64 on page 269 shows two accelerators, each with two ports, and a single volume mapped to each port's WWPN. One volume is in `legacy` mode, and three volumes are in `superpipe` mode. The WWID for each volume in the IBM FlashSystem are displayed for convenience of administration. This matches the WWID shown in the IBM FlashSystem GUI or CLI (`ibm@power8:~$ sudo /opt/ibm/capikv/bin/cxlfstatus`)

Set the mode for a volume

Use this command to set the mode for a volume.

Note: To run the commands in this section, you must have Linux Kernel 4.2.x, or later. For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

1. To set the mode for a volume, enter the following command:

   `sudo /opt/ibm/capikv/bin/cxlfsetlunmode <LUN> <Mode>`

   - An output similar to the following example is displayed:

     ```
     ibm@power8:~$ /opt/ibm/capikv/bin/cxlfsetlunmode
     60050768218b0818200000000400006e 1
     INFO: Adding LUN 60050768218b0818200000000400006e to Super IO table. SUCCESS
     ```

     – LUN modes might be 0 for `legacy` mode, or 1 for `superpipe` mode.
     – After a LUN is set to `superpipe` mode, all paths to that volume will also be set to `superpipe` mode.
     – As shown in Table 64 on page 269, each volume might be in either `legacy` or `superpipe` mode.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  – Ubuntu 16.04.1 or later
  – Red Hat Enterprise Linux (RHEL) 7.3, or later
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  – The latest version of enabling libraries and utilities may be downloaded from Fix Central.

Related information:

➔ IBM Prerequisite website

➔ Installing, removing, or replacing PCIe adapters

➔ PCIe adapter placement

➔ PCIe adapter information by feature type

PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter (FC EJ1P and EJ1N; CCIN 57B3)

Learn about the specifications and operating system requirements for the feature code (FC) EJ1P and EJ1N adapters.

Overview

FC EJ1P and EJ1N are both the same adapter with different tail stock brackets. FC EJ1N is a low-profile adapter and FC EJ1P is a full-height adapter. FC EJ1P and EJ1N are functionally identical to FC 5901 and 5278, but designates to IBM configurator tools that the usages are tape and DVD, not disk.

The PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter is a PCI Express (PCIe) generation 1 (Gen1), x8 adapter. The adapter is for high-performance, high-density, and serial attached SCSI (SAS) applications. It supports the attachment of SAS tape and DVD by using a pair of mini-SAS 4x connectors. The mini-SAS 4x connectors allow the adapter's eight physical links to be used in various narrow and wide-port configurations. The adapter can also be used for external tape drives, which are not supported on the newer and faster four-port 6 Gb PCIe3 adapters. The adapter does not have write cache.

The PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter is a 64 bit, 3.3 V, bootable SAS adapter.

Externally attached devices are designed to run at a data rate of 1.5 Gbps for serial ATA (SATA) devices, and 3 Gbps for SAS devices.
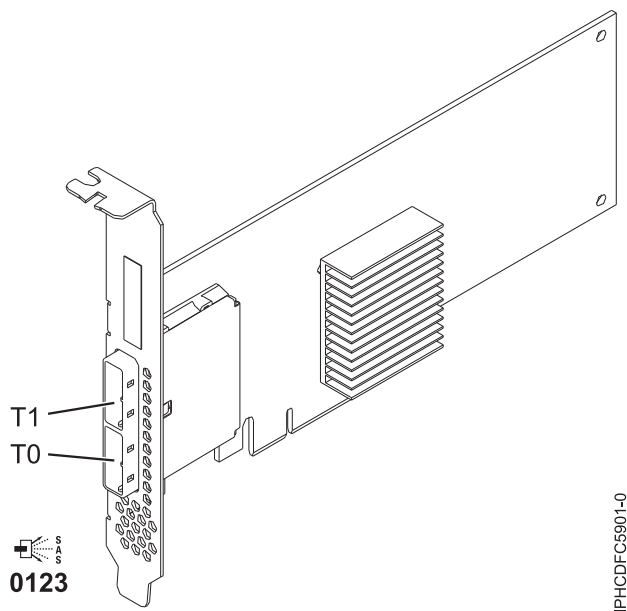
Figure 89. PCIe1 SAS Tape/DVD Dual-port 3 Gb x8 Adapter

Specifications

Item   Description

Adapter FRU number
> 44V4852 (Designed to comply with RoHS requirement)

I/O bus architecture
> PCIe1 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile (FC EJ1P)

Short, with full-height tailstock (FC EJ1N)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Two external mini-SAS 4x connectors provide attachment of SAS and Serial Advanced Technology Attachment (SATA) device enclosures
- SAS Serial SCSI Protocol (SSP), Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP)
- Removable media device supported
- Concurrent firmware update
- 440-500 Mhz PowerPC (PPC)

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX Version 7.2, or later.
  - AIX Version 7.1, or later.
  - AIX Version 6.1, or later.
- Linux
  - Red Hat Enterprise Linux 7.1, little-endian, or later.
  - Red Hat Enterprise Linux 7.1, or later.
  - Red Hat Enterprise Linux 6.5, or later.
  - SUSE Linux Enterprise Server 11 Server 12, or later.
  - SUSE Linux Enterprise Server 11 Server 11, Service Pack 3, or later.
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

This adapter requires the following drivers:

- AIX: devices.pci.1410bd02 device driver package
- Linux:

- iprutils version 2.4.1 and ipr driver version 2.0.11.6 (or later) for RHEL4 kernels
- iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for RHEL5 kernels
- iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for SLES10 kernels

Related information:

➜ IBM Prerequisite website

➜ Installing, removing, or replacing PCIe adapters

➜ PCIe adapter placement

➜ PCIe adapter information by feature type

4767-002 Cryptographic Coprocessor (FC EJ32 and EJ33 for BSC; CCIN 4767)

Learn about the specifications and operating system requirements for the feature code (FC) EJ32

Overview

The 4767-002 Cryptographic Coprocessor is a PCI Express (PCIe) generation 1 (Gen1) x4 adapter. The secure-key adapter provides both cryptographic coprocessor and cryptographic accelerator functions in a single PCIe card. The 4767-002 Cryptographic Coprocessor is suited to applications that require high-speed, security-sensitive, RSA acceleration, cryptographic operations for data encryption and digital signing. Additionally, the adapter is useful in secure management, use of cryptographic keys, or custom cryptographic applications. It provides secure storage of cryptographic keys in a tamper-responding hardware security module that is certified to meet FIPS 140-2 level 4 security requirements (certificate #3164). The adapter runs in dedicated mode only.

FC EJ32 and EJ33 are identical cards and have the same CCIN of 4767. The different feature codes indicate whether a blind swap cassette is used and the type of cassette. FC EJ32 is not a blind-swap cassette, while FC EJ33 indicates a generation 3 blind-swap cassette.
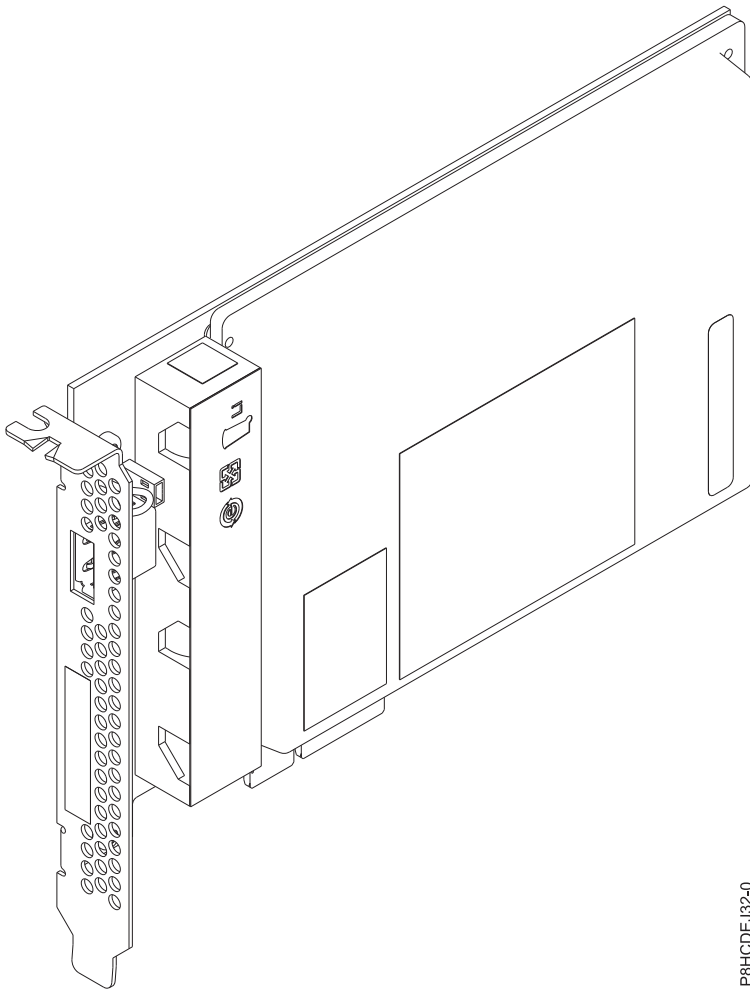
Figure 90. 4767-002 Cryptographic Coprocessor

Specifications

Item   Description
Adapter FRU number
    Not applicable
I/O bus architecture
    PCIe1 x4
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
    priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
    p8eab_mtm_pciplacement.htm) and select the system you are working on.
Supported Systems
    POWER8® processor-based server
    • 8247-21L, 8247-22L, and 8248-22A
    • 8247-42L
    • 9119-MME and 9119-MHE in the I/O drawer only
    • 9080-MME and 9080-MHE
Cables
    No cables are required
Voltage
    3.3 V

Form factor

Half-length, with full-height tail stock

Dual card (Mother-daughter)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

Supported cryptographic mode: Common Cryptographic Architecture (CCA)

PPC 476 Processors run in lockstep and the outputs of each core are compared cycle by cycle

Error Checking and Correction (ECC) protection on DDR3 memory

Cryptographic key generation and random number generation

Over 300 cryptographic algorithms and modes

Byte wide parity protection on all internal registers and data paths wider than two bits

RSA/ECC engines are protected by a duplicate engine which predicts the CRC of the result

SHA, MD5, AES and DES engines are protected by running the same operation on two independent engines and the outputs are compared cycle by cycle.

Performance

Table 65. 4767-002 Cryptographic Coprocessor Operation

Operation	Operations per second
AES-CBC 128 bit (1KB)	> 7K
PK-CRT 1024	> 5K
PK-CRT 2048	> 3.5K
Key Gen RSA CRT 1024 bit	> 30
Key Gen RSA CRT 2048 bit	> 7
Key Gen RSA CRT 4096 bit	> 0.6
Key Gen ECC-BP 192	> 750

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* AIX
  – AIX Version 7.2D, or later
  – AIX Version 7.1X, or later
* Linux:
  – Red Hat Enterprise Linux Version 7.3, or later
  – SUSE Linux Enterprise Server (SLES) 12 SP2, or later
  – Ubuntu 16.04.01, or later
* IBM i
  – IBM i 7.3, or later
  – IBM i 7.2, or later

Linux driver and firmware information

The 4767-002 Cryptographic Coprocessor's Linux drivers and firmware are not provided by the Linux distribution. To install and or update the Linux drivers and firmware, the user must download the Power Systems Linux drivers and firmware package. Refer to the IBM Power Systems information on the 4767-002 Cryptographic Coprocessor and follow the Linux drivers and firmware instructions at: Power Systems Information for the 4767-002 Cryptographic Coprocessor(https://www-03.ibm.com/security/cryptocards/pciecc2/overview.shtml).

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe LP 4 Gb 2-Port Fibre Channel Adapter (FC EL09; CCIN 5774)
Learn about the specifications and operating system requirements for the feature code (FC) EL09 adapter.

Overview

The PCIe LP 4 Gb 2-Port Fibre Channel adapter is a 64 bit, short form factor x4, PCIe adapter with an LC-type external fiber connector that provides single initiator capability over an optical fiber link or loop. The adapter automatically negotiates the highest data rate between the adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps of which the device or switch is capable. Distances between the adapter and an attaching device or switch can reach up to 500 meters running at 1 Gbps data rate, up to 300 meters running at 2 Gbps data rate, and up to 150 meters running at 4 Gbps data rate. When used with IBM Fibre Channel storage switches supporting longwave optics, the adapter can reach distances of up to 10 kilometers running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates.

The adapter can be used to attach devices either directly, or with Fibre Channel switches. If you are attaching a device or switch with an SC type fiber connector, you must use an LC-SC 50 micron fiber converter cable (FC 2456) or an LC-SC 62.5 micron fiber converter cable (FC 2459).

The adapter has the following features:
- Compliant with the PCIe Base and Card Electromechanical (CEM) 1.0a specifications:
  - x1 and x4 lane link interface at 2.5 Gbit/s (auto-negotiated with system)
  - Supports VC0 (1 Virtual Channel) and TC0 (1 Traffic Class)
  - Configuration and IO Memory read/write, completion, message
  - Support for 64-bit addressing
  - ECC error protection
  - Link CRC on all PCIe packets and message information
  - Large payload size: 2048 bytes for read and write
  - Large read request size: 4096 bytes
- Compatible with 1, 2, and 4 Gb Fibre Channel interface:
  - Auto-negotiate between 1 Gb, 2 Gb or 4 Gb link attachments
  - Support for all Fibre Channel topologies: point-to-point, arbitrated loop, and fabric
  - Support for Fibre Channel class 2 and 3
  - Maximum Fibre Channel throughput achieved by using full duplex hardware support
- End-to-end data path parity and CRC protection, including internal data path RAMs
- Architectural support for multiple upper layer protocols

- Internal high-speed SRAM memory
- ECC protection of local memory, includes single-bit correction and double-bit protection
- Embedded shortwave optical connection with diagnostics capability
- Onboard Context Management by firmware (per port):
  - Up to 510 FC Port Logins
  - Up to 2047 concurrent Exchanges
  - I/O multiplexing down to the FC Frame level
- Data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Link management and recovery handled by firmware
- Onboard diagnostic capability accessible by optional connection
- Parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- Performance up to 4.25 Gbps full duplex

The following figure shows the adapter.

Figure 91. EL09 adapter

Specifications

Item   Description
Adapter FRU number
     000E0807, 000E0904*

     * Designed to comply with RoHS requirement
Wrap plug FRU number
     12R9314
I/O bus architecture
     PCIe Base and Card Electromechanical (CEM) 1.0a

     x4 PCIe bus interface

Slot requirement

> One available PCIe x4, x8, or x16 slot

Voltage

> 3.3 V

Form factor

> Short, low-profile

FC compatibility

> 1, 2, 4 Gigabit

Cables

> 50/125 micron fiber (500 MHz*km bandwidth cable)
> - 1.0625 Gbps 0.5 – 500 m
> - 2.125 Gbps 0.5 – 300 m
> - 4.25 Gbps 0.5 – 150 m
>
> 62.5/125 micron fiber (200 MHz*km bandwidth cable)
> - 1.0625 Gbps 0.5 – 300 m
> - 2.125 Gbps 0.5 – 150 m
> - 4.25 Gbps 0.5 – 70 m

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 66 on page 279 summarizes normal LED states. There is a 1 Hz pause when the LED is off between each group of fast flashes (1, 2 or 3). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 66. Normal LED states

Green LED	Yellow LED	State
On	1 fast flash	1 Gbps link rate - normal, link active
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active

Power-On Self Test (POST) conditions and results are summarized in Table 67. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 67. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	On	POST failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Slow flash	Wake-up failure monitor	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Fast flash	POST failure	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
On	On	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Slow flash	Slow flash	Offline for download	None
Slow flash	Fast flash	Restricted offline mode, waiting for restart	None
Slow flash	Flashing	Restricted offline mode, test active	None
Fast flash	Off	Debug monitor in restricted mode	None
Fast flash	On	Not defined	None
Fast flash	Slow flash	Debug monitor in test fixture mode	None
Fast flash	Fast flash	Debug monitor in remote debug mode	None
Fast flash	Flashing	Not defined	None

Device ID jumper

The default setting for the two device ID jumpers labeled P0_JX and P1_JX is to set the jumpers on pins 1 and 2 as shown in Figure 92 on page 280. Do not change the jumper settings for a standard installation.
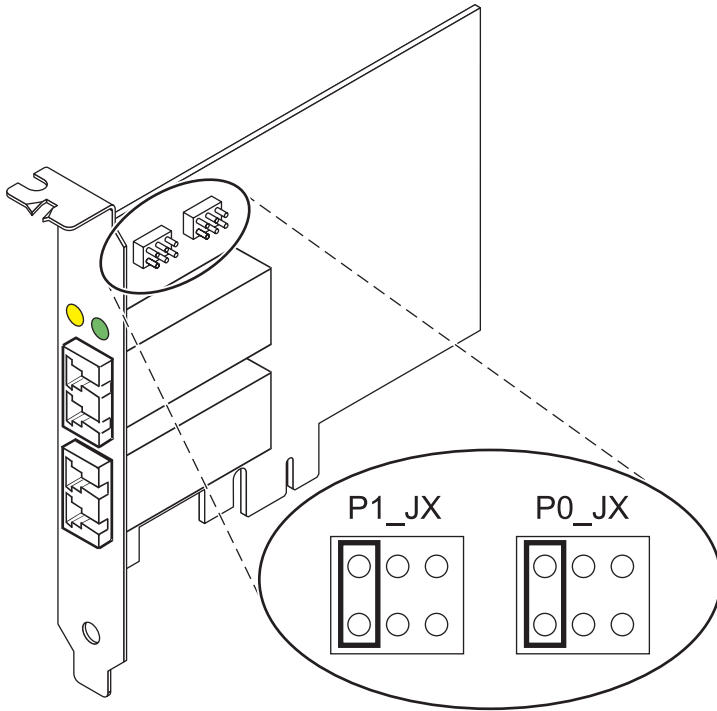
Figure 92. Device ID jumper

Replacing hot swap HBAs

Fibre Channel host bus adapters (HBAs) connected to a fiber array storage technology (FAStT) or DS4000 storage subsystem have a child device that is called a disk array router (dar). You must unconfigure the disk array router before you can hot swap an HBA that is connected to a FAStT or DS4000 storage subsystem. For instructions, see *Replacing hot swap HBAs* in the *IBM System Storage DS4000 Storage Manager Version 9, Installation and Support Guide for AIX, HP-UX, Solaris, and Linux on Power Systems Servers*, order number GC26-7848.

Related information:

↳ IBM Prerequisite website

↳ Installing, removing, or replacing PCIe adapters

↳ PCIe adapter placement

↳ PCIe adapter information by feature type

PCIe LP 2-x4-port SAS Adapter 3Gb (FC EL10; CCIN 57B3)
Learn about the specifications and operating system requirements for the feature code (FC) EL10 PCI Express (PCIe) adapter.

Overview

The PCIe LP 2-x4-port SAS Adapter 3Gb is a low-profile, short form factor adapter for high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk, tape, and DVD by using a pair of mini SAS x4 connectors which allow the eight physical links to be used in various narrow and wide-port configurations.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability. Some RAID level support is operating system dependent. The adapter provides RAID 0, RAID 5, RAID 6, and RAID 10 for the AIX and Linux operating systems. IBM i operating system provides mirroring and data

spreading capability. IBM i operating system does not support the RAID 5 and RAID 6 configurations for this adapter. The adapter does not have write cache. (The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter which provides write cache when using RAID 5 or RAID 6.)

The adapter can address up to 48 SAS disk drives, although the actual number of drives in a system is subject to the physical placement limitations of the system. Externally attached devices are designed to run at a data rate of 1.5 Gbps for serial ATA (SATA) devices, and 3 Gbps for SAS devices. This card supports RAID and non-RAID DASD, tape, and optical devices. This adapter supports the multi-initiator and high availability configurations in AIX and Linux. IBM i does not support feature EL10 in multi-initiator and high availability configurations.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

The EL10 supports SAS SFF disk drives located in a PCIe 12X I/O Drawer, or SAS disk drives located in an EXP 12S Disk Drawer, or SAS disk drives located in a supported POWER system unit (split disk backplane).

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Figure 93. PCIe LP Dual - x4 SAS adapter

Specifications

Item   Description
Adapter FRU number
    44V4852 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe
Slot requirement
    One available PCIe x8 slot

Cables

SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. For more information, see Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Two external mini SAS 4x connectors provide attachment of SAS and Serial Advanced Technology Attachment (SATA) device enclosures
- SAS Serial SCSI Protocol (SSP), Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP)
- RAID 0, 5, 6, 10

  The write performance of RAID 5 and RAID 6 can be poor on adapters that do not provide write cache. Consider using an adapter that provides write cache when using RAID 5 or RAID 6.
- Concurrent firmware update
- Removable media device supported (Removable media is not supported in multi-initiator and high availability configurations)
- Removable media device supported
- 440 - 500 Mhz PowerPC (PPC)
- Support for multi-initiator and high availability configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

This adapter is supported for the following versions of the Linux operating system, depending on the system you are using:

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 5.6, or later
- SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).

This adapter requires the following drivers:

- iprutils version 2.4.1 and ipr driver version 2.0.11.6 (or later) for RHEL4 kernels
- iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for RHEL5 kernels
- iprutils version 2.4.1 and ipr driver version 2.2.0.2 (or later) for SLES10 kernels

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➜ IBM Prerequisite website

➜ Installing, removing, or replacing PCIe adapters

➜ PCIe adapter placement

➜ PCIe adapter information by feature type

PCIe2 LP 2-Port 10GbE RoCE SFP+ Adapter (FC EL27; CCIN EC27)

Learn about the specifications and operating system requirements for the feature code (FC) EL27 adapters.

Overview

The FC EL27 PCIe2 LP 2-Port 10GbE RoCE SFP+ adapter is a low-profile adapter equivalent to the FC EC27.

The adapter is a PCIe generation-2 (PCIe2), dual port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the central processing unit (CPU) and providing enhanced performance. The two 10 Gb small form-factor pluggable (SFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length. The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
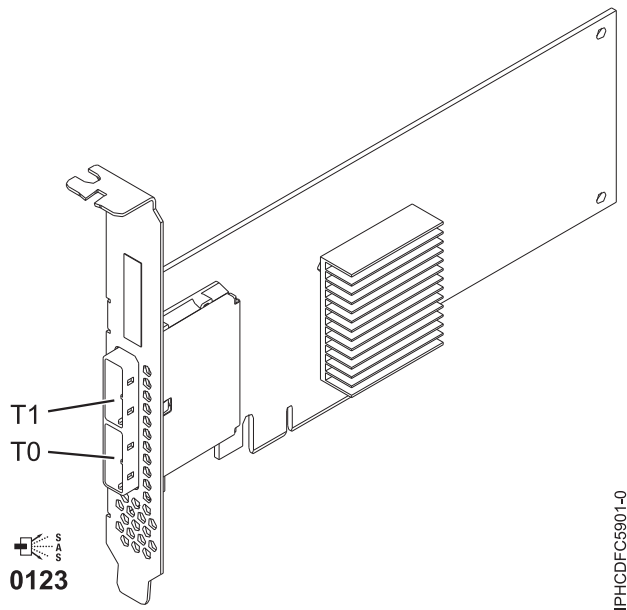
Specifications

Item   Description
Adapter FRU number
    74Y1988 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe2 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    See "Cables" on page 284 for details
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of the Linux operating system, depending on the system you are using:

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6.3, or later, with current maintenance updates available from Red Hat.
- SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
- Supported on Firmware level 7.6, or later
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 94 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 68 for details about the feature codes.

P7ECF505-0
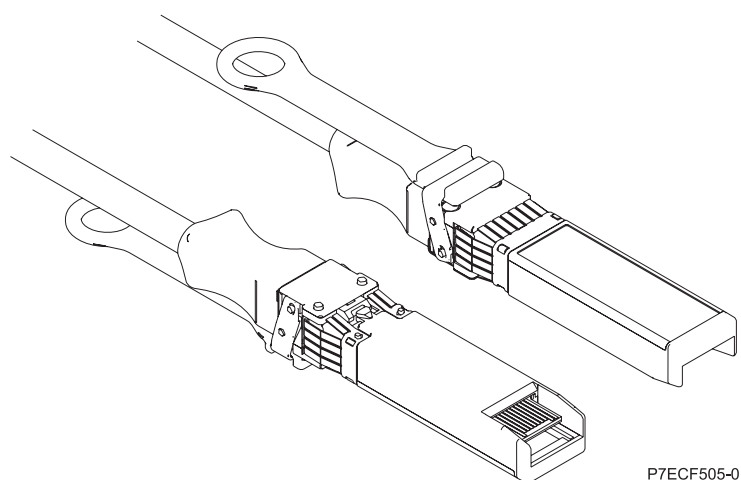
Figure 94. Top and bottom view of the cable

Table 68. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe LP 8 Gb 2-Port Fibre Channel Adapter (FC EL2N; CCIN 577D)

Learn about the specifications and operating system requirements for the feature code (FC) EL2N adapter.

Overview

The FC EL2N is a low-profile adapter. The PCIe LP 8 Gb 2-Port Fibre Channel Adapter is a high-performance adapter based on the Emulex LPe12002 PCIe Host Bus Adapter (HBA). Each port provides single initiator capability over a fiber link. The ports have LC type connectors that use shortwave laser optics. The adapter connects to Fibre Channel switches and operates at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed that the switch is capable of. LEDs on each port provide information about the status and link speed of the port.

N_Port ID Virtualization (NPIV) capability is supported through Virtual I/O Server (VIOS).

Figure 95 shows the adapter:
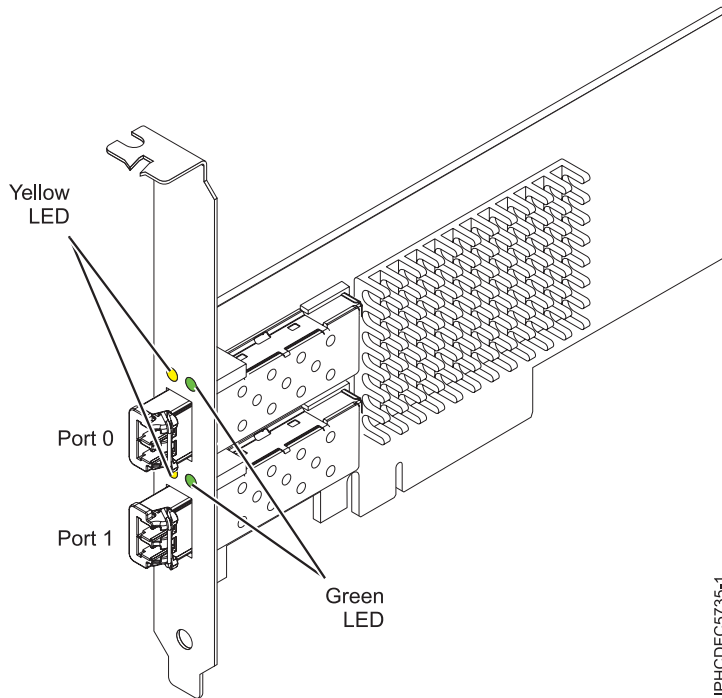
Figure 95. EL2N adapter

Adapter specifications

Item   Description
FRU number
          10N9824 (Designed to comply with RoHS requirement)

Wrap plug FRU number
> 12R9314

> **Note:** The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture
> PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0 x8 PCIe bus interface

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage
> 3.3 V

Form factor
> Short, low-profile

FC compatibility
> 2, 4, 8 Gigabit

Cables
> Cables are the responsibility of the customer.

> Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
> - OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
> - OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
> - OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

> Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 69. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6, or later
- Red Hat Enterprise Linux Version 5.6, or later
- SUSE Linux Enterprise Server Version 12, or later
- SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
- Ubuntu Server 14.04.3, or later
- Ubuntu 16.04.1 or later
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- PowerKVM
  - IBM PowerKVM 2.1 SP1, or later

Adapter LED

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation and yellow signifies port activity. Table 70 summarizes the link rate conditions. There is a 1-second pause when the LED is off between each group of fast flashes (2, 3, or 4). Observe the LED sequence for several seconds to be sure that you have correctly identified the state.

Table 70. Normal LED states

Green LED	Yellow LED	State
Slow flash	Off	Normal, link inactive or not started
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active
On	4 fast flashes	8 Gbps link rate - normal, link active

Power-on self test (POST) conditions and results are summarized in Table 71. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 71. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	On	POST failure (dead board)	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Slow flash	Wake-up failure monitor	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Fast flash	POST failure	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
On	On	Failure while functioning	Perform AIX, IBM i, or Linux operating system diagnostics procedure.
Slow flash	Slow flash	Offline for download	None
Slow flash	Fast flash	Restricted offline mode, waiting for restart	None

Table 71. POST conditions and results (continued)

Green LED	Yellow LED	State	Action to be taken
Slow flash	Flashing	Restricted offline mode, test active	None
Fast flash	Off	Debug monitor in restricted mode	None
Fast flash	On	Not defined	None
Fast flash	Slow flash	Debug monitor in test fixture mode	None
Fast flash	Fast flash	Debug monitor in remote debug mode	None
Fast flash	Flashing	Not defined	None

Replacing Fibre Channel adapters by using hot swap

When hot swapping Fibre Channel adapters, be aware that device-related software for the storage devices might have extra devices (for example, the disk array router (dar) device that is associated with the fiber array storage technology (FAStT) or DS4800) that need to be removed. See the specific storage device documentation for information about how to remove these additional devices.

The new adapter has a unique worldwide port name (WWPN). Check the zoning and logical unit number (LUN) assignments to ensure that the new adapter functions as expected.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 LP 2-port 10GbE SR Adapter (FC EL2P; CCIN 5287)
Learn about the specifications and operating system requirements for the feature code (FC) EL2P adapters.

Overview

The FC EL2P PCIe2 LP 2-port 10GbE SR adapter is the equivalent of the FC 5284.

The FC EL2P is a short, low-profile, high-performance, generation-2 PCIe adapter. This adapter provides two 10-Gb Ethernet ports that can be configured to run at 10 gigabits per second (Gbps). Each of the Ethernet ports can be connected by using a little connector (LC) duplex-type connector over a multi-mode fiber (MMF) 850 nm fiber cable up to 300 meters (984.25 feet) in length. The adapter conforms to the IEEE, 802.3ae 10GBASE-SR specification for Ethernet transmission.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
    74Y3242 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2.0 x8

Slot requirement

One PCIe x8 (low-profile) slot.

Cables

MMF 850 nm fiber cable are connected to LC duplex-type connectors.

Voltage

3.3-V

Form factor

Low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

- PCIe x8 Generation 2
- MSI-X and support of legacy pin interrupts
- 10GBASE-SR short-reach optics
- IEEE 802.3ae (10 GbE)
- IEEE 802.1p priority and 802.1Q VLAN tagging
- IEEE 802.3x flow control
- Link aggregation, 802.3ad 802.3 compliance
- IEEE 802.3ad load-balancing and failover
- Ether II and 802.3 encapsulated frames
- Multiple MAC addresses per interface
- Jumbo frames up to 9.6 Kbytes
- TCP checksum offload for IPv4
- TCP segmentation Offload (TSO) for IPv4
- UDP checksum offload for IPv4
- Receive side scaling and packet steering
- Line rate packet filtering and attack protection

The following figure shows the adapter.

Figure 96. Adapter

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

This adapter is supported for the following versions of the Linux operating system, depending on the system you are using:
- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6, or later
- SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 LP 2-Port 10 GbE RoCE SR Adapter (FC EL2Z; CCIN EC29)

Learn about the specifications and operating system requirements for the feature code (FC) EL2Z adapter.

Overview

The PCIe2 LP 2-Port 10 GbE RoCE SR adapter is a PCIe generation-2 (PCIe2), dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

The adapter has a preinstalled optical transceiver. Little connector (LC) type connectors connect the adapter to standard 10 Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
> 00E1600 (Designed to comply with RoHS requirement)

I/O bus architecture
> PCIe2 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> Supports standard 10 Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage
> 3.3 V

Form factor
> Short

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
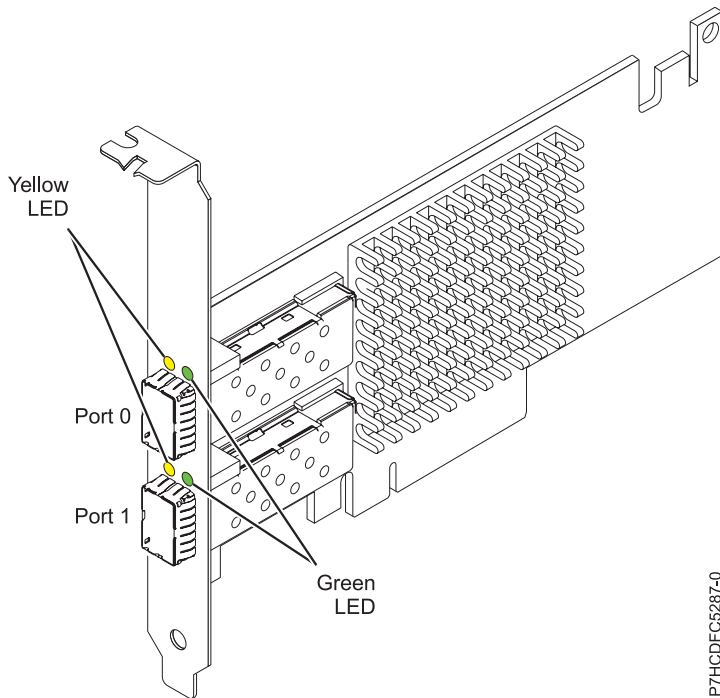
Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- – Red Hat Enterprise Linux Version 6.3, or later, with current maintenance updates available from Red Hat.
- – SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
- – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- Supported on Firmware level 7.6, or later
- PowerKVM
  - – IBM PowerKVM 2.1.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 2x10Gb FCoE 2x1GbE SFP+ Adapter (FC EL38; CCIN 2B93)

Learn about the specifications and operating system requirements for the feature code (FC) EL38 adapters.

Overview

The PCIe3 LP 2x10Gb FCoE 2x1GbE SFP+ Adapter is a PCI Express (PCIe) generation 3, low-profile capable adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both FCoE and network interface controller (NIC) functions are available for both FCoE ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE SR small form-factor pluggable (SFP+) ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 97 on page 293 shows the FC EL38 adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

Figure 97. FC EL38 adapter

Specifications

Item   Description
Adapter FRU number
    000E9284 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    12R9314 (for Fibre LC connector)

    10N7405 (for RJ45 connector)
I/O bus architecture
    PCIe3 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
    priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
    p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    SR SFP+ optical fiber cables and Cat5 Ethernet cables
Voltage
    3.3 V, 12 V
Form factor
    Short, regular sized bracket, low-profile capable
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter
    placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
    p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 14.04.3, or later
  - Linux Ubuntu 16.04, or later
- PowerKVM
  - IBM PowerKVM 2.1 SP1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe LP 2-Port 10 GbE SFN6122F Adapter (FC EL39; CCIN EC2G)

Learn about the specifications and operating system requirements for the feature code (FC) EL39 adapters.

Overview

The FC EL39 PCIe LP 2-Port 10 GbE SFN6122F adapter is a low-profile adapter.

The adapter is a PCIe generation-2 (PCIe2), dual-port, 10-Gigabit Ethernet (GbE) adapter with a PCIe 2.0 host bus interface. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by instantiating protected virtual network interface controller (vNIC) interfaces for each running guest operating system or application, which gives it a direct pipeline to the Ethernet network. This architecture provides the most efficient way to maximize network and processor efficiency. The adapter supports Solarflare OpenOnload (http://support.solarflare.com/oem/ibmpower) for environments that require high performance and low latency. You can download the Solarflare NET drivers that support this adapter, from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

The two 10 Gb small form-factor pluggable (SFP+) transceiver ports are used for connectivity with other servers or switches in the network. Each SFP+ port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps), and uses the SFP+ copper twinaxial cables up to 5 m (16.4 ft) in length.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
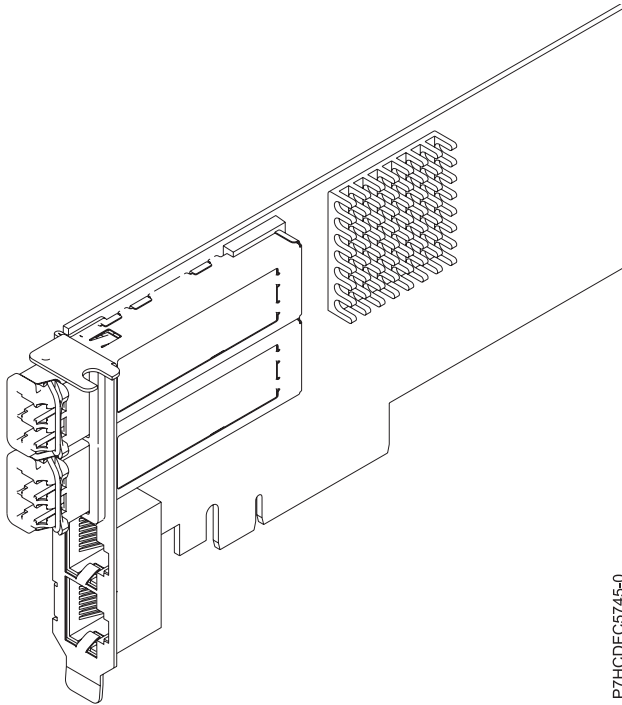
Figure 98. FC EL39 adapter

Specifications

Item   Description
Adapter FRU number
      00E8224 (Designed to comply with RoHS requirement)
I/O bus architecture
      PCIe2 x8
Slot requirement
      For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
      priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
      p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
      For details, see "Cables" on page 296.
Voltage
      3.3 V
Form factor
      Short
Maximum number
      For details about the maximum number of adapters that are supported, see PCIe adapter
      placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
      p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system
you are using:

- Linux

- Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
- Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Note: OpenOnload and performance optimized drivers are available for download directly from the Solarflare Support Site (http://support.solarflare.com/oem/ibmpower).

- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 99 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 72 for details about the feature codes.

P7ECF505-0
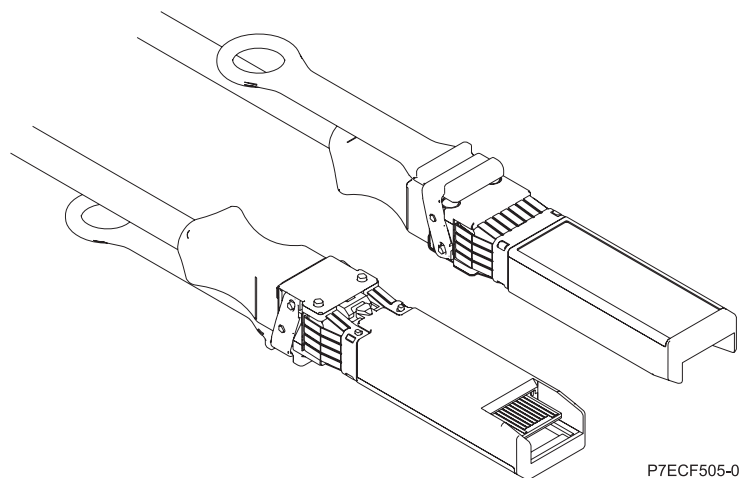
Figure 99. Top and bottom view of the cable

Table 72. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

PCIe3 RAID SAS quad-port 6 Gb LP Adapter (FC EL3B; CCIN 57B4)

Learn about the specifications and operating system requirements for the feature code (FC) EL3B adapter.

Overview

The PCIe3 RAID SAS quad-port 6 Gb LP Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter that has a low-profile and short-form factor. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk and SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 100 on page 298 shows the PCIe3 RAID SAS quad-port 6 Gb LP Adapter.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability, and system level mirroring via the operating system. The adapter provides both single and dual RAID controller configurations. Dual controller configurations (dual storage IOA) must run RAID. JBOD (512 byte) functionality is supported only in a single controller configuration based on the operating system. Best performance is achieved when multiple RAID sets are configured and optimized under a pair of adapters in a high availability, multi-initiator RAID configuration (dual storage IOA) which allows for an Active-Active mode of operation.

The adapter support a maximum of 98 attached disk devices that depends on the drive enclosure attached. A maximum of 48 devices can be solid-state devices (SSDs). Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS disk devices and 3 Gbps for SAS tape devices. This adapter supports RAID and non-RAID DASD, and SAS tape devices. Specific device attachment support rules apply. This adapter supports the multi-initiator and high availability (dual storage IOA) configurations in AIX, IBM i, and Linux partitions. This adapter enables configuring the SAS drives as dedicated hot-spares with equal or higher capacity.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 100 on page 298 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.
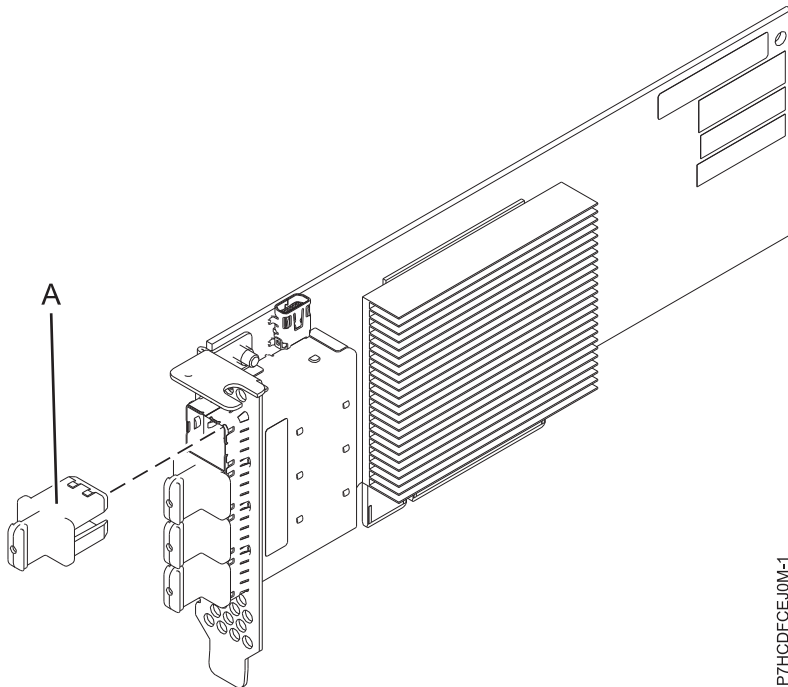
Figure 100. PCIe3 RAID SAS quad-port 6 Gb LP Adapter

Specifications

Item   Description

Adapter FRU number

> 000MH910 (Designed to comply with RoHS requirement)

Connector plug part number

> 00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture

> PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement

> One available PCIe x8 slot per adapter.

Cables

> Specific X, YO, AA, or AT SAS cable features with new narrow HD connectors are used to attach to the other adapter or disk expansion drawers.
>
> SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. Specific AE1 or YE1 SAS cable features are required for SAS Tape attachment. See Serial attached SCSI cable planning.

Voltage

> 3.3 V

Form factor

> Short, low-profile but packaged for full-height installations.

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

> - Four external mini SAS HD 4x connectors provide attachment of SAS device enclosures
> - SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)

- RAID 0, 5, 6, or 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is supported in a single controller configuration only.
- Concurrent firmware update
- Removable media device (SAS Tape) are supported in a single controller configuration only and cannot be combined with disk devices attached to the same adapter. Removable media is not supported in multi-initiator and high availability (dual storage IOA) configurations
- Support for multi-initiator and high availability or single controller configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
- Supported on Firmware level 7.8, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 4-port (10Gb FCoE and 1GbE) Copper and RJ45 Adapter (FC EL3C; CCIN 2CC1)

Learn about the specifications and operating system requirements for the feature code (FC) EL3C adapters.

Overview

The PCIe3 LP 4-port (10Gb FCoE and 1GbE) Copper and RJ45 Adapter is a PCI Express (PCIe) generation 2, low-profile adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the

FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Copper Twin-axial ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 101 shows the FC EL3C adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter is SR-IOV (Single Root I/O Virtualization) capable. The adapter can function as a boot adapter. The adapter supports all Fibre Channel and Ethernet topologies.
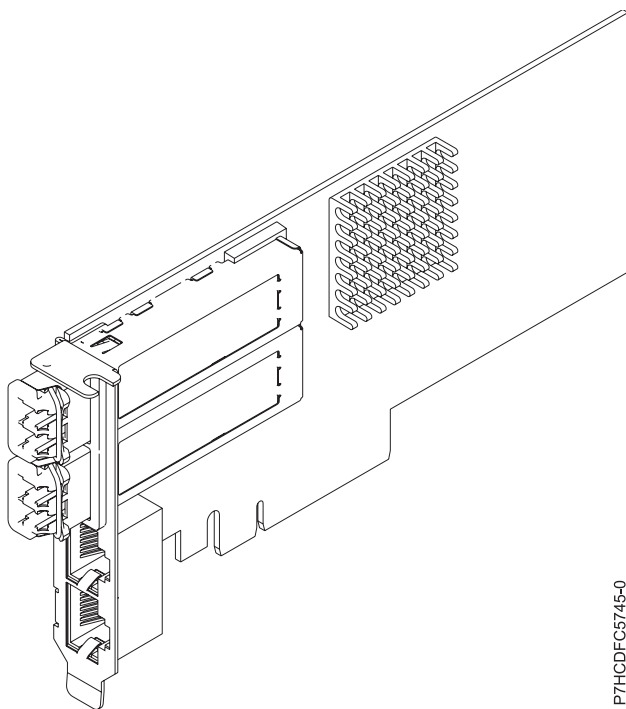
Figure 101. FC EL3C adapter

Specifications

Item   Description
Adapter FRU number
    00E8140 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    74Y7010

    10N7405

    Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.
I/O bus architecture
    PCIe3 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot

priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

SR SFP+ Copper Twinax and Cat5 Ethernet cables

Voltage

3.3 V, 12 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter
placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

This adapter is supported for the following versions of the Linux operating system, depending on the
system you are using:

• Linux
  – Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red
    Hat.
  – Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates
    available from Red Hat.
  – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red
    Hat.
  – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates
    available from SUSE.
  – SUSE Linux Enterprise Server Version 12, or later
  – Linux Ubuntu 14.04.3, or later
  – Linux Ubuntu 16.04, or later

For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/
lopdiags/info/LinuxAlerts.html).

The latest version of the device driver or iprutils can be downloaded from the IBM Service and
Productivity Tools website(http://www.ibm.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 2-port 56 Gb FDR IB Adapter x16 (FC EL3D; CCIN 2CE7)

Learn about the specifications and operating system requirements for the feature code (FC) EL3D adapter.

Overview

The PCIe Gen3 low profile x16 2-port FDR Infiniband adapter provides high speed connectivity with other servers or IB switches. Each port maximum of 56Gb assumes no other system and/or switch bottlenecks are present. The x16 adapter allows full bandwidth in a PCIe Gen3 slot.

The two 56 Gb ports have QSFP+ connections which support industry standard FDR cables, either FDR DAC cables, or FDR optical. One adapter can support either or both types of cable. The user can choose to cable up just one port if they desire.
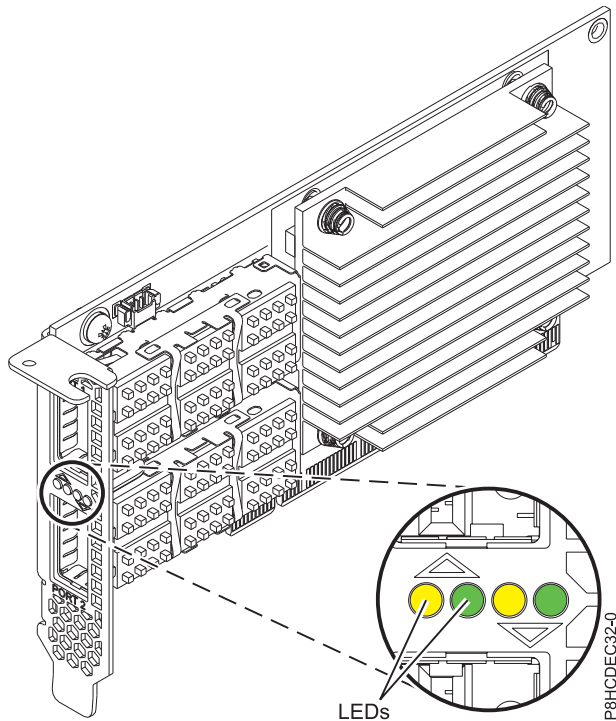
Figure 102. FC EL3D adapter

Note: The LEDs that are shown in Figure 102 indicate the following states:
- A lit solid amber LED (left LED) indicates a good physical link.
- A flashing amber LED (left LED) indicates a problem with the physical link.
- If neither the amber LED (left LED) or the green LED (right LED) is lit, then the physical link has not been established.
- The amber LED (left LED) turns off when the logical link is established.
- A lit solid green LED (right LED) indicates a valid logical (data activity) link without data transfer.
- A flashing green LED (right LED) indicates a valid logical link with data transfer.
- If only the amber LED (left LED) is lit and the green LED (right LED) is off, then the logical link has not been established.

Specifications

Item   Description
Adapter FRU number
00RX852 (Designed to comply with RoHS requirement)

Low-profile tailstock part number: 00ND499

I/O bus architecture
> PCIe x16

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> No cables required.

Voltage
> 3.3 V

Form factor
> Short

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux:
  - Red Hat Enterprise Linux Version 7, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 x8 cache SAS RAID internal adapter 6Gb (FC EL3U; CCIN 57D8)

Learn about the specifications and operating system requirements for the high-function PCIe3 x8 cache SAS RAID internal adapter 6Gb (CCIN 57D8) that is integrated with the composite storage backplane (feature code (FC) EL3U) in the 8247-21L or 8247-22L.

Overview

The expanded function PCIe3 x8 cache SAS RAID internal adapter 6Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter that is integrated in the 8247-21L or 8247-22L. The PCIe3 x8 cache SAS RAID internal adapter 6Gb is a composite feature of the high-function storage backplane (FC EL3U). The adapter contains the SAS RAID controller and SAS Expander ports.

A pair of the high-function internal adapters is preinstalled in the dedicated internal PCIe3, x8 slots, P1-C14 and P1-C15 in the 8247-21L or 8247-22L. The high-function composite storage feature (FC EL3U) provides the following features:

- A high-function storage backplane (CCIN 2B5A) that provides slots for eight numbers of 6.35 cm (2.5 inches) SFF disks and six numbers of 1.8 inches SSDs. This backplane also supports a slim DVD media bay.
- A pair of the high-function PCIe3 cache SAS RAID internal adapters (CCIN 57D8) that are installed in the slots P1-C14 and P1-C15.
- A pair of Backup power supply cards (also called capacitor card) and card cage that is installed in the slots P1-C14-C1 and P1-C15-C1.

- Two mini-SAS HD cables that attach to the high-function storage backplane.
- A mini-SAS HD cable with two external SAS ports that is installed in the system rear bulkhead in the slot P1-C8.

Alternatively, you can upgrade your system that has the storage backplane FC EL3T to a high-function system by ordering the composite high-function storage backplane feature (FC EL3U).

The PCIe3 x8 cache SAS RAID internal adapter 6Gb has a data read or write speed of 6 Gbps and a real write cache of 2 GB. With a 4:1 cache compression, this high-function adapter provides an increased cache of 8 GB and increases the storage system performance. The write cache contents are protected against power loss with flash memory and super capacitors and removes the need for cache battery.

The two mini-SAS HD cables connect each of the PCIe3 x8 cache SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. The high-function internal adapters supports both the drives (SFF and SSDs) to be used in a RAID configuration. The supported RAID configurations include, RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2. The second PCIe3 x8 cache SAS RAID internal adapter 6Gb in slot P1-C15 controls the slim DVD bay. The high-function storage backplane does not support the split storage backplane configuration.

Each of the internal adapters provides a mini-SAS HD connector that attaches to a mini-SAS HD cable (YO) and provided with two external SAS ports on the other end. In the 8247-21L or 8247-22L, the external SAS ports are installed in slot P1-C8. The external SAS port is used to attach the FC EL1S drive enclosure. Only one EL1S drive enclosure is supported by the high-function internal adapter pair.

Systems running the Linux operating system support both adapters RAID controllers that are owned by the same or different partitions. Linux also provide mirroring (logical volume manager (LVM)) capabilities. The dual controllers support the Easy Tier function that enables the controllers to automatically move hot data to attached SSDs and cold data to attached HDDs in the Linux systems.
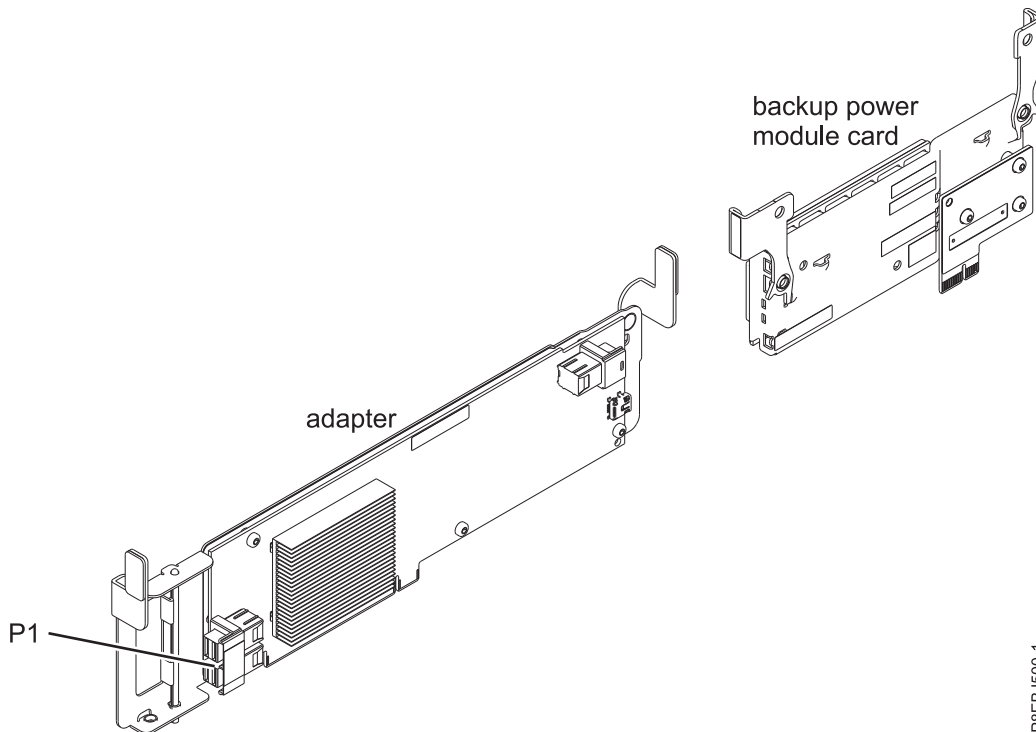
Figure 103. PCIe3 x8 cache SAS RAID internal adapter 6Gb

Specifications

Item   Description

Adapter CCIN number
> 57D8

I/O bus architecture
> PCIe3 x8

Slot requirement
> Internal PCIe3 slot with x16 connector and x8 bus signaling per adapter.
>
> High-function configuration: Two adapters are installed in slot P1-C14 and P1-C15.

Cables
> Two mini-SAS HD cables that are supplied with the adapter. A SAS cable (YO) with mini-SAS connectors and external SAS ports can be attached to the high-function internal adapters.

Voltage
> 12 V

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  - Red Hat Enterprise Linux, SUSE Linux Enterprise Server, and Ubuntu
    - Red Hat Enterprise Linux 7.2, little-endian, or later
    - Red Hat Enterprise Linux 7, or later, with current maintenance updates available from Red Hat
    - Red Hat Enterprise Linux 6.5, or later, with current maintenance updates available from Red Hat
    - SUSE Linux Enterprise Server 12, or later
    - SUSE Linux Enterprise Server 11 Service Pack 3, or later, with current maintenance updates available from SUSE
    - Ubuntu Server 16.04, or later
    - Ubuntu Server 14.04.3, or later
  - PowerKVM
    - PowerKVM 3.1 Systems (indicated by #EC40): Virtualized for Red Hat Linux, SUSE Linux or Ubuntu Server
    - PowerKVM 2.1.1, or later (#EC20): Virtualized for Red Hat Linux, SUSE Linux or Ubuntu Server
    - KVM on Power Systems (indicated by #EC70): Not supported
  - Bare Metal Systems
    - Bare Metal Systems (indicated by #EC16): Not supported

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 x8 SAS RAID internal adapter 6Gb (FC EL3V; CCIN 57D7)

Learn about the specifications and operating system requirements for the PCIe3 x8 SAS RAID internal adapter 6Gb (CCIN 57D7) that is integrated with the storage backplane (feature code (FC) EL3T) in the 8247-21L or 8247-22L. Adding of another PCIe3 x8 SAS RAID internal adapter 6Gb (FC EL3V) enables the storage backplane to be configured as a split storage backplane in the 8247-21L or 8247-22L.

Overview

The PCIe3 x8 SAS RAID internal adapter 6Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter that is integrated in the 8247-21L or 8247-22L. The PCIe3 x8 SAS RAID internal adapter 6Gb is a composite feature of the storage backplane FC EL3T. The adapter contains the SAS RAID controller and SAS Expander ports. The PCIe3 x8 SAS RAID internal adapter 6Gb is preinstalled in the dedicated internal PCIe3, x8 slot P1-C14 in the 8247-21L or 8247-22L

Adapter caching

The PCIe3 x8 SAS RAID internal adapter 6Gb does not have a non-volatile write cache. However, Linux customers can take advantage of a volatile adapter write cache of up to 1 Gb (compressed) for improved performance. This support is available with the 2.4.10 version of iprutils available from the IBM Linux Power Tools Repository (http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/yum.html) and with the latest adapter firmware available from the Fix Central website (http://www.ibm.com/support/fixcentral/)

Single adapter configuration

This configuration of the storage backplane in the 8247-21L or 8247-22L with one PCIe3 x8 SAS RAID internal adapter 6Gb supports 12 numbers of 6.35 cm (2.5 inches) , small form-factor (SFF) hard disk drives (HDDs) or solid-state drives (SSDs). FC EL3T also supports a slim DVD bay. The PCIe3 x8 SAS RAID internal adapter 6Gb supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. Two mini-SAS HD cables connect the PCIe3 x8 SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. This configuration with one PCIe3 x8 SAS RAID internal adapter 6Gb does not split the disks in the storage backplane.

Two adapters configuration

To enable the split storage backplane, another PCIe3 x8 SAS RAID internal adapter 6Gb (FC EL3V) must be installed in the other dedicated internal PCIe3, x8 slot P1-C15. The same backplane as in FC EL3T is used in the split storage backplane configuration. The two mini-SAS HD cables connect each of the PCIe3 x8 SAS RAID internal adapter 6Gb to the two SAS ports on the storage backplane. The 12 drives are then split into two sets of six drives (HDDs or SSDs), each controlled by one PCIe3 x8 SAS RAID internal adapter 6Gb. The split storage backplane configuration supports the drives to be used as just-a-bunch of disks (JBOD) or as a RAID. The supported RAID is RAID 0, 5, 6, and 10. The second PCIe3 x8 SAS RAID internal adapter 6Gb in slot P1-C15 controls the slim DVD bay. The split storage backplane does not support the mixing of HDDs and SSDs in the same RAID.

Systems running the Linux operating system support both adapters RAID controllers that are owned by the same or different partitions. The controllers provide RAID 0, RAID 5, RAID 6, and RAID 10 configurations for systems that are running the Linux operating system. Linux also provide mirroring (logical volume manager (LVM)) capabilities.

Figure 104 on page 307 shows the PCIe3 x8 SAS RAID internal adapter 6Gb.
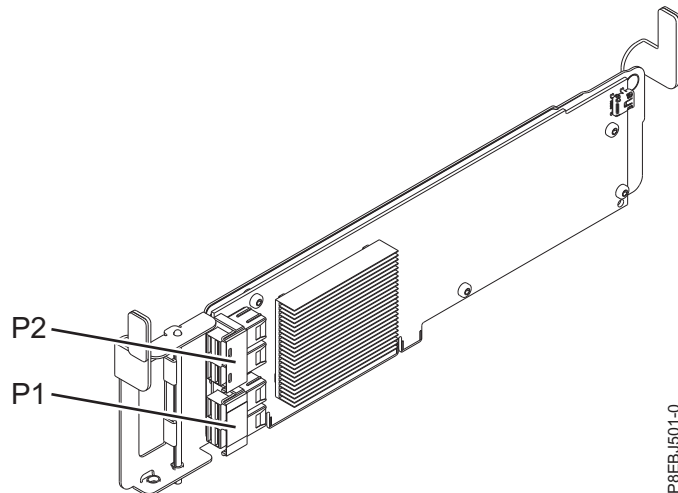
Figure 104. PCIe3 x8 SAS RAID internal adapter 6Gb

Specifications

Item   Description
Adapter CCIN number
> 57D7

I/O bus architecture
> PCIe3 x8

Slot requirement
> Internal PCIe3 slot with x16 connector and x8 bus signaling per adapter.
>
> Base configuration: Adapter is preinstalled in slot P1-C14.
>
> Split storage backplane configuration: Second adapter is installed in slot P1-C15.

Cables
> Two mini-SAS HD cables that are supplied with the adapter.

Voltage
> 12 V

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
- Bare Metal Systems (Indicated by FC EC16)
  - Red Hat Enterprise Linux Version 7.2, little-endian, or later
  - Ubuntu Server 16.04, or later
  - Ubuntu Server 14.04.3, or later
- IBM PowerKVM 3.1 Systems (Indicated by FC EC40) or PowerKVM 2.1 (Indicated by FC EC20)
  - Virtualized resources to Red Hat Linux, SUSE Linux, and Ubuntu Server
- Other environments
  - Red Hat Enterprise Linux Version 7, or later
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 12, or later
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.

– Ubuntu Server 16.04, or later
  – Ubuntu Server 14.04.3, or later
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 x8 cache SAS RAID internal adapter 6 Gb (FC EL3W; CCIN 57DC) in the IBM Elastic Storage Server

Learn about the specifications and operating system requirements for the PCIe3 x8 cache SAS RAID internal adapter 6 Gb (CCIN 57DC) that is integrated with the composite storage backplane (feature code (FC) EL3W) in the IBM Elastic Storage Server.

Overview

The high performance PCIe3 x8 cache SAS RAID internal adapter 6 Gb is an internal PCI Express generation-3 (PCIe3), serial-attached SCSI (SAS) Random Array of Independent Disks (RAID) adapter integrated in the Elastic Storage Server offering. The PCIe3 x8 cache SAS RAID internal adapter 6 Gb is part of a composite feature of the storage backplane (FC EL3W). The adapter contains the SAS RAID controller and SAS Expander ports.

The high performance internal adapter is pre-installed in the dedicated internal PCIe3, x8 slot P1-C14 in the IBM Elastic Storage Server. The composite storage feature (FC EL3W) provides the following features:

- A high performance storage backplane (CCIN 2B5A) that provides slots for 8 numbers of 2.5 inches small form-factor (SFF) hard disk drives (HDDs) or solid-state drives (SDDs) and 6 of 1.8 inches SSDs. This backplane also supports a slim DVD media bay.
- A PCIe3 cache SAS RAID internal adapter (CCIN 57DC) is installed in the slot P1-C14.
- One mini-SAS HD cable that attaches to the high performance storage backplane.

The PCIe3 x8 cache SAS RAID internal adapter 6 Gb has a data read-write speed of 6 Gbps and a real write cache of 2 GB. With a 4:1 cache compression, this high performance adapter provides an increased cache of 8 GB and increases the storage system performance. The write cache contents are protected against power loss with flash memory and super capacitors and removes the need for cache battery.

One mini-SAS HD cable connects the PCIe3 x8 cache SAS RAID internal adapter 6 Gb to the SAS port on the storage backplane. The high performance internal adapter supports both the drives (SFF and SSDs) to be used in a Dual Storage IOA RAID configuration. The supported RAID configurations include: RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2.

Figure 105 on page 309 shows the PCIe3 x8 cache SAS RAID internal adapter 6 Gb.
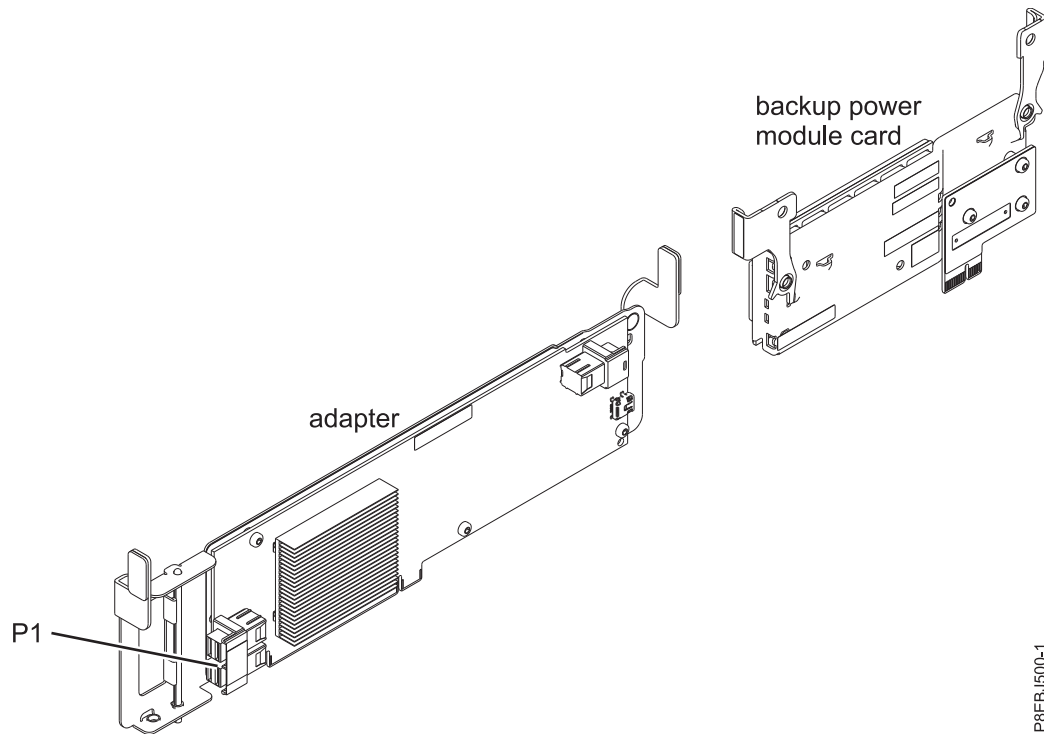
Figure 105. PCIe3 x8 cache SAS RAID internal adapter 6 Gb

Specifications

Item   **Description**
Adapter CCIN number
      57DC
Adapter FRU number
      00WV511 (Designed to comply with RoHS requirement)
I/O bus architecture
      PCIe3 x8
Slot requirement
      Internal PCIe3 slot with x16 connector and x8 bus signalling.

      Adapter is installed in slot P1-C14.
Cables
      One mini-SAS HD cable part number 00RR483 connects the lower storage backplane connector
      (J1) to the P1 connector on the PCIe3 x8 cache SAS RAID internal adapter 6 Gb in slot P1-C14.
Voltage
      12 V

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:

- Linux
  - Red Hat Enterprise Linux Version 7, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/
    lopdiags/info/LinuxAlerts.html).

Related information:

➭ IBM Prerequisite website

➭ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LP 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EL3X; CCIN 57BC)

Learn about the specifications and operating system requirements for the feature code (FC) EL3X adapter.

Overview

The PCIe3 2-Port 10 GbE NIC and RoCE SR adapter is a PCIe generation-3 (PCIe3), full-height, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter provides two 10 Gb SFP+ ports for copper twinax cabling. These cables also include copper transceivers. The adapter is a converged network adapter supporting both NIC and IBTA RoCE standard. RoCE is Remote Direct Memory Access (RDMA) over Converged Ethernet. Using RoCE, the adapter can support significantly greater bandwidth with low latency and minimize CPU overhead by more efficiently using memory access. This offloads the CPU from I/O networking tasks, improving performance and scalability.

Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A copper transceiver is included with these cables. See "Cables" on page 311 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 106 on page 311 shows the FC EL3X adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  – AIX NIM and Linux Network Install are supported
  – IBTA RoCE v2 support
  – IEEE 802.3ae in the 10 GbE ports
  – 802.3ab in the 1 GbE ports
  – Ether II and IEEE 802.3 for encapsulated frames
  – 802.1p for setting up priority levels in tagged VLAN frames
  – 802.1Q for VLAN tagging
  – 802.3x for flow control
  – 802.3ad for load-balancing and failover
  – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 106. FC EL3X adapter

Specifications

Item   Description

Adapter FRU number

00RX859 (Designed to comply with RoHS requirement)

Low-profile tailstock: 00RX856

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" for details.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 107 on page 312 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 73 for details about the feature codes.

Figure 107. Top and bottom view of the cable

Table 73. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

PCIe adapter information by feature type

PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter (FC EL3Z; CCIN 2CC4)

Learn about the specifications and operating system requirements for the feature code (FC) EL3Z adapter.

Overview

The PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile adapter. The adapter provides two 10 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability. Figure 108 on page 314 shows the FC EL3Z adapter.

The ports default to auto negotiate the highest speed either at 10 Gb (10G BaseT), 1Gb (1000 BaseT), or 100 Mb (100 BaseT) full duplex. Each RJ45 port can be configured independent of the other port. Each RJ45 port is connected with a 4-pair, CAT-6A cable, and is supported for distances of up to 100 meters.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb RJ45 ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
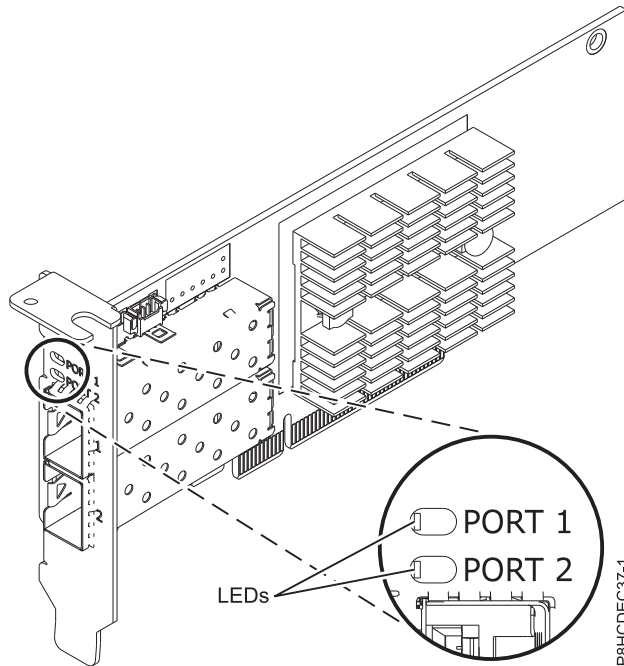
Figure 108. FC EL3Z adapter

Specifications

Item   Description
Adapter FRU number
> 00E2714 (Designed to comply with RoHS requirement)
>
> Regular-height tailstock part number: 00E2862
>
> Low-profile tailstock part number: 00E2721

Wrap plug FRU number
> 10N7405 (RJ45 wrap plug)
>
> **Note:** Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture
> PCIe2 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> CAT-6A cable

Voltage
> 3.3 V

Form factor
> Short, low-profile

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* Linux
  – Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
* PowerKVM
  – IBM PowerKVM 2.1.1, or later

This adapter requires the following driver in the Linux operating system:

* `bnx2x driver`
* The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 2-port 10 GbE NIC and RoCE SR Adapter (FC EL40; CCIN 57BE)

Learn about the specifications and operating system requirements for the feature code (FC) EL40 adapter.

Overview

The PCIe3 LP 2-port 10 GbE NIC and RoCE SR Adapter is a PCIe generation-3 (PCIe3), low-profile, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

The adapter has two preinstalled optical transceivers. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 109 on page 316 shows the FC EL40 adapter.

The adapter provides the following features:

* The adapter is a PCIe3 NIC network convergence adapter.
* The adapter supports RoCE and NIC functions but not concurrently on same adapter.
* The adapter supports the following standards for the different ports and functions:

- – AIX NIM and Linux Network Install are supported
- – IBTA RoCE v2 support
- – IEEE 802.3ae in the 10 GbE ports
- – 802.3ab in the 1 GbE ports
- – Ether II and IEEE 802.3 for encapsulated frames
- – 802.1p for setting up priority levels in tagged VLAN frames
- – 802.1Q for VLAN tagging
- – 802.3x for flow control
- – 802.3ad for load-balancing and failover
- – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 109. FC EL40 adapter

Specifications

Item   Description
Adapter FRU number

      00RX875 (Designed to comply with RoHS requirement)

      Low-profile tailstock: 00RX872

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

⇨ IBM Prerequisite website

⇨ Installing, removing, or replacing PCIe adapters

⇨ PCIe adapter placement

⇨ PCIe adapter information by feature type

PCIe3 LP 16 Gb 2-port Fibre Channel Adapter (FC EL43; CCIN 577F)

Learn about the specifications and operating system requirements for the feature code (FC) EL43 adapter.

Overview

The PCIe3 LP 16 Gb 2-port Fibre Channel Adapter is a low-profile, x8, generation 3, PCIe adapter. This adapter has a little connector-type (LC) external fiber connector that provides single initiator capability over an optical fiber link. The adapter automatically negotiates the highest data rate between the adapter and an attaching device at a link speed of 16 Gbps, 8 Gbps, or 4 Gbps. The adapter supports a maximum

link speed of 16 Gbps at both ports. Distances between the adapter and an attaching device or switch can reach up to 380 m running at a 4 Gbps data rate, up to 150 m running at an 8 Gbps data rate, and up to 100 m running at a 16 Gbps data rate.

The adapter has the following features:

- This adapter has parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- The adapter is compliant with the PCIe base and Card Electromechanical (CEM) 2.0 specifications with the following characteristics:
  - Provides an x8 lane link interface at 14.025 Gbps, 8.5 Gbps, or 4.25 Gbps (automatic negotiation with system)
  - Provides support for one Virtual Channel (VC0) and one Traffic Class (TC0)
  - Provides configuration and I/O memory read and write, completion, and messaging capabilities
  - Provides support for 64-bit addressing
  - Provides error correction code (ECC) and error protection functions
  - Provides link cyclic redundancy check (CRC) on all PCIe packets and message information
  - Provides a large payload size of 2048 bytes for read and write functions
  - Provides a large read request size of 4096 bytes
- The adapter is compatible with 4, 8, and 16 Gb Fibre Channel interface with the following characteristics:
  - Provides for automatic negotiation between 4 Gb, 8 Gb, or 16 Gb link attachments
  - Provides support for the following Fibre Channel topologies: point-to-point (16Gb only) and fabric
  - Provides support for Fibre Channel class 3
  - Provides a maximum Fibre Channel throughput that is achieved by using full duplex hardware support
- The adapter provides an end-to-end data path parity and CRC protection, including internal data path random-access memory (RAM)
- Provides architectural support for multiple upper layer protocols
- Provides comprehensive virtualization capabilities with support for N_Port ID Virtualization (NPIV) and virtual fabric (VF)
- Provides support for message signaled interrupts extended (MSI-X)
- Provides support for 255 VFs and 1024 MSi-X
- Provides an internal, high-speed static random-access memory (SRAM) memory
- Provides ECC protection of local memory that includes single-bit correction and double-bit protection
- Provides an embedded shortwave optical connection with diagnostics capability
- Provides support for an on-board context management by firmware:
  - Up to 8192 FC port logins
  - I/O multiplexing down to the Fibre Channel frame level
- Provides data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Provides link management and recovery that is handled by firmware
- Provides on-board diagnostic capability accessible by an optional connection
- Provides a performance up to 16 Gbps full duplex

The following figure shows the adapter.

Figure 110. EL43 adapter

Specifications

Item   Description

Adapter FRU number

00E3496 (Designed to comply with RoHS requirement)

Wrap plug FRU number

12R9314

I/O bus architecture

PCIe3 x8

Slot requirement

One available PCIe x8 or x16 slot

Voltage

3.3 V, 12 V

Form factor

Short, low-profile

FC compatibility

4, 8, 16 Gb

Cables

Cables are the responsibility of the customer. Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM4: Multimode 50/125 micron fiber, 4700 MHz x km bandwidth
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables.

The following table shows the supported distances for the different cable types at the different link speeds.

Table 74. Supported distances for cables

Header	Cable type and distance			
Rate	OM1	OM2	OM3	OM4
4.25 Gbps	0.5 - 70 m (1.64 - 229.65 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 380 m (1.64 - 1246.71 ft)	0.5 - 400 m (1.64 - 1312.34 ft)
8.5 Gbps	0.5 - 21 m (1.64 - 68.89 ft)	0.5 - 50 m (1.64 - 164.04 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 190 m (1.64 - 623.36 ft)
14.025 Gbps	0.5 - 15 m (1.64 - 49.21 ft)	0.5 - 35 m (1.64 - 114.82 ft)	0.5 - 100 m (1.64 - 328.08 ft)	0.5 - 125 m (1.64 - 410.10 ft)

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation, and yellow signifies port activity. Table 75 summarizes normal LED states. A 1 Hz pause occurs when the LED is off between each group of fast flashes (2, 3 or 4). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 75. Normal LED states

Green LED	Yellow LED	State
On	2 fast flashes	4 Gbps link rate: normal, link active
On	3 fast flashes	8 Gbps link rate: normal, link active
On	4 fast flashes	16 Gbps link rate: normal, link active

Power-on-self-test (POST) conditions and results are summarized in Table 76. These states can be used to identify abnormal states or problems.

Table 76. POST conditions and results

Green LED	Yellow LED	State
Off	Off	Wake-up failure of the adapter board
Off	On	POST failure of the adapter board
Off	Slow flash	Wake-up failure monitor
Off	Fast flash	Failure in post
Off	Flashing	Postprocessing in progress
On	Off	Failure while functioning
On	On	Failure while functioning
Slow flash	Off	Normal, link down
Slow flash	On	Not defined
Slow flash	Slow flash	Offline for download
Slow flash	Fast flash	Restricted offline mode, waiting for restart
Slow flash	Flashing	Restricted offline mode, test active
Fast flash	Off	Debug monitor in restricted mode
Fast flash	On	Not defined
Fast flash	Slow flash	Debug monitor in test fixture mode
Fast flash	Fast flash	Debug monitor in remote debug mode
Fast flash	Flashing	Not defined

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-port 1 GbE Adapter (FC EL4L and EL4M; CCIN 576F)

Learn about the specifications and operating system requirements for the feature code (FC) EL4L and EL4M adapters.

Overview

FC EL4L and EL4M are both the same adapter with different feature codes. FC EL4L is a low-profile adapter and FC EL4M is a full-height adapter.

The PCIe2 LP 4-port 1 GbE Adapter is a full-height, generation 2 (Gen2) PCIe adapter. This adapter provides four 1-Gb Ethernet ports that can be configured to run at 1000 megabits per second (Mbps) or 1 gigabit per second (Gbps), 100 Mbps, or 10 Mbps. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability and conforms to the IEEE 802.3ab 1000Base-T standard. The adapter also supports jumbo frames when running at the 1000 Mbps speed.

Each of the Ethernet ports can be connected by using:

- CAT5e (or later) UTP cables for 1000 Mbps network attachment
- CAT5 or CAT3 UTP cables for 100 Mbps or 10 Mbps network attachment

The cables are attached to the copper RJ45 connectors. Each port is independent of one another and supports full-duplex or half-duplex. The half-duplex mode does not support a speed of 1000 Mbps.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software
- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Specifications

Item   Description
Adapter FRU number
    74Y4064 (Designed to comply with RoHS requirement)
Wrap plug
    10N7405
I/O bus architecture
    PCIe2.0, x4
Slot requirement
    One PCIe x4 slot.
Cables
    4-pair, CAT5e, UTP cables are connected to copper RJ45 connectors.
Voltage
    3.3 V
Form factor
    Short, full-height
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Connector information
    - Two RJ-45 ports

- Two LED adapter status indicators per port, for link activity and speed

Attributes provided
- PCIe x4, generation 1 or generation 2
- 4-Port machine access code (MAC)
- High performance IPV4/IPV6 checksum offload
- Large Send and Large Receive Support
- Multiple Queues
- VIOS

The following figure shows the adapter.

Link / Speed

Activity

Figure 111. Adapter

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket. Figure 111 shows the location of the LEDs. Table 77 describes the different LED states and what those states indicate.

Table 77. Adapter LEDs and descriptions

LED	Light	Description
Link/Speed	Yellow	10 Mbps or 100 Mbps
	Green	1000 Mbps or 1 Gbps
Activity	Green flashing	Active link or data activity
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:
- Linux

- – Bare Metal Systems (Not supported)
- – PowerKVM 3.1 Systems or PowerKVM 2.1 (Not Supported)
- – Other environments
  - - Red Hat Enterprise Linux 7 big-endian, or later
  - - Red Hat Enterprise Linux 7.1, little-endian, or later
  - - Red Hat Enterprise Linux 6.5 or later
  - - SUSE Linux Enterprise Server 12, or later
  - - SUSE Linux Enterprise Server 11, Service Pack 3, or later
  - - Ubuntu 14.04.03, or later
  - - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-port 1 GbE Adapter (FC EL4L and EL4M; CCIN 576F)

Learn about the specifications and operating system requirements for the feature code (FC) EL4L and EL4M adapters.

Overview

FC EL4L and EL4M are both the same adapter with different feature codes. FC EL4L is a low-profile adapter and FC EL4M is a full-height adapter.

The PCIe2 LP 4-port 1 GbE Adapter is a full-height, generation 2 (Gen2) PCIe adapter. This adapter provides four 1-Gb Ethernet ports that can be configured to run at 1000 megabits per second (Mbps) or 1 gigabit per second (Gbps), 100 Mbps, or 10 Mbps. The adapter connects to a network that uses unshielded twisted pair (UTP) cable for distances of up to 100 meters (328.08 feet). The adapter supports AIX Network Installation Management (NIM) boot capability and conforms to the IEEE 802.3ab 1000Base-T standard. The adapter also supports jumbo frames when running at the 1000 Mbps speed.

Each of the Ethernet ports can be connected by using:
- CAT5e (or later) UTP cables for 1000 Mbps network attachment
- CAT5 or CAT3 UTP cables for 100 Mbps or 10 Mbps network attachment

The cables are attached to the copper RJ45 connectors. Each port is independent of one another and supports full-duplex or half-duplex. The half-duplex mode does not support a speed of 1000 Mbps.

The adapter provides the following features:
- Supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- Supports dual port operation in almost any PCIe slot, except x1
- Supports auto-negotiation, full-duplex only
- Supports integrated media-access control (MAC) and physical layer (PHY)
- Supports Fast EtherChannel (FEC) with the existing software

- Supports gigabit EtherChannel (GEC) with the existing software
- Supports IEEE 802.3ad (Link Aggregation control protocol)
- Supports IEEE 802.1Q VLANs
- Supports IEEE 802.3 z, ab, u, x flow control support
- Supports IEEE 802.1p
- Supports IEEE 802.3ab for TX
- Supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), Internet Protocol (IP) for IPv4 and IPv6
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Supports interrupt levels INTA and MSI
- Hardware certifications FCC B, UL, CE, VCCI, BSMI, CTICK, MIC
- Network Controller (MAC) Intel 82571EB
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Specifications

Item   Description
Adapter FRU number
    74Y4064 (Designed to comply with RoHS requirement)
Wrap plug
    10N7405
I/O bus architecture
    PCIe2.0, x4
Slot requirement
    One PCIe x4 slot.
Cables
    4-pair, CAT5e, UTP cables are connected to copper RJ45 connectors.
Voltage
    3.3 V
Form factor
    Short, full-height
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Connector information
    - Two RJ-45 ports
    - Two LED adapter status indicators per port, for link activity and speed
Attributes provided
    - PCIe x4, generation 1 or generation 2
    - 4-Port machine access code (MAC)
    - High performance IPV4/IPV6 checksum offload
    - Large Send and Large Receive Support
    - Multiple Queues
    - VIOS

The following figure shows the adapter.

Figure 112. Adapter

Adapter LED states

The LEDs on the adapter provide information about the operation status of the adapter. The LEDs are visible through the mounting bracket. Figure 111 on page 323 shows the location of the LEDs. Table 77 on page 323 describes the different LED states and what those states indicate.

Table 78. Adapter LEDs and descriptions

LED	Light	Description
Link/Speed	Yellow	10 Mbps or 100 Mbps
	Green	1000 Mbps or 1 Gbps
Activity	Green flashing	Active link or data activity
	Off	No link The absence of a link can indicate a defective cable, defective connector, or a configuration mismatch.

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:
- Linux
  - Bare Metal Systems (Not supported)
  - PowerKVM 3.1 Systems or PowerKVM 2.1 (Not Supported)
  - Other environments
    - Red Hat Enterprise Linux 7 big-endian, or later
    - Red Hat Enterprise Linux 7.1, little-endian, or later
    - Red Hat Enterprise Linux 6.5 or later
    - SUSE Linux Enterprise Server 12, or later
    - SUSE Linux Enterprise Server 11, Service Pack 3, or later

- Ubuntu 14.04.03, or later
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 2-port 56 Gb FDR IB Adapter x16 (FC EL50; CCIN 2CE7)

Learn about the specifications and operating system requirements for the feature code (FC) EL50 adapter.

Overview

The PCIe Gen3 low profile x16 2-port Infiniband QDR adapter provides high speed connectivity with other servers or IB switches. Each port maximum of 56 Gb assumes no other system and/or switch bottlenecks are present. The x16 adapter allows full bandwidth in a PCIe Gen3 slot.

The two 56 Gb ports have QSFP+ connections which support industry standard FDR cables, either FDR DAC cables or FDR optical. One adapter can support either or both types of cable. The user can choose to cable up just one port if they desire.
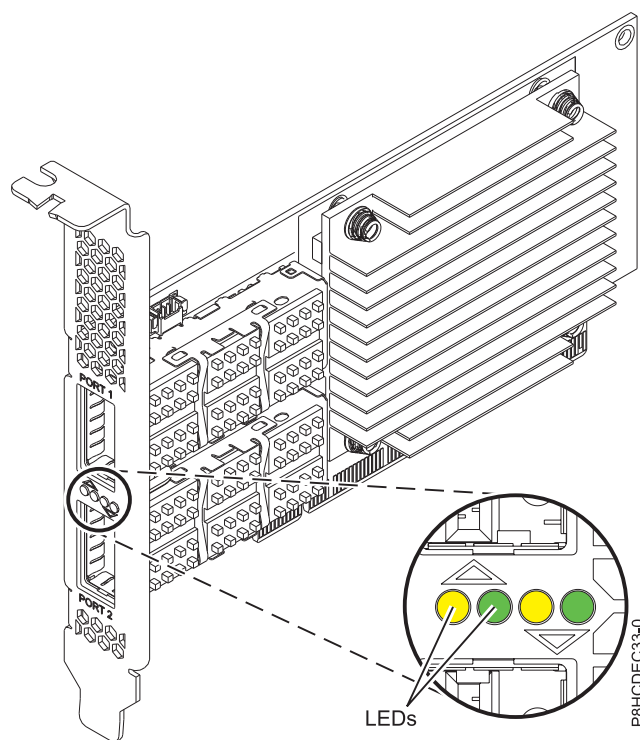
Figure 113. FC EL50 adapter

Note: The LEDs that are shown in Figure 113 indicate the following states:

- A lit solid amber LED (left LED) indicates a good physical link.
- A flashing amber LED (left LED) indicates a problem with the physical link.
- If neither the amber LED (left LED) or the green LED (right LED) is lit, then the physical link has not been established.
- The amber LED (left LED) turns off when the logical link is established.
- A lit solid green LED (right LED) indicates a valid logical (data activity) link without data transfer.
- A flashing green LED (right LED) indicates a valid logical link with data transfer.
- If only the amber LED (left LED) is lit and the green LED (right LED) is off, then the logical link has not been established.

Specifications

Item   Description
Adapter FRU number
    00RX852 (Designed to comply with RoHS requirement)

    Full-height tailstock
I/O bus architecture
    PCIe x16
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    No cables required.
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux:
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 2-Port 10 GbE NIC and RoCE SFP+ Copper Adapter (FC EL53; CCIN 57BC)
Learn about the specifications and operating system requirements for the feature code (FC) EL53 adapter.

Overview

The PCIe3 2-Port 10 GbE NIC and RoCE SR adapter is a PCIe generation-3 (PCIe3), full-height, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A copper transceiver is included with these cables. See "Cables" on page 331 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 114 on page 330 shows the FC EL53 adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  – AIX NIM and Linux Network Install are supported
  – IBTA RoCE v2 support
  – IEEE 802.3ae in the 10 GbE ports
  – 802.3ab in the 1 GbE ports
  – Ether II and IEEE 802.3 for encapsulated frames
  – 802.1p for setting up priority levels in tagged VLAN frames
  – 802.1Q for VLAN tagging
  – 802.3x for flow control
  – 802.3ad for load-balancing and failover
  – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 114. FC EL53 adapter

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number

00RX859 (Designed to comply with RoHS requirement)

Low-profile tailstock: 00RX856

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" on page 331 for details.

Voltage

3.3 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 115 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 79 for details about the feature codes.

P7ECF505-0
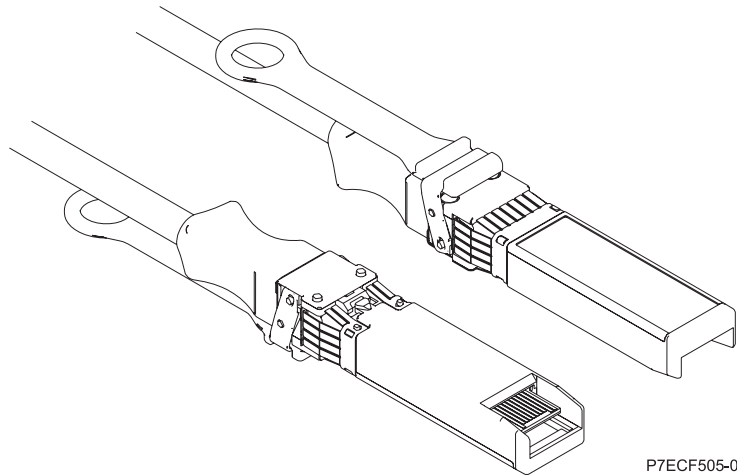
Figure 115. Top and bottom view of the cable

Table 79. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/ home.html).
- VIOS

- VIOS 2.2.3.51, or later
- Supports NIC capability only

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 2-port 10 GbE NIC and RoCE SR adapter (FC EL54; CCIN 57BE)

Learn about the specifications and operating system requirements for the feature code (FC) EL54 adapter.

Overview

The PCIe3 2-port 10 GbE NIC and RoCE SR adapter is a PCIe generation-3 (PCIe3), full-height, dual port, 10 Gigabit Ethernet (GbE) adapter with a PCIe 3.0 host bus interface. The adapter supports the InfiniBand trade association (IBTA) standard for remote direct memory access (RDMA) over converged Ethernet (RoCE). The adapter supports short range (SR) optical connectivity. The adapter delivers high-bandwidth and low-latency 10 GbE connectivity. The adapter is optimized for high-transaction databases, cloud computing, virtualization, storage, and other data center applications. The adapter improves network performance by increasing available bandwidth to the processor and providing enhanced performance. The adapter minimizes processor usage by efficiently using memory access.

The adapter has two preinstalled optical transceivers. Little connector (LC) type connectors connect the adapter to standard 10-Gb SR optical cabling and provide up to 300 m (984.25 ft) cable length. The two transceiver ports are used for connectivity with other servers or switches in the network. Each port provides Ethernet connectivity with a nominal data rate of 10 gigabits per second (Gbps). The link aggregation and failover features of the adapter are ideal for critical network applications that require redundancy and high availability. Figure 116 on page 333 shows the FC EL54 adapter.

The adapter provides the following features:
- The adapter is a PCIe3 NIC network convergence adapter.
- The adapter supports RoCE and NIC functions but not concurrently on same adapter.
- The adapter supports the following standards for the different ports and functions:
  - AIX NIM and Linux Network Install are supported
  - IBTA RoCE v2 support
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload

- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
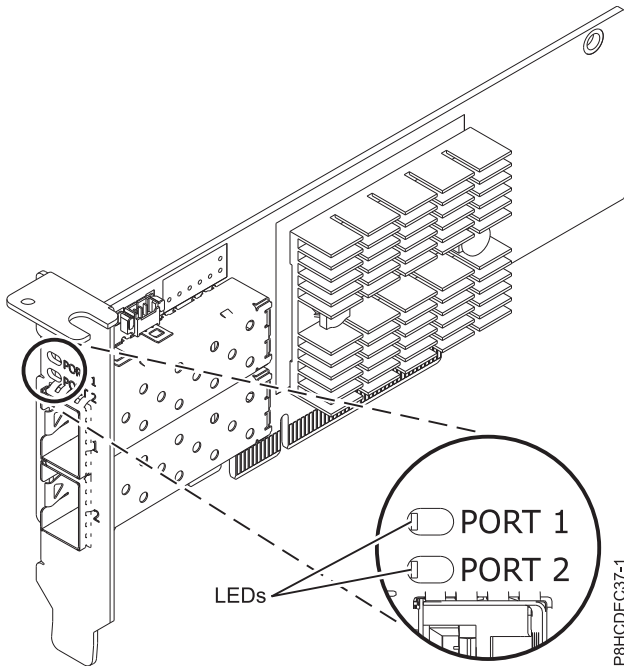

Figure 116. FC EL54 adapter

Specifications

Item   Description
Adapter FRU number

> 00RX875 (Designed to comply with RoHS requirement)

> Full-height tailstock part number

I/O bus architecture

> PCIe3 x8

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

> Supports standard 10-Gb SR optical cabling and up to 300 m (984.25 ft) cable length.

Voltage

> 3.3 V

Form factor

> Short

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 15.04, or later
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS 2.2.3.51, or later
  - Supports NIC capability only

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EL55; CCIN 2CC4)

Learn about the specifications and operating system requirements for the feature code (FC) EL55 adapter.

Overview

The PCIe2 2-port 10 GbE BaseT RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile capable, regular-height adapter. The adapter provides two 10 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability. Figure 117 on page 335 shows the FC EL55 adapter.

The ports default to auto negotiate the highest speed either at 10 Gb (10G BaseT), 1Gb (1000 BaseT), or 100 Mb (100 BaseT) full duplex. Each RJ45 port can be configured independent of the other port. Each RJ45 port is connected with a 4-pair, CAT-6A cable, and is supported for distances of up to 100 meters.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb RJ45 ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.

- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
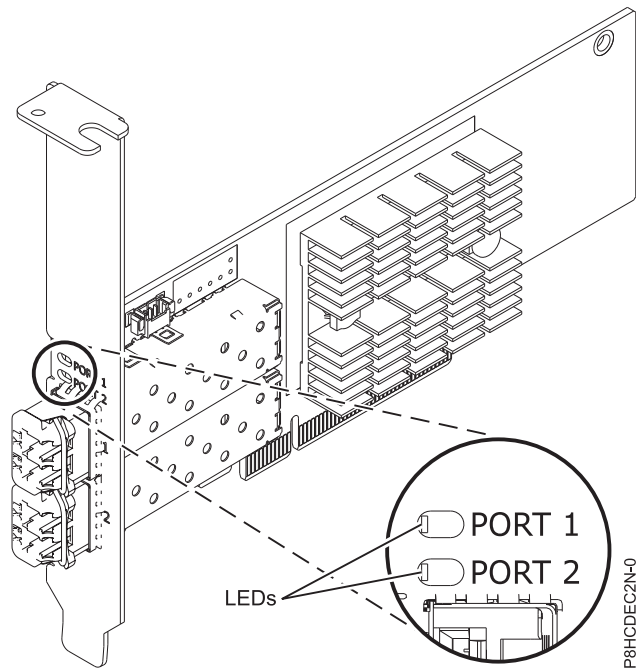

Figure 117. FC EL55 adapter

Specifications

Item   Description
Adapter FRU number
      00E2714 (Designed to comply with RoHS requirement)

Regular-height tailstock part number: 00E2862

Low-profile tailstock part number: 00E2721

Wrap plug FRU number

10N7405 (RJ45 wrap plug)

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

CAT-6A cable

Voltage

3.3 V

Form factor

Short, regular-height tailstock, low-profile capable

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 7.1, Technology Level 2, Service Pack 2, or later
  - AIX 7.1, Technology Level 1, Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
  - AIX 6.1, Technology Level 7, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i is supported only with VIOS

This adapter requires the following drivers:

- AIX: `devices.pciex.e4148e1614109204`
- Linux: `bnx2x driver`

- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

⇨ IBM Prerequisite website

⇨ Installing, removing, or replacing PCIe adapters

⇨ PCIe adapter placement

⇨ PCIe adapter information by feature type

PCIe2 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EL56, CCIN 2B93)

Learn about the specifications and operating system requirements for the feature code (FC) EL56 adapters.

Overview

The PCIe2 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter is a PCI Express (PCIe) generation 3, low-profile capable adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 2.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both FCoE and network interface controller (NIC) functions are available for both FCoE ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE small form-factor pluggable (SFP+) SR optical ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 118 on page 338 shows the FC EL56 adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:
- The adapter is a PCIe2 FCoE or NIC network convergence adapter.
- The 10 Gb SFP+ ports can function in the NIC or FCoE mode.
- The adapter supports the Single Root IO Virtualization (SRIOV) function.
- The adapter can function as a Boot adapter.
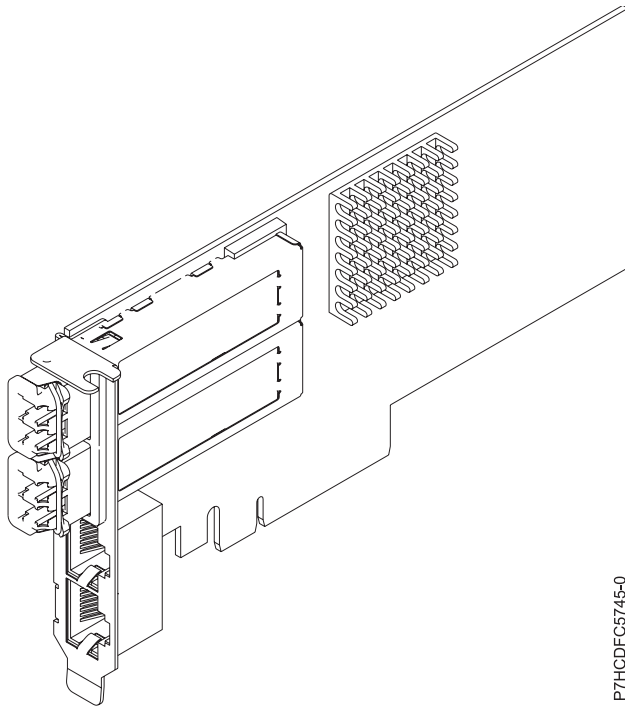
Figure 118. FC EL56 adapter

Specifications

Item   Description
Adapter FRU number
>   00E3498 (Designed to comply with RoHS requirement)

Wrap plug FRU number
>   12R9314 (for Fibre LC connector)
>
>   10N7405 (for RJ45 connector)

I/O bus architecture
>   PCIe3 x8

Slot requirement
>   For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
>   SR SFP+ optical fiber cables and Cat5 Ethernet cables

Voltage
>   3.3 V, 12 V

Form factor
>   Short, regular sized bracket, low-profile capable

Maximum number
>   For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EL57; CCIN 2CC1)

Learn about the specifications and operating system requirements for the feature code (FC) EL57 adapters.

Overview

The PCIe2 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter is a PCI Express (PCIe) generation 2, regular-height adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 2.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Copper Twin-axial ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 119 on page 340 shows the FC EL57 adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter is Single Root I/O Virtualization (SR-IOV) capable. The adapter can function as a boot adapter. The adapter supports all Fibre Channel and Ethernet topologies.
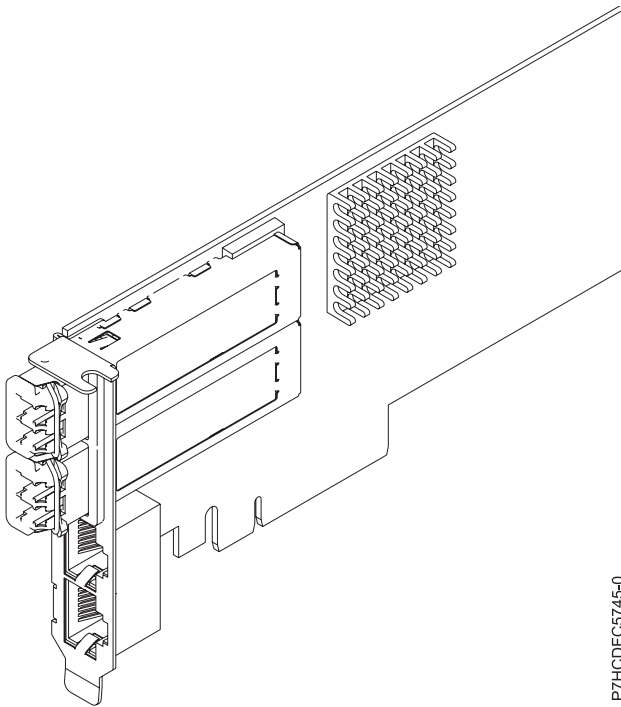
Figure 119. FC EL57 adapter

Specifications

Item   Description

Adapter FRU number

> 00E8140 (Designed to comply with RoHS requirement)

Wrap plug FRU number

> 12R9314 (for Fibre LC connector)
>
> 10N7405 (for RJ45 connector)

I/O bus architecture

> PCIe2 x8

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

> SR SFP+ Copper Twinax and Cat5 Ethernet cables

Voltage

> 3.3 V, 12 V

Form factor

> Short, low-profile

Maximum number

> For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 7.1, or later
  - AIX 6.1, or later
- Linux
  - SUSE Linux Enterprise Server Version 11 SP 3, or later
  - Red Hat Enterprise Linux Version 6.5, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.1, or later , supported through VIOS 2.2.2, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe 8 Gb 2-port Fibre Channel Adapter (FC EL58; CCIN 577D)

Learn about the specifications and operating system requirements for the feature code (FC) EL58 adapter.

Overview

The 8 Gigabit PCI Express Dual Port Fibre Channel Adapter is a high-performance adapter based on the Emulex LPe12002 PCIe Host Bus Adapter (HBA). Each port provides single initiator capability over a fibre link. The ports have LC type connectors and utilize shortwave laser optics. The adapter connects to fibre channel switches and operates at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed of which the switch is capable. LEDs on each port provide information on the status and link speed of the port.

The following figure shows the adapter:
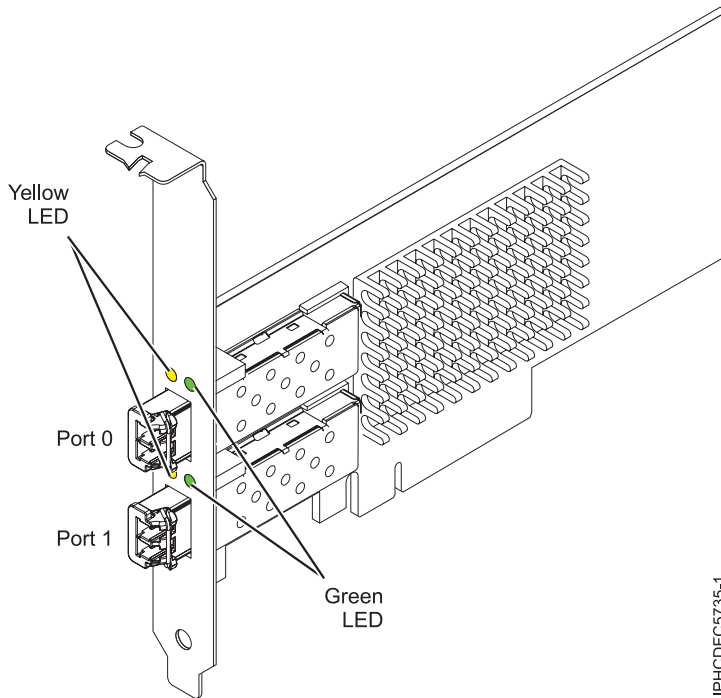
Figure 120. PCIe 8 Gb 2-port Fibre Channel Adapter

Adapter specifications

Item   Description

FRU number
> 10N9824 (Designed to comply with RoHS requirement)

Wrap plug FRU number
> 12R9314 (Designed to comply with RoHS requirement)

> 11P3847 (Not designed to comply with RoHS requirement)

I/O bus architecture
> PCI Express (PCIe) Base and Card Electromechanical (CEM) 2.0
> x8 PCIe bus interface

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
> priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
> p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage
> 3.3 V

Form factor
> Short, low-profile with standard size bracket

FC compatibility
> 2, 4, 8 Gigabit

Cables
> Cables are the responsibility of the customer. Use multimode fibre optic cables with short-wave
> lasers that adhere to the following specifications:
> • OM3: Multimode 50/125 micron fibre, 2000 MHz x km bandwidth
> • OM2: Multimode 50/125 micron fibre, 500 MHz x km bandwidth
> • OM1: Multimode 62.5/125 micron fibre, 200 MHz x km bandwidth

> Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best
> results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is
> connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the
> cables.

The following table shows the supported distances for the three different cable types at the three different link speeds.

Table 80. Supported cable distances by link speed

Cable type	2.125 Gbps	4.25 Gbps	8.5 Gbps
OM3	0.5 m - 500 m	0.5 m - 380 m	0.5 m - 150 m
OM2	0.5 m - 300 m	0.5 m -150 m	0.5 m - 50 m
OM1	0.5 m - 150 m	0.5 m - 70 m	0.5 m - 21 m

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6, or later
  - Red Hat Enterprise Linux Version 5.6, or later
  - SUSE Linux Enterprise Server Version 12, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later, with current maintenance updates available from SUSE.
  - Ubuntu Server 14.04.3, or later
  - Ubuntu 16.04.1 or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).
- PowerKVM
  - IBM PowerKVM 2.1 SP1, or later

Adapter LED

Green and yellow LEDs can be seen through openings in the adapter mounting bracket. Green indicates firmware operation and yellow signifies port activity. Table 81 summarizes the link rate conditions. There is a 1-second pause when the LED is off between each group of fast flashes (2, 3, or 4). Observe the LED sequence for several seconds to be sure that you have correctly identified the state.

Table 81. Normal LED states

Green LED	Yellow LED	State
Slow flash	Off	Normal, link inactive or not started
On	2 fast flashes	2 Gbps link rate - normal, link active
On	3 fast flashes	4 Gbps link rate - normal, link active
On	4 fast flashes	8 Gbps link rate - normal, link active

Power-on self test (POST) conditions and results are summarized in Table 82. These states can be used to identify abnormal states or problems. Follow the action to be taken for each condition.

Table 82. POST conditions and results

Green LED	Yellow LED	State	Action to be taken
Off	Off	Wake-up failure (dead board)	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	On	POST failure (dead board)	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Slow blink	Wake-up failure monitor	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Fast blink	POST failure	Perform AIX, Linuxor IBM i operating system diagnostics.
Off	Flashing	POST processing in progress	None
On	Off	Failure while functioning	Perform AIX, Linuxor IBM i operating system diagnostics.
On	On	Failure while functioning	Perform AIX, Linuxor IBM i operating system diagnostics.
Slow blink	Slow blink	Offline for download	None
Slow blink	Fast blink	Restricted offline mode, waiting for restart	None
Slow blink	Flashing	Restricted offline mode, test active	None

Replacing Fibre Channel adapters using hot swap

When hot swapping fibre channel adapters, be aware that device-related software for the storage devices might have additional devices (for example, the dar device associated with the FAStT or DS4800) that need to be removed. Refer to specific storage device documentation for information about how to remove these additional devices.

The new adapter has a unique worldwide port name (WWPN). Check the zoning and LUN assignments to ensure that the new adapter will function as expected.

Related information:

⮞ IBM Prerequisite website

⮞ Installing, removing, or replacing PCIe adapters

⮞ PCIe adapter placement

⮞ PCIe adapter information by feature type

PCIe3 RAID SAS Adapter Quad-port 6 Gb x8 (FC EL59 and EL65; CCIN 57B4)
Learn about the specifications and operating system requirements for the feature code (FC) EL59 and EL65 adapters.

Overview

FC EL59 and FC L65 are the same adapter with the same, but have different feature code numbers to indicate different usage to IBM configurator tools. FC EL65 runs SAS LTO-5 or later tape drives and DVDs, whereas FC EL59 runs HDD or SSD. Support of both tape/DVD and HDD/SSD on the same adapter is not supported.

The PCIe3 RAID SAS quad-port 6 Gb LP Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter that has a low-profile and short-form factor. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS disk and SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 121 on page 346 shows the PCIe3 RAID SAS quad-port 6 Gb LP Adapter.

The adapter is a 64 bit, 3.3 V, bootable SAS adapter that provides RAID 0, 5, 6, and 10 capability, and system level mirroring via the operating system. The adapter provides both single and dual RAID controller configurations. Dual controller configurations (dual storage IOA) must run RAID. JBOD (512 byte) functionality is supported only in a single controller configuration based on the operating system. Best performance is achieved when multiple RAID sets are configured and optimized under a pair of adapters in a high availability, multi-initiator RAID configuration (dual storage IOA) which allows for an Active-Active mode of operation.

The adapter support a maximum of 98 attached disk devices that depends on the drive enclosure attached. A maximum of 48 devices can be solid-state devices (SSDs). Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS disk devices and 3 Gbps for SAS tape devices. This adapter supports RAID and non-RAID DASD, and SAS tape devices. Specific device attachment support rules apply. This adapter supports the multi-initiator and high availability (dual storage IOA) configurations in AIX, IBM i, and Linux partitions. This adapter enables configuring the SAS drives as dedicated hot-spares with equal or higher capacity.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 121 on page 346 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.

Figure 121. PCIe3 RAID SAS quad-port 6 Gb LP Adapter

Specifications

Item   Description

Adapter FRU number

000MH910 (Designed to comply with RoHS requirement)

Connector plug part number

00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture

PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement

One available PCIe x8 slot per adapter.

Cables

Specific X, YO, AA, or AT SAS cable features with new narrow HD connectors are used to attach to the other adapter or disk expansion drawers.

SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached. Special cabling is required for multi-initiator and high availability configurations. Specific AE1 or YE1 SAS cable features are required for SAS Tape attachment. See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, low-profile but packaged for full-height installations.

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS device enclosures
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)

- RAID 0, 5, 6, or 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is supported in a single controller configuration only.
- Concurrent firmware update
- Removable media device (SAS Tape) are supported in a single controller configuration only and cannot be combined with disk devices attached to the same adapter. Removable media is not supported in multi-initiator and high availability (dual storage IOA) configurations
- Support for multi-initiator and high availability or single controller configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
- Supported on Firmware level 7.8, or later

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EL5B; CCIN 577F)

Learn about the specifications and operating system requirements for the feature code (FC) EL5B adapter.

Overview

The PCIe3 16 Gb 2-port Fibre Channel Adapter is an x8, generation 3, PCIe adapter. This adapter is a high-performance 8x short form adapter also referred to as a PCIe Host Bus Adapter (HBA). The adapter provides two ports of 16 Gb Fibre Channel capability using SR optics. Each port can provide up to 16 Gb Fibre Channel functions simultaneously.

Each port provides single initiator capability over a fibre link or with NPIV, multiple initiator capability is provided. The ports are SFP+ and include an optical SR transceiver. The ports have little connector-type

(LC) and utilize shortwave laser optics. The adapter operates at link speeds of 4, 8 and 16 Gbps and will automatically negotiate to the highest speed possible. LEDs on each port provide information on the status and link speed of the port.

N_Port ID Virtualization (NPIV) capability is supported through VIOS.

The adapter has the following features:
- This adapter has parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- The adapter is compliant with the PCIe base and Card Electromechanical (CEM) 2.0 specifications with the following characteristics:
  – Provides an x8 lane link interface at 14.025 Gbps, 8.5 Gbps, or 4.25 Gbps (automatic negotiation with system)
  – Provides support for one Virtual Channel (VC0) and one Traffic Class (TC0)
  – Provides configuration and I/O memory read and write, completion, and messaging capabilities
  – Provides support for 64-bit addressing
  – Provides error correction code (ECC) and error protection functions
  – Provides link cyclic redundancy check (CRC) on all PCIe packets and message information
  – Provides a large payload size of 2048 bytes for read and write functions
  – Provides a large read request size of 4096 bytes
- The adapter is compatible with 4, 8, and 16 Gb Fibre Channel interface with the following characteristics:
  – Provides for automatic negotiation between 4 Gb, 8 Gb, or 16 Gb link attachments
  – Provides support for the following Fibre Channel topologies: point-to-point (16Gb only) and fabric
  – Provides support for Fibre Channel class 3
  – Provides a maximum Fibre Channel throughput that is achieved by using full duplex hardware support
- The adapter provides an end-to-end data path parity and CRC protection, including internal data path random-access memory (RAM)
- Provides architectural support for multiple upper layer protocols
- Provides comprehensive virtualization capabilities with support for N_Port ID Virtualization (NPIV) and virtual fabric (VF)
- Provides support for message signaled interrupts extended (MSI-X)
- Provides support for 255 VFs and 1024 MSi-X
- Provides an internal, high-speed static random-access memory (SRAM) memory
- Provides ECC protection of local memory that includes single-bit correction and double-bit protection
- Provides an embedded shortwave optical connection with diagnostics capability
- Provides support for an on-board context management by firmware:
  – Up to 8192 FC port logins
  – I/O multiplexing down to the Fibre Channel frame level
- Provides data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Provides link management and recovery that is handled by firmware
- Provides on-board diagnostic capability accessible by an optional connection
- Provides a performance up to 16 Gbps full duplex

The following figure shows the adapter.

Figure 122. EL5B adapter

Specifications

Item   Description

Adapter FRU number
> 00E3496 (Designed to comply with RoHS requirement)

Wrap plug FRU number
> 12R9314

I/O bus architecture
> PCIe3 x8

Slot requirement
> One available PCIe x8 or x16 slot

Voltage
> 3.3 V, 12 V

Form factor
> Short, MD2

FC compatibility
> 4, 8, 16 Gb

Cables
> Cables are the responsibility of the customer. Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
> - OM4: Multimode 50/125 micron fiber, 4700 MHz x km bandwidth
> - OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
> - OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
> - OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth
>
> Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables.
>
> The following table shows the supported distances for the different cable types at the different link speeds.

Table 83. Supported distances for cables

Header	Cable type and distance			
Rate	OM1	OM2	OM3	OM4
4.25 Gbps	0.5 - 70 m (1.64 - 229.65 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 380 m (1.64 - 1246.71 ft)	0.5 - 400 m (1.64 - 1312.34 ft)
8.5 Gbps	0.5 - 21 m (1.64 - 68.89 ft)	0.5 - 50 m (1.64 - 164.04 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 190 m (1.64 - 623.36 ft)
14.025 Gbps	0.5 - 15 m (1.64 - 49.21 ft)	0.5 - 35 m (1.64 - 114.82 ft)	0.5 - 100 m (1.64 - 328.08 ft)	0.5 - 125 m (1.64 - 410.10 ft)

Maximum number

For the maximum adapters supported, see the PCI adapter placement topic collection for your system.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 7.1, little endian, or later
  - Red Hat Enterprise Linux Version 6.5, or later
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later
  - SUSE Linux Enterprise Server 12, or later
  - Ubuntu Server 14.04.3, or later
  - Ubuntu Server 16.04, or later
- Supports PowerKVM and VIOS.

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation, and yellow signifies port activity. Table 84 summarizes normal LED states. A 1 Hz pause occurs when the LED is off between each group of fast flashes (2, 3 or 4). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 84. Normal LED states

Green LED	Yellow LED	State
On	2 fast flashes	4 Gbps link rate: normal, link active
On	3 fast flashes	8 Gbps link rate: normal, link active
On	4 fast flashes	16 Gbps link rate: normal, link active

Power-on-self-test (POST) conditions and results are summarized in Table 85 on page 351. These states can be used to identify abnormal states or problems.

Table 85. POST conditions and results

Green LED	Yellow LED	State
Off	Off	Wake-up failure of the adapter board
Off	On	POST failure of the adapter board
Off	Slow flash	Wake-up failure monitor
Off	Fast flash	Failure in post
Off	Flashing	Postprocessing in progress
On	Off	Failure while functioning
On	On	Failure while functioning
Slow flash	Off	Normal, link down
Slow flash	On	Not defined
Slow flash	Slow flash	Offline for download
Slow flash	Fast flash	Restricted offline mode, waiting for restart
Slow flash	Flashing	Restricted offline mode, test active
Fast flash	Off	Debug monitor in restricted mode
Fast flash	On	Not defined
Fast flash	Slow flash	Debug monitor in test fixture mode
Fast flash	Fast flash	Debug monitor in remote debug mode
Fast flash	Flashing	Not defined

Related information:

→ IBM Prerequisite website

→ Installing, removing, or replacing PCIe adapters

→ PCIe adapter placement

→ PCIe adapter information by feature type

PCIe2 8 Gb 2-Port Fibre Channel Adapter (FC EL5Y and EL5Z; CCIN 578D)

Learn about the specifications and operating system requirements for feature codes (FC) EL5Y and EL5Z adapters.

Overview

FC EL5Y and EL5Z are both the same adapter with different feature codes. FC EL5Y is a low-profile adapter and FC EL5Z is a full-height adapter.

The PCIe2 8 Gb 2-port Fibre Channel Adapter is a PCI Express (PCIe) generation 2 (Gen2), high-performance, based on the QLogic QLE2562 Host Bus Adapter (HBA). This adapter enables multiple logical (virtual) connections to share the same physical port. Each logical connection has its own resources and the ability to be managed independently. Each port provides single initiator capability over a fiber link or provides multiple initiator capability with N_Port ID Virtualization (NPIV). The ports have LC type connectors and use shortwave laser optics. The adapter operates at link speeds of 2, 4, and 8 gigabits per second (Gbps) and automatically negotiates to the highest speed possible. LEDs on each port provide information about the connection status and link speed of the port. The adapter connects to a Fibre Channel switch. See "PCIe LP 8 Gb 2-Port Fibre Channel Adapter (FC EL2N; CCIN 577D)" on page 285 or "PCIe 8 Gb 2-port Fibre Channel Adapter (FC EL58; CCIN 577D)" on page 341 for a 2-port 8 Gb Fibre Channel adapter based on an Emulex adapter.
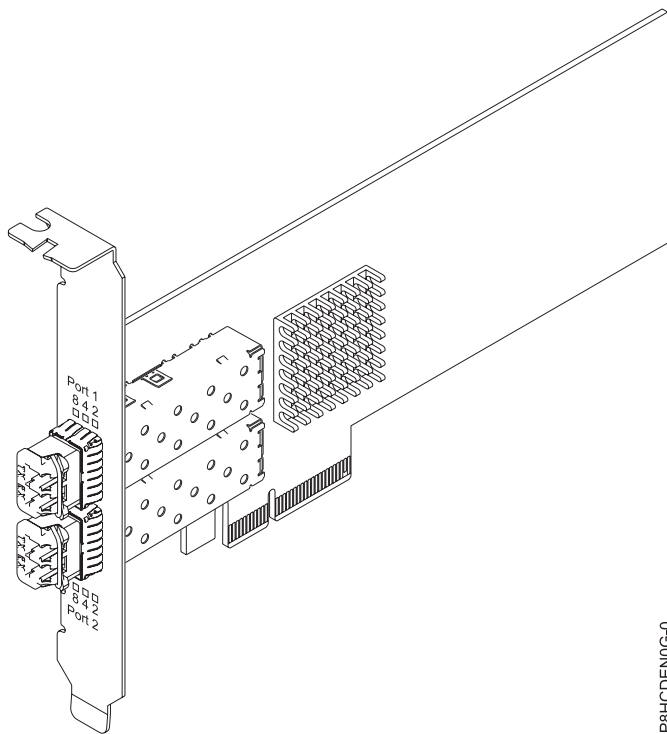
Figure 123. PCIe2 8 Gb 2-Port Fibre Channel Adapter

Specifications

Item   **Description**

Adapter FRU number

00WT111 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

FC compatibility

2, 4, 8 Gigabit

Cables

Cables are the responsibility of the customer.

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 86. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Supported Systems
> POWER8® processor-based server

Voltage
> 12 V

Form factor
> Short, low-profile (FC EL5Y)
>
> Short, with full-height tailstock (FC EL5Z)

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided
> NPIV capability is supported through VIOS
>
> Requires a PCIe2 x8 slot for all ports to operate at full speed

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- Linux
  - Red Hat Enterprise Linux 7.2, or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8, or later
  - SUSE Linux Enterprise Server 12, Service Pack 1, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Adapter LED

Table 87. LED States

Hardware State	Yellow LED (8 Gbps)	Green LED (4 Gbps)	Amber LED (2 Gbps)	Comments
Power Off	Off	Off	Off	
Power On (before firmware initialization)	On	On	On	
Power On (after firmware initialization)	Flash	Flash	Flash	All flash at the same time.
Firmware Fault	Flash in sequence	Flash in sequence	Flash in sequence	Flashing in sequence of yellow LED, green LED, amber LED, then back to yellow LED.
2 Gbps Link UP/ACT	Off	Off	On/Flash	On for link up and flash if I/O activity.
4 Gbps Link UP/ACT	Off	On/Flash	Off	
8 Gbps Link UP/ACT	On/Flash	Off	Off	
Beacon	Flash	Off	Flash	All flashing at the same time.

Related information:

⇨ IBM Prerequisite website

⇨ Installing, removing, or replacing PCIe adapters

⇨ PCIe adapter placement

⇨ PCIe adapter information by feature type

PCIe3 LP 4 x8 SAS Port Adapter (FC EL60; CCIN 57B4)

Learn about the specifications and operating system requirements for the feature code (FC) EL60 adapter.

Overview

The PCIe3 LP 4 x8 SAS Port Adapter is a PCI Express (PCIe), generation 3, RAID SAS adapter is a low-profile, short-form factor adapter. The adapter is used in high-performance and high-density, serial attached SCSI (SAS) applications. It supports the attachment of SAS DVD or SAS tape by using four mini SAS high-density (HD) x4 connectors that allow the physical links to be used in various narrow and wide-port configurations. SAS tape attachment is only supported in a single adapter configuration and cannot be mixed with SAS disk on the same adapter. The adapter does not have write cache. Figure 124 on page 355 shows the PCIe3 LP 4 x8 SAS Port Adapter.

A maximum of four DVD or tape drives can be attached per adapter by using four AE1 cables (FC ECBY). A maximum of eight DVD or tape drives can be attached by using four YE1 cables (ECBZ).

Externally attached devices are designed to run at a maximum data rate of 6 Gbps for SAS tape devices.

Important: See the SAS RAID controllers for AIX, SAS RAID controllers for IBM i, or SAS RAID controllers for Linux topics for more information and important considerations for multi-initiator and high availability or dual storage IOA configurations

Figure 124 shows the adapter. The connector plug **(A)** is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.

P7HCDFCEJ0M-1
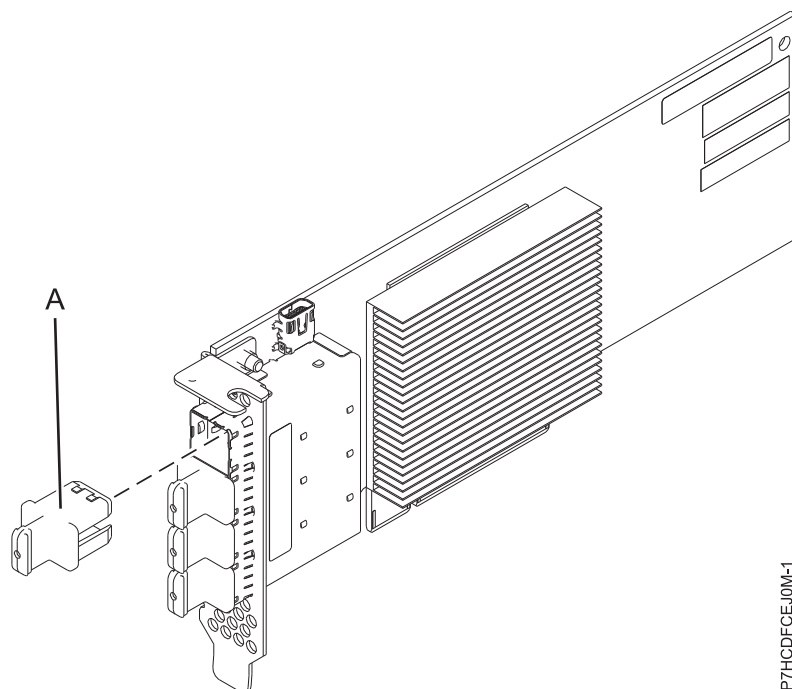
Figure 124. PCIe3 LP 4 x8 SAS Port Adapter

Specifications

Item   Description

Adapter FRU number
    000MH910 (Designed to comply with RoHS requirement)

Connector plug part number
    00FW784 (The connector plug is installed in an empty port and prevents damage to that port whenever a cable for the adjacent port connectors is plugged-in or removed.)

I/O bus architecture
    PCIe 3.0 but compatible to PCIe 2.0 or PCIe 1.0 slots.

Slot requirement
    One available PCIe x8 slot per adapter.

Cables
    Specific AE1 or YE1 SAS cable features with new narrow HD connectors are used to attach the adapter to SAS devices.

    SAS device attachment requires specific cables that are provided with the subsystem or device features that are being attached.See Serial attached SCSI cable planning.

Voltage
    3.3 V

Form factor
    Short, low-profile

Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter

placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes

- Four external mini SAS HD 4x connectors provide attachment of SAS devices
- SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP)
- Concurrent firmware update
- Removable media device (DVD and SAS tape) are supported in a single controller
  configuration only and cannot be combined with disk devices attached to the same adapter.
  Removable media is not supported in multi-initiator and high availability (dual storage IOA)
  configurations
- Support for multi-initiator and high availability or single controller configurations

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system
you are using:

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red
    Hat.
  - Red Hat Enterprise Linux Version 6.4, or later, with current maintenance updates available from Red
    Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates
    available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/
    lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and
    Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/
    home.html).
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
- Supported on Firmware level 7.8, or later

Related information:

➦ IBM Prerequisite website

➦ Installing, removing, or replacing PCIe adapters

➦ PCIe adapter placement

➦ PCIe adapter information by feature type

PCIe3 16 Gb 2-port Fibre Channel Adapter (FC EN0A; CCIN 577F)

Learn about the specifications and operating system requirements for the feature code (FC) EN0A
adapter.

Overview

The PCIe3 16 Gb 2-port Fibre Channel Adapter is an x8, generation 3, PCIe adapter. This adapter is a high-performance 8x short form adapter also referred to as a PCIe Host Bus Adapter (HBA). The adapter provides two ports of 16 Gb Fibre Channel capability using SR optics. Each port can provide up to 16 Gb Fibre Channel functions simultaneously.

Each port provides single initiator capability over a fibre link or with NPIV, multiple initiator capability is provided. The ports are SFP+ and include an optical SR transceiver. The ports have little connector-type (LC) and utilize shortwave laser optics. The adapter operates at link speeds of 4, 8 and 16 Gbps and will automatically negotiate to the highest speed possible. LEDs on each port provide information on the status and link speed of the port.

The adapter connects to a Fibre Channel switch at 4 Gb, 8 Gb or 16 Gb. It can directly attach to a device without a switch at 16 Gb. Attachment without a switch is not supported at 4 Gb or 8 Gb.

N_Port ID Virtualization (NPIV) capability is supported through VIOS.

The adapter has the following features:
- This adapter has parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- The adapter is compliant with the PCIe base and Card Electromechanical (CEM) 2.0 specifications with the following characteristics:
  - Provides an x8 lane link interface at 14.025 Gbps, 8.5 Gbps, or 4.25 Gbps (automatic negotiation with system)
  - Provides support for one Virtual Channel (VC0) and one Traffic Class (TC0)
  - Provides configuration and I/O memory read and write, completion, and messaging capabilities
  - Provides support for 64-bit addressing
  - Provides error correction code (ECC) and error protection functions
  - Provides link cyclic redundancy check (CRC) on all PCIe packets and message information
  - Provides a large payload size of 2048 bytes for read and write functions
  - Provides a large read request size of 4096 bytes
- The adapter is compatible with 4, 8, and 16 Gb Fibre Channel interface with the following characteristics:
  - Provides for automatic negotiation between 4 Gb, 8 Gb, or 16 Gb link attachments
  - Provides support for the following Fibre Channel topologies: point-to-point (16Gb only) and fabric
  - Provides support for Fibre Channel class 3
  - Provides a maximum Fibre Channel throughput that is achieved by using full duplex hardware support
- The adapter provides an end-to-end data path parity and CRC protection, including internal data path random-access memory (RAM)
- Provides architectural support for multiple upper layer protocols
- Provides comprehensive virtualization capabilities with support for N_Port ID Virtualization (NPIV) and virtual fabric (VF)
- Provides support for message signaled interrupts extended (MSI-X)
- Provides support for 255 VFs and 1024 MSi-X
- Provides an internal, high-speed static random-access memory (SRAM) memory
- Provides ECC protection of local memory that includes single-bit correction and double-bit protection
- Provides an embedded shortwave optical connection with diagnostics capability
- Provides support for an on-board context management by firmware:

- Up to 8192 FC port logins
- I/O multiplexing down to the Fibre Channel frame level
- Provides data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Provides link management and recovery that is handled by firmware
- Provides on-board diagnostic capability accessible by an optional connection
- Provides a performance up to 16 Gbps full duplex

The following figure shows the adapter.

Figure 125. EN0A adapter

Specifications

Item   Description
Adapter FRU number
      00E3496 (Designed to comply with RoHS requirement)
Wrap plug FRU number
      12R9314

      Note: The wrap plug is included with the card, and can also be purchased from IBM.
I/O bus architecture
      PCIe base and CEM 3.0, x8 PCIe bus interface
Slot requirement
      For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Voltage
      3.3 V, 12 V
Form factor
      Short, MD2

FC compatibility

> 4, 8, 16 Gb

Cables

> Cables are the responsibility of the customer. Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
> * OM4: Multimode 50/125 micron fiber, 4700 MHz x km bandwidth
> * OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
> * OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
> * OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth
>
> Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables.
>
> The following table shows the supported distances for the different cable types at the different link speeds.

Table 88. Supported distances for cables

Header	Cable type and distance			
Rate	OM1	OM2	OM3	OM4
4 Gbps	0.5 - 70 m (1.64 - 229.65 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 380 m (1.64 - 1246.71 ft)	0.5 - 400 m (1.64 - 1312.34 ft)
8 Gbps	0.5 - 21 m (1.64 - 68.89 ft)	0.5 - 50 m (1.64 - 164.04 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 190 m (1.64 - 623.36 ft)
16 Gbps	0.5 - 15 m (1.64 - 49.21 ft)	0.5 - 35 m (1.64 - 114.82 ft)	0.5 - 100 m (1.64 - 328.08 ft)	0.5 - 125 m (1.64 - 410.10 ft)

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
* AIX
  - AIX 7.1, or later
  - AIX 6.1, or later
* Linux
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).
* IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation, and yellow signifies port activity. Table 89 summarizes normal LED states. A 1 Hz pause occurs when the LED is off between each group of fast flashes (2, 3 or 4). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 89. Normal LED states

Green LED	Yellow LED	State
On	2 fast flashes	4 Gbps link rate: normal, link active
On	3 fast flashes	8 Gbps link rate: normal, link active
On	4 fast flashes	16 Gbps link rate: normal, link active

Power-on-self-test (POST) conditions and results are summarized in Table 90. These states can be used to identify abnormal states or problems.

Table 90. POST conditions and results

Green LED	Yellow LED	State
Off	Off	Wake-up failure of the adapter board
Off	On	POST failure of the adapter board
Off	Slow flash	Wake-up failure monitor
Off	Fast flash	Failure in post
Off	Flashing	Postprocessing in progress
On	Off	Failure while functioning
On	On	Failure while functioning
Slow flash	Off	Normal, link down
Slow flash	On	Not defined
Slow flash	Slow flash	Offline for download
Slow flash	Fast flash	Restricted offline mode, waiting for restart
Slow flash	Flashing	Restricted offline mode, test active
Fast flash	Off	Debug monitor in restricted mode
Fast flash	On	Not defined
Fast flash	Slow flash	Debug monitor in test fixture mode
Fast flash	Fast flash	Debug monitor in remote debug mode
Fast flash	Flashing	Not defined

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LP 16 Gb 2-port Fibre Channel Adapter (FC EN0B; CCIN 577F)

Learn about the specifications and operating system requirements for the feature code (FC) EN0B adapter.

Overview

The PCIe3 LP 16 Gb 2-port Fibre Channel Adapter is a low-profile, x8, generation 3, PCIe adapter. This adapter is a high-performance 8x short form adapter also referred to as a PCIe Host Bus Adapter (HBA). The adapter provides two ports of 16 Gb Fibre Channel capability using SR optics. Each port can provide up to 16 Gb Fibre Channel functions simultaneously.

Each port provides single initiator capability over a fibre link or with NPIV, multiple initiator capability is provided. The ports are SFP+ and include an optical SR transceiver. The ports have little connector-type (LC) and utilize shortwave laser optics. The adapter operates at link speeds of 4, 8 and 16 Gbps and will automatically negotiate to the highest speed possible. LEDs on each port provide information on the status and link speed of the port.

The adapter connects to a Fibre Channel switch at 4 Gb, 8 Gb or 16 Gb. It can directly attach to a device without a switch at 16 Gb. Attachment without a switch is not supported at 4 Gb or 8 Gb.

N_Port ID Virtualization (NPIV) capability is supported through VIOS.

The adapter has the following features:
- This adapter has parts and construction compliant with the European Union Directive of Restriction of Hazardous Substances (RoHS)
- The adapter is compliant with the PCIe base and Card Electromechanical (CEM) 2.0 specifications with the following characteristics:
  - Provides an x8 lane link interface at 14.025 Gbps, 8.5 Gbps, or 4.25 Gbps (automatic negotiation with system)
  - Provides support for one Virtual Channel (VC0) and one Traffic Class (TC0)
  - Provides configuration and I/O memory read and write, completion, and messaging capabilities
  - Provides support for 64-bit addressing
  - Provides error correction code (ECC) and error protection functions
  - Provides link cyclic redundancy check (CRC) on all PCIe packets and message information
  - Provides a large payload size of 2048 bytes for read and write functions
  - Provides a large read request size of 4096 bytes
- The adapter is compatible with 4, 8, and 16 Gb Fibre Channel interface with the following characteristics:
  - Provides for automatic negotiation between 4 Gb, 8 Gb, or 16 Gb link attachments
  - Provides support for the following Fibre Channel topologies: point-to-point (16Gb only) and fabric
  - Provides support for Fibre Channel class 3
  - Provides a maximum Fibre Channel throughput that is achieved by using full duplex hardware support
- The adapter provides an end-to-end data path parity and CRC protection, including internal data path random-access memory (RAM)
- Provides architectural support for multiple upper layer protocols
- Provides comprehensive virtualization capabilities with support for N_Port ID Virtualization (NPIV) and virtual fabric (VF)
- Provides support for message signaled interrupts extended (MSI-X)
- Provides support for 255 VFs and 1024 MSi-X
- Provides an internal, high-speed static random-access memory (SRAM) memory
- Provides ECC protection of local memory that includes single-bit correction and double-bit protection
- Provides an embedded shortwave optical connection with diagnostics capability
- Provides support for an on-board context management by firmware:

- – Up to 8192 FC port logins
- – I/O multiplexing down to the Fibre Channel frame level
- Provides data buffers capable of supporting 64+ buffer-to-buffer (BB) credits per port for shortwave applications
- Provides link management and recovery that is handled by firmware
- Provides on-board diagnostic capability accessible by an optional connection
- Provides a performance up to 16 Gbps full duplex

The following figure shows the adapter.

Figure 126. FC EN0B adapter

Specifications

Item   Description
Adapter FRU number
    000E9283 (Designed to comply with RoHS requirement)
Wrap plug FRU number
    12R9314

    Note: The wrap plug is included with the card, and can also be purchased from IBM.
I/O bus architecture
    PCIe base and CEM 3.0, x8 PCIe bus interface
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.
Voltage
    3.3 V, 12 V
Form factor
    Short, low-profile

FC compatibility

4, 8, 16 Gb

Cables

Cables are the responsibility of the customer. Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:

- OM4: Multimode 50/125 micron fiber, 4700 MHz x km bandwidth
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables.

The following table shows the supported distances for the different cable types at the different link speeds.

Table 91. Supported distances for cables

Header	Cable type and distance			
Rate	OM1	OM2	OM3	OM4
4 Gbps	0.5 - 70 m (1.64 - 229.65 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 380 m (1.64 - 1246.71 ft)	0.5 - 400 m (1.64 - 1312.34 ft)
8 Gbps	0.5 - 21 m (1.64 - 68.89 ft)	0.5 - 50 m (1.64 - 164.04 ft)	0.5 - 150 m (1.64 - 492.12 ft)	0.5 - 190 m (1.64 - 623.36 ft)
16 Gbps	0.5 - 15 m (1.64 - 49.21 ft)	0.5 - 35 m (1.64 - 114.82 ft)	0.5 - 100 m (1.64 - 328.08 ft)	0.5 - 125 m (1.64 - 410.10 ft)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
    - AIX 7.1, or later
    - AIX Version 6.1, or later
- Linux
    - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
    - Red Hat Enterprise Linux Version 6.3, or later, with current maintenance updates available from Red Hat.
    - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
    - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/ home.html).

- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- PowerKVM
  - IBM PowerKVM 2.1 SP1, or later

Adapter LED states

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. Green indicates firmware operation, and yellow signifies port activity. Table 92 summarizes normal LED states. A 1 Hz pause occurs when the LED is off between each group of fast flashes (2, 3 or 4). Observe the LED sequence for several seconds to ensure that you correctly identify the state.

Table 92. Normal LED states

Green LED	Yellow LED	State
On	2 fast flashes	4 Gbps link rate: normal, link active
On	3 fast flashes	8 Gbps link rate: normal, link active
On	4 fast flashes	16 Gbps link rate: normal, link active

Power-on-self-test (POST) conditions and results are summarized in Table 93. These states can be used to identify abnormal states or problems.

Table 93. POST conditions and results

Green LED	Yellow LED	State
Off	Off	Wake-up failure of the adapter board
Off	On	POST failure of the adapter board
Off	Slow flash	Wake-up failure monitor
Off	Fast flash	Failure in post
Off	Flashing	Postprocessing in progress
On	Off	Failure while functioning
On	On	Failure while functioning
Slow flash	Off	Normal, link down
Slow flash	On	Not defined
Slow flash	Slow flash	Offline for download
Slow flash	Fast flash	Restricted offline mode, waiting for restart
Slow flash	Flashing	Restricted offline mode, test active
Fast flash	Off	Debug monitor in restricted mode
Fast flash	On	Not defined
Fast flash	Slow flash	Debug monitor in test fixture mode
Fast flash	Fast flash	Debug monitor in remote debug mode
Fast flash	Flashing	Not defined

Related information:

IBM Prerequisite website

⬀ Installing, removing, or replacing PCIe adapters

⬀ PCIe adapter placement

⬀ PCIe adapter information by feature type

PCIe2 8 Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D)

Learn about the specifications and operating system requirements for feature codes (FC) EN0F and EN0G adapters.

Overview

FC EN0F and EN0G are both the same adapter with different feature codes. FC EN0F is a low-profile adapter and FC EN0G is a full-height adapter.

The PCIe2 8 Gb 2-port Fibre Channel Adapter is a PCI Express (PCIe) generation 2 (Gen2), high-performance, x8 short form factor pluggable plus (SFP+) Host Bus. This adapter enables multiple logical (virtual) connections to share the same physical port. Each logical connection has its own resources and the ability to be managed independently. Each port provides single initiator capability over a fiber link or provides multiple initiator capability with N_Port ID Virtualization (NPIV). The ports are connected by using LC type connectors. These connectors use shortwave laser optics. The adapter operates at link speeds of 2, 4, and 8 gigabits per second (Gbps) and automatically negotiates to the highest speed possible. LEDs on each port provide information about the connection status and link speed of the port. The adapter connects to a Fibre Channel switch.
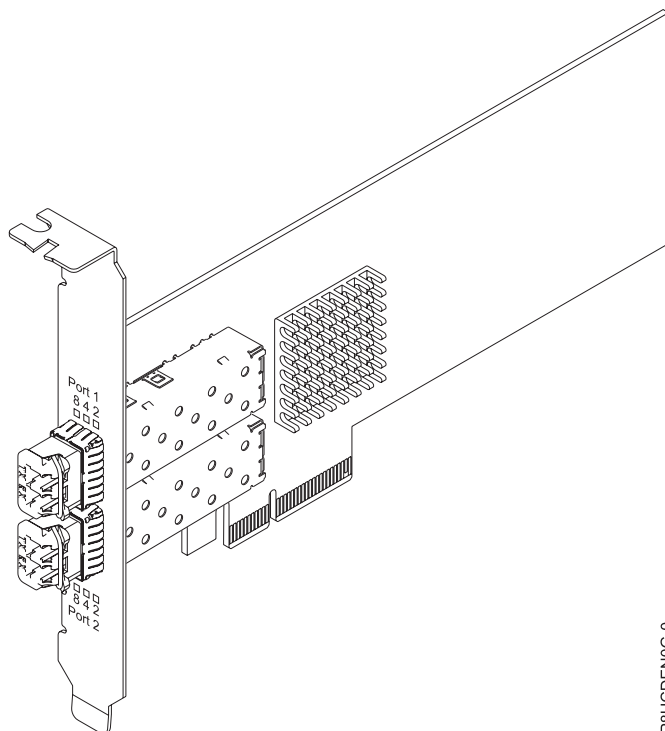

Figure 127. PCIe2 8 Gb 2-Port Fibre Channel Adapter

Specifications

Item   Description
Adapter FRU number
          00WT111 (Designed to comply with RoHS requirement)

I/O bus architecture

> PCIe2.0 x8

Slot requirement

> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

FC compatibility

> 2, 4, 8 Gigabit

Cables

> Cables are the responsibility of the customer.
>
> Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
> * OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
> * OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
> * OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth
>
> Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 94. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Supported Systems

> POWER8® processor-based server

Voltage

> 12 V

Form factor

> Short, low-profile (FC EN0F)
>
> Short, with full-height tailstock (FC EN0G)

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

> NPIV capability is supported through VIOS
>
> Requires a PCI Express Gen2 x8 slot for all ports to operate at full speed

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.2 7200-00 Technology Level and Service Pack 2, or later.
  - AIX 7.1 7100-04 Technology Level and Service Pack 2, or later.
  - AIX 6.1 6100-09 Technology Level and Service Pack 7, or later.
- Linux
  - Red Hat Enterprise Linux 7.2, or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 1, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS support requires VIOS 2.2.4.20, or later

Adapter LED

Table 95. LED States

Hardware State	Yellow LED (8 Gbps)	Green LED (4 Gbps)	Amber LED (2 Gbps)	Comments
Power Off	Off	Off	Off	
Power On (before firmware initialization)	On	On	On	
Power On (after firmware initialization)	Flash	Flash	Flash	All flash at the same time.
Firmware Fault	Flash in sequence	Flash in sequence	Flash in sequence	Flashing in sequence of yellow LED, green LED, amber LED, then back to yellow LED.
2 Gbps Link UP/ACT	Off	Off	On/Flash	On for link up and flash if I/O activity.
4 Gbps Link UP/ACT	Off	On/Flash	Off	
8 Gbps Link UP/ACT	On/Flash	Off	Off	
Beacon	Flash	Off	Flash	All flashing at the same time.

Related information:

⮕ IBM Prerequisite website

PCIe2 8 Gb 2-Port Fibre Channel Adapter (FC EN0F and EN0G; CCIN 578D)

Learn about the specifications and operating system requirements for feature codes (FC) EN0F and EN0G adapters.

Overview

FC EN0F and EN0G are both the same adapter with different feature codes. FC EN0F is a low-profile adapter and FC EN0G is a full-height adapter.

The PCIe2 8 Gb 2-port Fibre Channel Adapter is a PCI Express (PCIe) generation 2 (Gen2), high-performance, x8 short form factor pluggable plus (SFP+) Host Bus. This adapter enables multiple logical (virtual) connections to share the same physical port. Each logical connection has its own resources and the ability to be managed independently. Each port provides single initiator capability over a fiber link or provides multiple initiator capability with N_Port ID Virtualization (NPIV). The ports are connected by using LC type connectors. These connectors use shortwave laser optics. The adapter operates at link speeds of 2, 4, and 8 gigabits per second (Gbps) and automatically negotiates to the highest speed possible. LEDs on each port provide information about the connection status and link speed of the port. The adapter connects to a Fibre Channel switch.
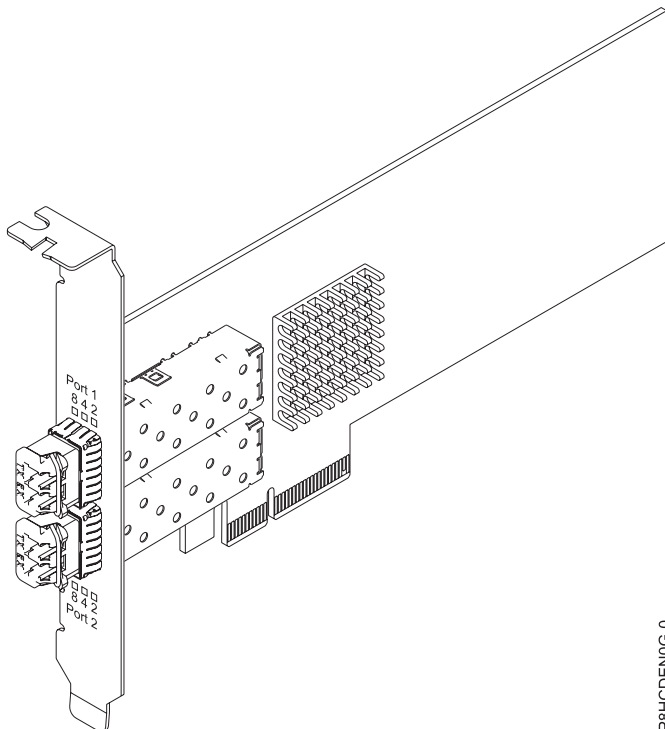

Figure 128. PCIe2 8 Gb 2-Port Fibre Channel Adapter

Specifications

Item   Description
Adapter FRU number
        00WT111 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2.0 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

FC compatibility

2, 4, 8 Gigabit

Cables

Cables are the responsibility of the customer.

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 96. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Supported Systems

POWER8® processor-based server

Voltage

12 V

Form factor

Short, low-profile (FC EN0F)

Short, with full-height tailstock (FC EN0G)

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

NPIV capability is supported through VIOS

Requires a PCI Express Gen2 x8 slot for all ports to operate at full speed

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 7.2 7200-00 Technology Level and Service Pack 2, or later.
  - AIX 7.1 7100-04 Technology Level and Service Pack 2, or later.
  - AIX 6.1 6100-09 Technology Level and Service Pack 7, or later.
- Linux
  - Red Hat Enterprise Linux 7.2, or later
  - Red Hat Enterprise Linux 7.2, little-endian, or later
  - Red Hat Enterprise Linux 6.8 or later
  - SUSE Linux Enterprise Server 12, Service Pack 1, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - Ubuntu Server 16.04, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
  - The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).
- VIOS
  - VIOS support requires VIOS 2.2.4.20, or later

Adapter LED

Table 97. LED States

Hardware State	Yellow LED (8 Gbps)	Green LED (4 Gbps)	Amber LED (2 Gbps)	Comments
Power Off	Off	Off	Off	
Power On (before firmware initialization)	On	On	On	
Power On (after firmware initialization)	Flash	Flash	Flash	All flash at the same time.
Firmware Fault	Flash in sequence	Flash in sequence	Flash in sequence	Flashing in sequence of yellow LED, green LED, amber LED, then back to yellow LED.
2 Gbps Link UP/ACT	Off	Off	On/Flash	On for link up and flash if I/O activity.
4 Gbps Link UP/ACT	Off	On/Flash	Off	
8 Gbps Link UP/ACT	On/Flash	Off	Off	
Beacon	Flash	Off	Flash	All flashing at the same time.

Related information:

➡ IBM Prerequisite website

➱ Installing, removing, or replacing PCIe adapters

➱ PCIe adapter placement

➱ PCIe adapter information by feature type

PCIe3 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0H, CCIN 2B93)

Learn about the specifications and operating system requirements for the feature code (FC) EN0H adapters.

Overview

The PCIe3 LP 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter is a PCI Express (PCIe) generation 3, low-profile capable adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both FCoE and network interface controller (NIC) functions are available for both FCoE ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE small form-factor pluggable (SFP+) SR optical ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 129 on page 372 shows the FC EN0H adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:
- The adapter is a PCIe3 FCoE or NIC network convergence adapter.
- The 10 Gb SFP+ ports can function in the NIC or FCoE mode.
- The adapter supports the Single Root IO Virtualization (SRIOV) function.
- The adapter can function as a Boot adapter.

Figure 129. FC EN0H adapter

Specifications

Item   Description

Adapter FRU number

00E3498 (Designed to comply with RoHS requirement)

Wrap plug FRU number

12R9314 (for Fibre LC connector)

10N7405

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

SR SFP+ optical fiber cables and Cat5 Ethernet cables

Voltage

3.3 V, 12 V

Form factor

Short, regular sized bracket, low-profile capable

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 LP 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter (FC EN0J, CCIN 2B93)

Learn about the specifications and operating system requirements for the feature code (FC) EN0J adapters.

Overview

The PCIe3 LP 4-port (2x10 Gb FCoE, 2x1 GbE) SFP+ Adapter is a PCI Express (PCIe) generation 3, low-profile capable adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both FCoE and network interface controller (NIC) functions are available for both FCoE ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE SR small form-factor pluggable (SFP+) ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 130 on page 374 shows the FC EN0J adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:
- The adapter is a PCIe3 FCoE or NIC network convergence adapter.
- The 10 Gb SFP+ ports can function in the NIC or FCoE mode.
- The adapter supports the SR-IOV (Single Root I/O Virtualization) function.
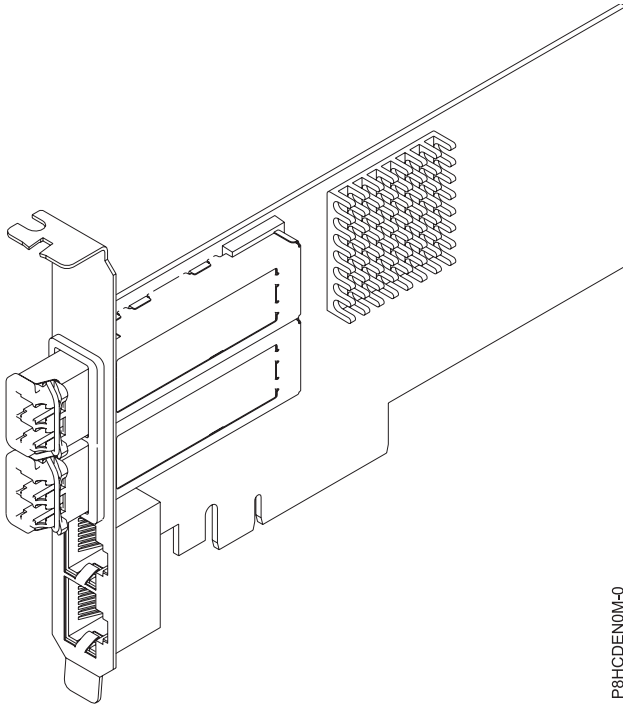- The adapter can function as a Boot adapter.
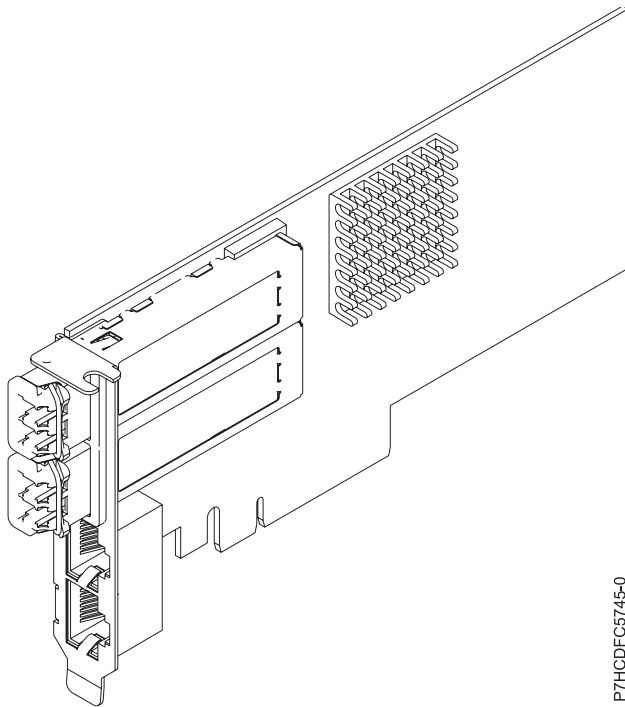
Figure 130. FC EN0J adapter

Specifications

Item   Description
Adapter FRU number
> 00E3498 (Designed to comply with RoHS requirement)

Wrap plug FRU number
> 12R9314 (for Fibre LC connector)
>
> 10N7405 (for RJ45 connector)

I/O bus architecture
> PCIe3 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> SR SFP+ optical fiber cables and Cat5 Ethernet cables

Voltage
> 3.3 V, 12 V

Form factor
> Short, with full-height tailstock

> Low-profile capable

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 6.1, Technology Level 9, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0K; CCIN 2CC1)

Learn about the specifications and operating system requirements for the feature code (FC) EN0K adapters.

Overview

The PCIe3 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter is a PCI Express (PCIe) generation 3, regular-height adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the

FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Copper Twin-axial ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 131 shows the FC EN0K adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter is Single Root I/O Virtualization (SR-IOV) capable. The adapter can function as a boot adapter. The adapter supports all Fibre Channel and Ethernet topologies.
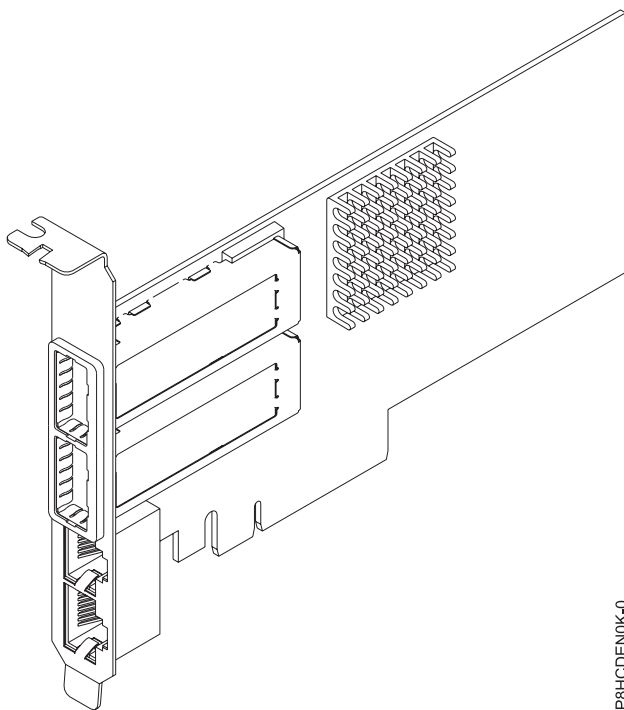
Figure 131. FC EN0K adapter

Specifications

Item   Description

Adapter FRU number
    00E3501 (Designed to comply with RoHS requirement)

Wrap plug FRU number
    74Y7010

    10N7405

    Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture
    PCIe3 x8

Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot

priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" for details

Voltage

3.3 V, 12 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 132 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 98 for details about the feature codes.

P7ECF505-0
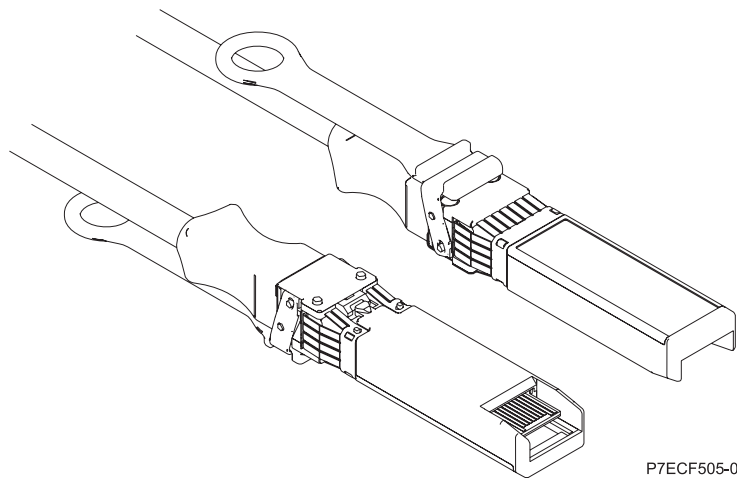
Figure 132. Top and bottom view of the cable

Table 98. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 14.04.3, or later
  - Linux Ubuntu 16.04, or later
- IBM i
  - IBM i Version 7.2, Technology Refresh 2, or later
  - IBM i Version 7.1, Technology Refresh 10, or later
- VIOS
  - VIOS 2.2.3.51, or later

Related information:

➙ IBM Prerequisite website

➙ Installing, removing, or replacing PCIe adapters

➙ PCIe adapter placement

➙ PCIe adapter information by feature type

PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter (FC EN0L; CCIN 2CC1)

Learn about the specifications and operating system requirements for the feature code (FC) EN0L adapter.

Overview

The PCIe3 LP 4-port (10 Gb FCoE and 1 GbE) Copper and RJ45 Adapter is a PCI Express (PCIe) generation 3, low-profile adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Copper Twin-axial ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports are connected by little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. A 10 Mb data rate is not supported. Figure 133 on page 379 shows the FC EN0L adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:
- The adapter supports all Fibre Channel and Ethernet topologies.
- The 10 Gb SFP+ ports can function in the NIC or FCoE mode.
- The adapter supports the SR-IOV (Single Root I/O Virtualization) NIC capability.
- The adapter can function as a Boot adapter.
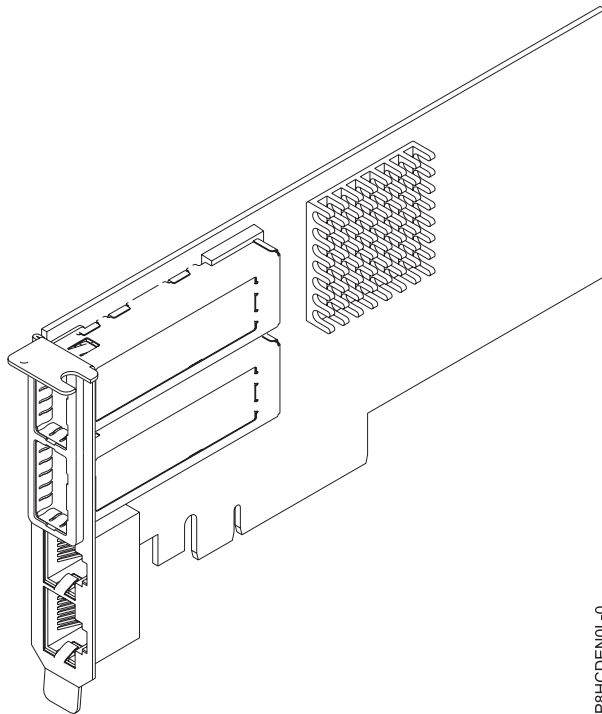
Figure 133. FC EN0L adapter

Specifications

Item   Description
Adapter FRU number
00E3501 (Designed to comply with RoHS requirement)

Low-profile bracket part number 00ND496
Wrap plug FRU number
74Y7010

10N7405

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.
I/O bus architecture
PCIe3 x8
Slot requirement
For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
See "Cables" on page 380 for details

Voltage
>3.3 V, 12 V

Form factor
>Short, low-profile

Maximum number
>For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 134 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 99 for details about the feature codes.

P7ECF505-0
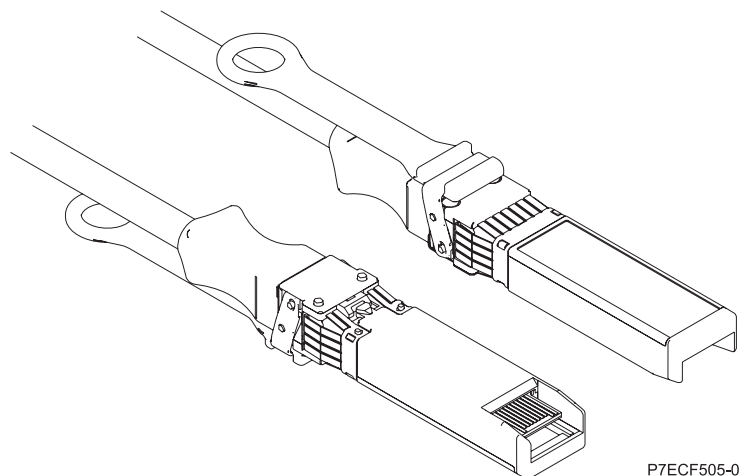
Figure 134. Top and bottom view of the cable

Table 99. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, or later
  - AIX Version 6.1, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 14.04.3, or later
  - Linux Ubuntu 16.04, or later
- IBM i
  - IBM i Version 7.1, or later , supported through VIOS 2.2.2, or later

Related information:

� IBM Prerequisite website

� Installing, removing, or replacing PCIe adapters

� PCIe adapter placement

� PCIe adapter information by feature type

PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter (FC EN0M; CCIN 2CC0)

Learn about the specifications and operating system requirements for the feature code (FC) EN0M adapter.

Overview

The PCIe3 4-port (10 Gb FCoE and 1 GbE) LR and RJ45 Adapter is a PCI Express (PCIe) generation 3, x8, regular-height adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Long Range (LR) optical ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports provide an SFP+ optical transceiver and have little connector (LC) duplex-type connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). The optical transceiver uses shortwave laser optics and is attached with MMF-850nm fiber cabling with LC connectors. An FCoE switch is required to be attached for any FCoE traffic on this adapter.

Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. Figure 135 on page 382 shows the FC EN0M adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:

*   The adapter supports both the dedicated mode and SR-IOV (Single Root I/O Virtualization) mode to function as a NIC.
*   The adapter can function as a boot adapter.
*   The adapter supports all Fibre Channel and Ethernet topologies.
*   The adapter provides end-to-end data path parity and cyclic redundancy check
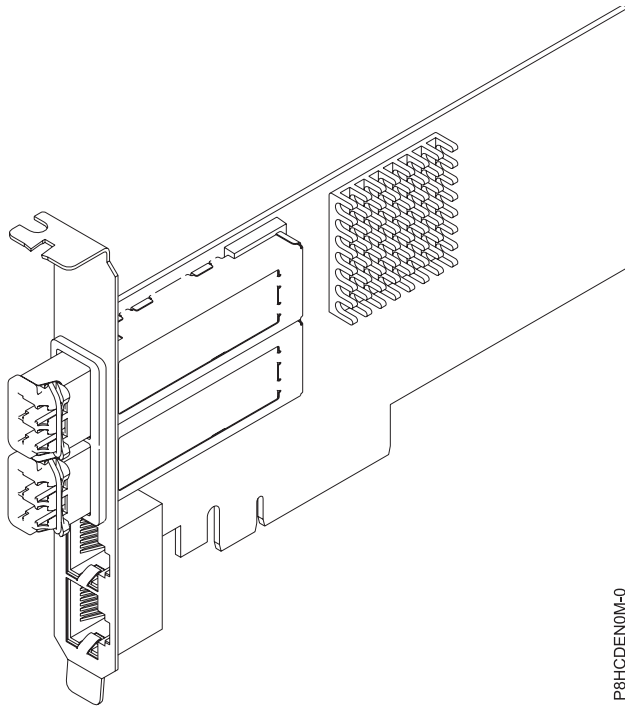
Figure 135. FC EN0M adapter

Specifications

Item   Description
Adapter FRU number
        00E8144 (Designed to comply with RoHS requirement)
Wrap plug FRU number
        12R9314 (for Fibre LC connector)

        10N7405

        Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap
        plug that can be purchased from IBM.
I/O bus architecture
        PCIe3 x8
Slot requirement
        For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
        priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
        p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables

Table 100. Cable type

Fiber cable type	Connector type	Operating range in meters
9 μm SMF	LC	10 km

Voltage

> 12 V

Form factor

> Short, regular-height

Maximum number

> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 7.1, Technology Level 2, Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 14.04.3, or later
  - Linux Ubuntu 16.04, or later
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LP 4-port (10Gb FCoE and 1GbE) LR and RJ45 Adapter (FC EN0N; CCIN 2CC0)

Learn about the specifications and operating system requirements for the feature code (FC) EN0N adapter.

Overview

The PCIe3 LP 4-port (10Gb FCoE and 1GbE) LR and RJ45 Adapter is a PCI Express (PCIe) generation 3, x8, low-profile adapter. The adapter has four-ports and is a Fibre Channel over Ethernet (FCoE) converged network adapter (CNA). This adapter provides a PCIe 3.0 host bus interface. The adapter is a high-performance adapter that consolidates traffic for networking and Fibre Channel storage. The adapter is optimized for cloud computing, virtualization, storage, and other data center applications. Both the FCoE and network interface controller (NIC) functions are available for all the four ports. Use of the FCoE requires that you use convergence enhanced Ethernet (CEE) switches. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb FCoE Long Range (LR) optical ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb FCoE ports provide an SFP+ optical transceiver and have duplex little connector-type (LC) connectors. Each FCoE port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). The optical transceiver uses shortwave laser optics and is attached with MMF-850nm fiber cabling with LC connectors. An FCoE switch is required to be attached for any FCoE traffic on this adapter.

Each of the 1 Gb ports provides Ethernet connectivity at a data rate of 1 Gbps and is connected with Ethernet cables. Figure 136 on page 385 shows the FC EN0N adapter.

Restriction: The 1 Gb Ethernet ports do not support data rates of 10 Mbps (megabits per second).

The adapter provides the following features:
- The adapter supports both the dedicated mode and SR-IOV (Single Root I/O Virtualization) mode to function as a NIC.
- The adapter can function as a boot adapter.
- The adapter supports all Fibre Channel and Ethernet topologies.
- The adapter provides end-to-end data path parity and cyclic redundancy check
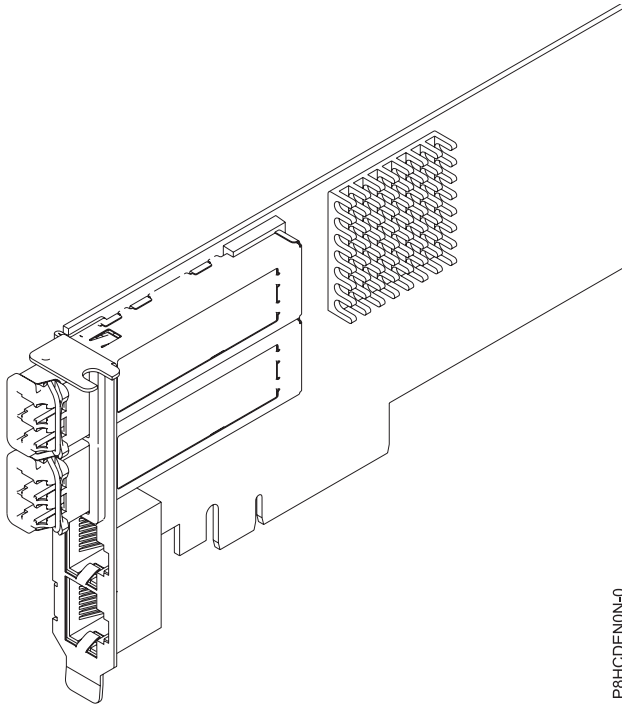
Figure 136. FC EN0N adapter

Specifications

Item   Description

Adapter FRU number

00E8143 (Designed to comply with RoHS requirement)

Low-profile tailstock part number: 00E8163

Wrap plug FRU number

12R9314 (for Fibre LC connector)

10N7405

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Table 101. Cable type

Fiber cable type	Connector type	Operating range in meters
9 µm SMF	LC	10 km

Voltage

12 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter

placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1, Technology Level 3, Service Pack 2, or later
  - AIX 7.1, Technology Level 2, Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
  - AIX 6.1, Technology Level 8, Service Pack 3, or later
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7.1, little endian, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server Version 12, or later
  - Linux Ubuntu 14.04.3, or later
  - Linux Ubuntu 16.04, or later
- PowerKVM
  - IBM PowerKVM 2.1.1, or later
- IBM i
  - IBM i Version 7.1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-Port (10 Gb + 1 GbE) SR+RJ45 Adapter (FC EN0S; CCIN 2CC3)
Learn about the specifications and operating system requirements for the feature code (FC) EN0S adapter.

Overview

The PCIe2 4-Port (10 Gb + 1 GbE) SR+RJ45 Adapter is a PCI Express (PCIe) generation 2 (Gen2) x8, short form-factor, low-profile capable, full-height adapter. The adapter provides two 10 Gb SR optical ports and two 1 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that

consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb small form-factor pluggable (SFP+) optical SR transceiver ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb SR ports have little connector (LC) duplex-type connectors. The optical transceiver uses shortwave laser optics and is attached with MMF-850nm fiber cabling with LC connectors. See "Cables" on page 389 for more information about the optical cables. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 137 on page 388 shows the FC EN0S adapter.

Each of the 1 Gb RJ45 port provides Ethernet connectivity at a data rate of 1 Gbps. Each of the 1 Gb ports is connected with a 4-pair, CAT-5 unshielded twisted pair (UTP) cable or with a cable of higher specification, and is supported for distances of up to 100 meters. In addition to 1 Gb (1000 Mb) networks, 100 Mb networks are also supported.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb SR ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe2 slot
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 137. FC EN0S adapter

Note: The ports are numbered from top to bottom as T1, T2, and so on for the AIX and IBM i operating systems.

Specifications

Item   Description
Adapter FRU number
> 00E2715 (Designed to comply with RoHS requirement)

> Regular-height tailstock part number: 00E2863

> Low-profile tailstock part number: 00E2720

Wrap plug FRU number
> 12R9314 (SFP+ SR wrap plug)

> 10N7405 (1 Gb UTP wrap plug)

> **Note:** These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture
> PCIe2 x8

Slot requirement
> For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
> See "Cables" on page 389 for details.

Voltage
> 3.3 V

Form factor
> Short, with full-height tailstock

Low-profile capable

Maximum number
For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3 or OM4: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables only can be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 or OM4 cables. However, if an OM2 cable is connected to an OM3 or OM4 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 102. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
10 Gbps	0.5 meters to 33 meters (1.64 feet to 108.26 feet)	0.5 meters to 82 meters (1.64 feet to 269.02 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- AIX
  - AIX 7.1with the 7100-03 Technology Level and Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 7.1, little endian, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - SUSE Linux Enterprise Server 12, or later
  - Ubuntu Server 16.04, or later
  - Ubuntu Server 14.04.3, or later
- IBM i
  - IBM i is supported only with VIOS

This adapter requires the following drivers:
- AIX: `devices.pciex.e4148a1614109304` for SFP+ optical ports and `devices.pciex.e4148a1614109404` for RJ45 ports

- Linux: bnx2x driver
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

↪ IBM Prerequisite website

↪ Installing, removing, or replacing PCIe adapters

↪ PCIe adapter placement

↪ PCIe adapter information by feature type

PCIe2 LP 4-Port (10Gb+1GbE) SR+RJ45 Adapter (FC EN0T; CCIN 2CC3)

Learn about the specifications and operating system requirements for the feature code (FC) EN0T adapter.

Overview

The PCIe2 LP 4-Port (10Gb+1GbE) SR+RJ45 Adapter is a PCI Express (PCIe) generation 2 (Gen2) x8, short form-factor, low-profile adapter. The adapter provides two 10 Gb SR optical ports and two 1 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The four-port adapter provides two 10 Gb small form-factor pluggable (SFP+) optical SR transceiver ports and two 1 Gb RJ45 Ethernet ports. The two 10 Gb SR ports have little connector (LC) duplex-type connectors. The optical transceiver uses shortwave laser optics and is attached with MMF-850nm fiber cabling with LC connectors. See "Cables" on page 392 for more information about the optical cables. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 138 on page 391 shows the FC EN0T adapter.

Each of the 1 Gb RJ45 port provides Ethernet connectivity at a data rate of 1 Gbps. Each of the 1 Gb ports is connected with a 4-pair, CAT-5 unshielded twisted pair (UTP) cable or with a cable of higher specification, and is supported for distances of up to 100 meters. In addition to 1 Gb (1000 Mb) networks, 100 Mb networks are also supported.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb SR ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging

- – 802.3x for flow control
- – 802.3ad for load-balancing and failover
- – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 138. FC EN0T adapter
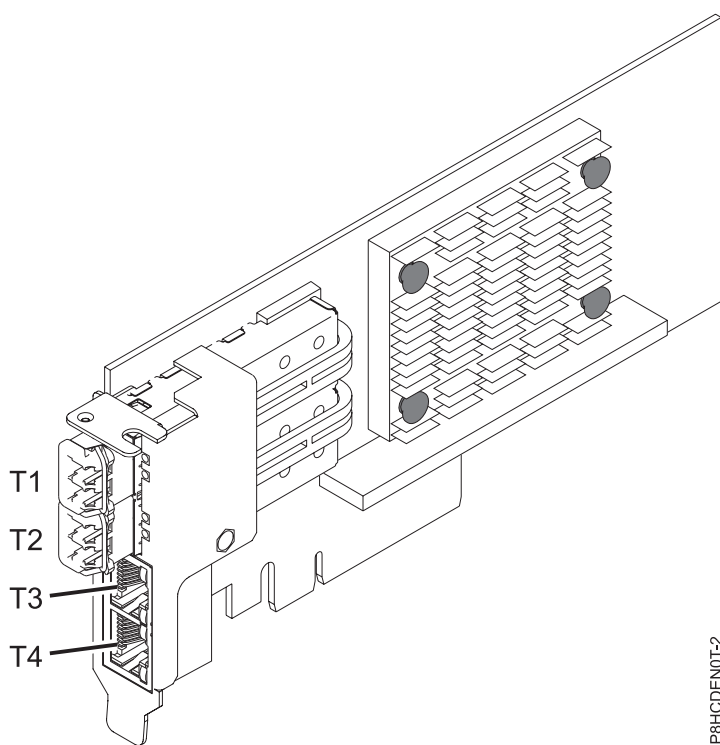
Note: The ports are numbered from top to bottom of the adapter as T1, T2, and so on for the AIX® and IBM® i operating systems.

Specifications

Item   Description
Adapter FRU number
    00E2715 (Designed to comply with RoHS requirement)

    Low-profile tailstock part number: 00E2720
Wrap plug FRU number
    12R9314 (SFP+ SR wrap plug)

    10N7405 (1 Gb UTP wrap plug)

Note: These wrap plugs are not included with the card. 12R9314 (FC ECW0) is the only wrap plug that can be purchased from IBM.

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

3.3 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:

- OM3 or OM4: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables only can be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 or OM4 cables. However, if an OM2 cable is connected to an OM3 or OM4 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 103. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
10 Gbps	0.5 meters to 33 meters (1.64 feet to 108.26 feet)	0.5 meters to 82 meters (1.64 feet to 269.02 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1with the 7100-03 Technology Level and Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- SUSE Linux Enterprise Server Version 12, or later
- SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
- Ubuntu Server 14.04.3, or later
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

- IBM i
  - IBM i is supported only with VIOS

This adapter requires the following drivers:
- AIX: `devices.pciex.e4148a1614109304` for SFP+ optical ports and `devices.pciex.e4148a1614109404` for RJ45 ports
- Linux: bnx2x driver
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0U; CCIN 2CC3)

Learn about the specifications and operating system requirements for the feature code (FC) EN0U adapter.

Overview

The PCIe2 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile capable, regular-height adapter. The adapter provides two 10 Gb copper twinax small form-factor pluggable (SFP+) ports and two 1 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The two 10 Gb are SFP+ and do not include a transceiver. Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A transceiver is included with these cables. See "Cables" on page 395 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 139 on page 394 shows the FC EN0U adapter.

Each of the 1 Gb RJ45 port provides Ethernet connectivity at a data rate of 1 Gbps. Each of the 1 Gb ports is connected with a 4-pair, CAT-5 unshielded twisted pair (UTP) cable or with a cable of higher specification, and is supported for distances of up to 100 meters. In addition to 1 Gb (1000 Mb) networks, 100 Mb networks are also supported.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.

- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 139. FC EN0U adapter

Note: The ports are numbered from top to bottom as T1, T2, and so on for the AIX® and IBM® i operating systems.

Specifications

Item   Description
Adapter FRU number
>   00E2715 (Designed to comply with RoHS requirement)
>
>   Low-profile tailstock part number: 00E2720

Wrap plug FRU number
>   74Y7010 (Twinax wrap plug)
>
>   10N7405 (1 Gb UTP wrap plug)
>
>   **Note:** Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture
>   PCIe2 x8

Slot requirement
>   For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
>   See "Cables" for details.

Voltage
>   3.3 V

Form factor
>   Short, regular-height tailstock, low-profile capable

Maximum number
>   For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 140 on page 396 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

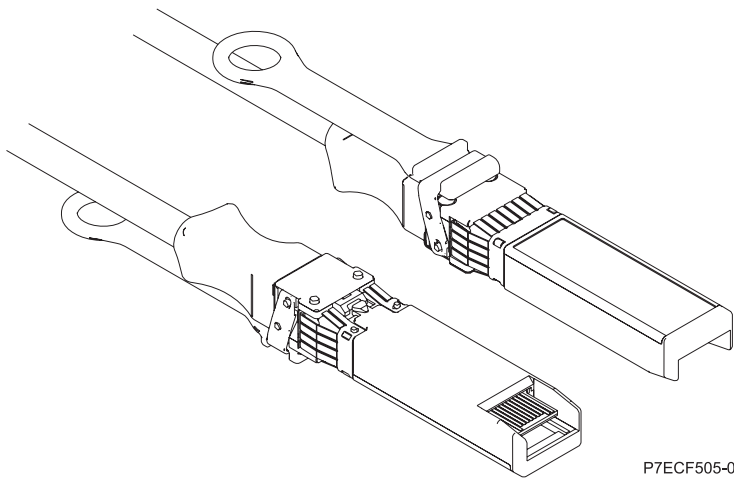See Table 104 on page 396 for details about the feature codes.

Figure 140. Top and bottom view of the cable

Table 104. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* AIX
  – AIX 7.1with the 7100-03 Technology Level and Service Pack 3, or later
  – AIX 6.1, Technology Level 9, Service Pack 2, or later
* Linux
  – Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  – Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  – SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  – For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
* IBM i
  – IBM i is supported only with VIOS

This adapter requires the following drivers:

* AIX: `devices.pciex.e4148a1614109304` for SFP+ optical ports and `devices.pciex.e4148a1614109404` for RJ45 ports

- Linux: bnx2x driver
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

⮕ IBM Prerequisite website

⮕ Installing, removing, or replacing PCIe adapters

⮕ PCIe adapter placement

⮕ PCIe adapter information by feature type

PCIe2 LP 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter (FC EN0V; CCIN 2CC3)

Learn about the specifications and operating system requirements for the feature code (FC) EN0V adapter.

Overview

The PCIe2 LP 4-port (10 Gb + 1 GbE) Copper SFP+RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile adapter. The adapter provides two 10 Gb copper twinax small form-factor pluggable (SFP+) ports and two 1 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability.

The two 10 Gb are SFP+ and do not include a transceiver. Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A transceiver is included with these cables. See "Cables" on page 399 for details. Each 10 Gb port provides Ethernet connectivity with a nominal data rate of 10 Gbps (gigabits per second). Figure 141 on page 398 shows the FC EN0V adapter.

Each of the 1 Gb RJ45 port provides Ethernet connectivity at a data rate of 1 Gbps. Each of the 1 Gb ports is connected with a 4-pair, CAT-5 unshielded twisted pair (UTP) cable or with a cable of higher specification, and is supported for distances of up to 100 meters. In addition to 1 Gb (1000 Mb) networks, 100 Mb networks are also supported.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames

- – 802.1Q for VLAN tagging
- – 802.3x for flow control
- – 802.3ad for load-balancing and failover
- – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 141. FC EN0V adapter
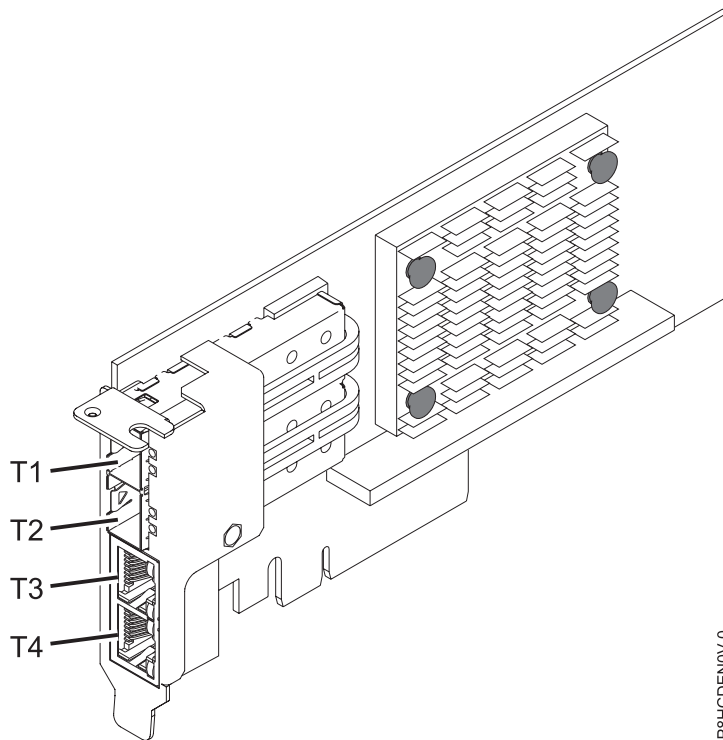
Note: The ports are numbered from top to bottom as T1, T2, and so on for the AIX® and IBM® i operating systems.

Specifications

Item   Description
Adapter FRU number
      00E2715 (Designed to comply with RoHS requirement)

      Low-profile tailstock part number: 00E2720
Wrap plug FRU number
      74Y7010 (Twinax wrap plug)

      10N7405 (1 Gb UTP wrap plug)

Note: Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture

PCIe2 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Voltage

3.3 V

Form factor

Short, low-profile

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables.

Note: These cables are EMC Class A compliant.

See Table 105 for details about the feature codes.

Table 105. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

* AIX
  - AIX 7.1with the 7100-03 Technology Level and Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
* Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

- IBM i
  - IBM i is supported only with VIOS

This adapter requires the following drivers:
- AIX: `devices.pciex.e4148a1614109304` for SFP+ optical ports and `devices.pciex.e4148a1614109404` for RJ45 ports
- Linux: bnx2x driver
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe2 2-port 10 GbE BaseT RJ45 Adapter (FC EN0W; CCIN 2CC4)

Learn about the specifications and operating system requirements for the feature code (FC) EN0W adapter.

Overview

The PCIe2 2-port 10 GbE BaseT RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile capable, regular-height adapter. The adapter provides two 10 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability. Figure 142 on page 401 shows the FC EN0W adapter.

The ports default to auto negotiate the highest speed either at 10 Gb (10G BaseT), 1Gb (1000 BaseT), or 100 Mb (100 BaseT) full duplex. Each RJ45 port can be configured independent of the other port. Each RJ45 port is connected with a 4-pair, CAT-6A cable, and is supported for distances of up to 100 meters.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb RJ45 ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging

- – 802.3x for flow control
- – 802.3ad for load-balancing and failover
- – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 142. FC EN0W adapter

Specifications

Item   Description
Adapter FRU number
  00E2714 (Designed to comply with RoHS requirement)

  Regular-height tailstock part number: 00E2862

  Low-profile tailstock part number: 00E2721
Wrap plug FRU number
  10N7405 (RJ45 wrap plug)

  Note: Wrap plugs are not included with the card and cannot be purchased from IBM.
I/O bus architecture
  PCIe2 x8
Slot requirement
  For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
  CAT-6A cable

Voltage
> 3.3 V

Form factor
> Short, regular-height tailstock, low-profile capable

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-01 Technology Level and Service Pack 10, or later
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 5, or later
  - AIX 6.1 with the 6100-07 Technology Level and Service Pack 10, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 5, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/ lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i supported only with VIOS
- VIOS
  - VIOS 2.2.3.3 with ifix IV56366, or later
  - VIOS 2.2.2.5, or later
  - VIOS 2.2.1.9, or later

This adapter requires the following drivers:

- AIX: `devices.pciex.e4148e1614109204`
- Linux: `bnx2x driver`
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/ home.html).

Related information:

IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter (FC EN0X; CCIN 2CC4)

Learn about the specifications and operating system requirements for the feature code (FC) EN0X adapter.

Overview

The PCIe2 LP 2-port 10 GbE BaseT RJ45 Adapter is a PCI Express (PCIe) generation 2, x8, short form-factor, low-profile adapter. The adapter provides two 10 Gb RJ45 ports. This adapter provides a PCIe 2.0 host bus interface. The adapter supports the Ethernet network interface controller (NIC) function. The adapter is a high-performance adapter that consolidates traffic for networking. The link aggregation and failover features of the adapter make it suitable for critical network applications that require redundancy and high availability. Figure 143 on page 404 shows the FC EN0X adapter.

The ports default to auto negotiate the highest speed either at 10 Gb (10G BaseT), 1Gb (1000 BaseT), or 100 Mb (100 BaseT) full duplex. Each RJ45 port can be configured independent of the other port. Each RJ45 port is connected with a 4-pair, CAT-6A cable, and is supported for distances of up to 100 meters.

The adapter provides the following features:
- The adapter is a PCIe2 NIC network convergence adapter.
- The 10 Gb RJ45 ports can function in the NIC mode.
- The adapter can be used as the host local area network (LAN) adapter.
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports dual port operation in any PCIe3 or PCIe2 slot.
- The adapter supports auto-negotiation, full-duplex only.
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports gigabit EtherChannel (GEC) with the existing software.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
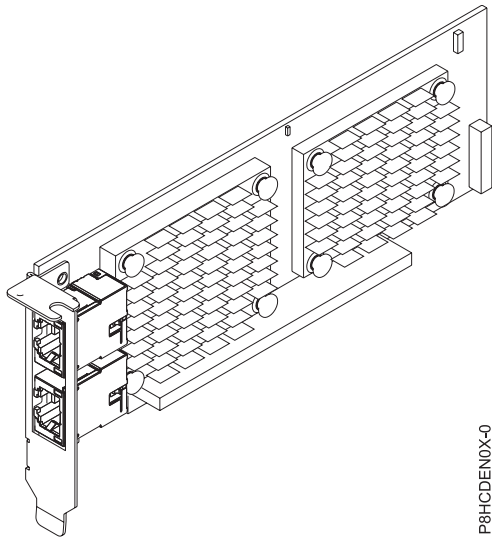
Figure 143. FC EN0X adapter

Specifications

Item   Description

Adapter FRU number

>   00E2714 (Designed to comply with RoHS requirement)

>   Low-profile tailstock part number: 00E2721

Wrap plug FRU number

>   10N7405 (RJ45 wrap plug)

>   **Note:** Wrap plugs are not included with the card and cannot be purchased from IBM.

I/O bus architecture

>   PCIe2 x8

Slot requirement

>   For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/ p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

>   CAT-6A cable

Voltage

>   3.3 V

Form factor

>   Short, low-profile

Maximum number

>   For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/ eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:

- AIX
  - AIX 7.1with the 7100-03 Technology Level and Service Pack 3, or later
  - AIX 6.1, Technology Level 9, Service Pack 2, or later
- Linux
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i is supported only with VIOS

This adapter requires the following drivers:

- AIX: `devices.pciex.e4148e1614109204`
- Linux: `bnx2x driver`
- The latest version of the device driver or iprutils can be downloaded from the IBM Service and Productivity Tools website(http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/home.html).

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 LP 8 Gb 4-port Fibre Channel Adapter (FC EN0Y; CCIN EN0Y)

Learn about the specifications and operating system requirements for the feature code (FC) EN0Y adapter.

Overview

The PCIe2 LP 8 Gb 4-port Fibre Channel Adapter is a PCI Express (PCIe) generation-2, low-profile, high-performance, x8 short form factor plus (SFF+) Host Bus Adapter (HBA). This adapter enables multiple logical (virtual) connections to share the same physical port. Each logical connection has its own resources and the ability to be managed independently. Each port provides single initiator capability over a fiber link or provides multiple initiator capability with N_Port ID Virtualization (NPIV). The ports are connected by using LC type connectors. These connectors use shortwave laser optics. The adapter operates at link speeds of 2, 4, and 8 gigabits per second (Gbps) and automatically negotiates to the highest speed possible. LEDs on each port provide information about the connection status and link speed of the port. The adapter connects to a Fibre Channel switch.

The LEDs on the adapter indicate the TX/RX and link status as shown in Table 106 on page 406.

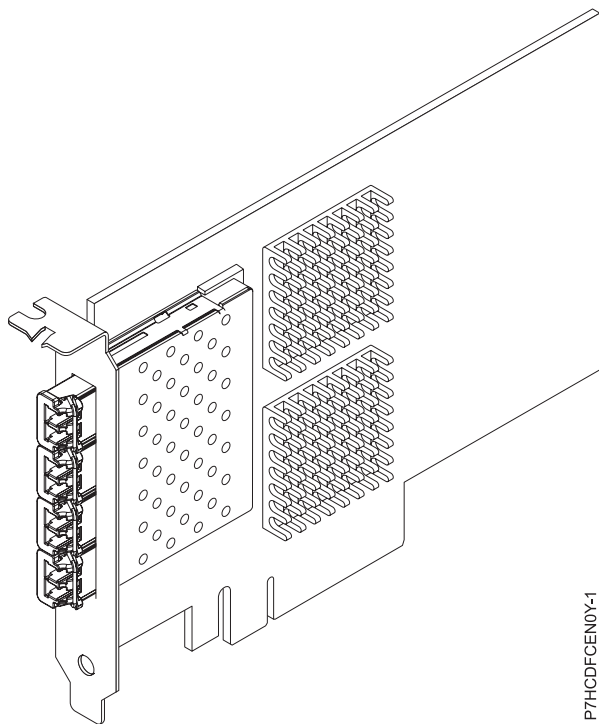Figure 144 on page 406 shows the adapter.

Figure 144. PCIe2 LP 8 Gb 4-port Fibre Channel Adapter

Table 106. LED indications

Hardware State	Yellow LED (8 Gbps)	Green LED (4 Gbps)	Amber LED (2 Gbps)	Comments
Power Off	Off	Off	Off	
Power On (before firmware initialization)	On	On	On	
Power On (after firmware initialization)	Flash	Flash	Flash	All flash at the same time.
Firmware Fault	Flash in sequence	Flash in sequence	Flash in sequence	Flashing in sequence of yellow LED, green LED, amber LED, then back to yellow LED.
2 Gbps Link UP/ACT	Off	Off	On/Flash	On for link up and flash if I/O activity.
4 Gbps Link UP/ACT	Off	On/Flash	Off	
8 Gbps Link UP/ACT	On/Flash	Off	Off	
Beacon	Flash	Off	Flash	All flashing at the same time.

Specifications

Item   Description
Adapter FRU number
        00E1578 (Designed to comply with RoHS requirement)
Wrap plug FRU number
        12R9314

Note: The wrap plug is included with the card, and can also be purchased from IBM.

I/O bus architecture
> PCIe2.0 x8

Slot requirement
> One PCIe generation-2 x8 slot.

Cables
> For information about the cables, see "Cables"

Voltage
> 3.3 V and 12.0 V

Form factor
> Short, low-profile

Maximum number
> For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided
- NPIV capability is supported through VIOS.
- Requires a PCI Express generation-2 x8 slot for all four ports to operate at full speed.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 107. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:
- AIX
  - AIX 7.1, Service Pack 4, or later.
  - AIX 6.1, Service Pack 8, or later.
  - AIX 6.1, Service Pack 6, or later.
  - AIX 5.3, Service Pack 6, or later.

- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.2, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server 10, Service Pack 4, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM ionly with VIOS
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.1.4, or later.

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 FH 4-port 8 Gb Fibre Channel Adapter (FC EN12, CCIN EN0Y)

Learn about the specifications and operating system requirements for the feature code (FC) EN12 adapter.

Overview

The PCIe2 FH 4-port 8 Gb Fibre Channel Adapter is a PCI Express (PCIe) generation-2, full height, high-performance, x8 short form factor plus (SFF+) Host Bus Adapter (HBA). This adapter enables multiple logical (virtual) connections to share the same physical port. Each logical connection has its own resources and the ability to be managed independently. Each port provides single initiator capability over a fiber link or provides multiple initiator capability with N_Port ID Virtualization (NPIV). The ports are connected by using LC type connectors. These connectors use shortwave laser optics. The adapter operates at link speeds of 2, 4, and 8 gigabits per second (Gbps) and automatically negotiates to the highest speed possible. LEDs on each port provide information about the connection status and link speed of the port. The adapter connects to a Fibre Channel switch.

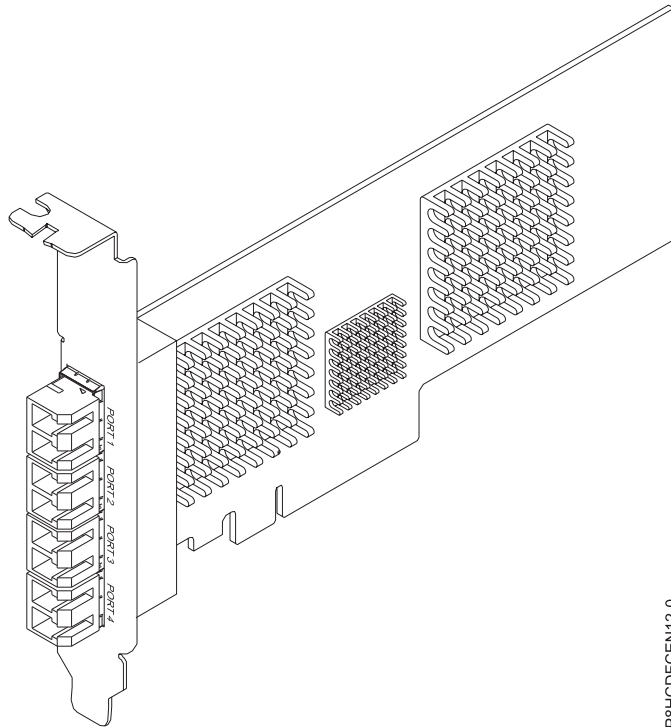Figure 145 on page 409 shows the adapter.

Figure 145. PCIe2 FH 4-port 8 Gb Fibre Channel Adapter

Specifications

Item   Description

Adapter FRU number

00WT107 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2.0 x8

Slot requirement

One PCIe generation-2 x8 slot.

Cables

For information about the cables, see "Cables" on page 410.

Voltage

3.3 V and 12.0 V

Form factor

Short

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Attributes provided

- NPIV capability is supported through VIOS.
- Requires a PCI Express generation-2 x8 slot for all four ports to operate at full speed.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:
- OM3: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 108. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
2.125 Gbps	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)	0.5 meters to 500 meters (1.64 feet to 1640.41 feet)
4.25 Gbps	0.5 meters to 70 meters (1.64 feet to 229.65 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)	0.5 meters to 380 meters (1.64 feet to 1246.71 feet)
8.5 Gbps	0.5 meters to 21 meters (1.64 feet to 68.89 feet)	0.5 meters to 50 meters (1.64 feet to 164.04 feet)	0.5 meters to 150 meters (1.64 feet to 492.12 feet)

Operating system or partition requirements

This adapter is supported for the following versions of operating systems, depending on the system you are using:
- AIX
  - AIX 7.1 with the 7100-01 Technology Level and Service Pack 4, or later.
  - AIX 7.1 with the 7100-00 Technology Level and Service Pack 6, or later.
  - AIX 6.1 with the 6100-07 Technology Level and Service Pack 4, or later.
  - AIX 6.1 with the 6100-06 Technology Level and Service Pack 8, or later.
  - AIX 5.3 with the 5300-12 Technology Level and Service Pack 6, or later.
- Linux
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.2, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 2, or later, with current maintenance updates available from SUSE.
  - SUSE Linux Enterprise Server 10, Service Pack 4, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i only with VIOS
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- VIOS
  - VIOS support requires VIOS 2.2.1.4, or later.

Related information:

 IBM Prerequisite website

⬑ Installing, removing, or replacing PCIe adapters

⬑ PCIe adapter placement

⬑ PCIe adapter information by feature type

PCIe Binary Synchronous Adapter (FC EN13 and FC EN14; CCIN 576C)

Learn about the features of the PCIe Binary Synchronous Adapters.

The PCIe Binary Synchronous Adapter is a full-high PCIe adapter with one RVX communication port that can be used for binary synchronous communication using an external, client-provided modem. Port 1 is the RVX port that provides Bisync capability. Port 0 is the modem port and does not provide Bisync capabilities. Figure 146 shows the FC EN13 and EN14 adapter.

EN13 is the non-CIM (Complex Impedance Matching) version offered in all countries and regions except Australia and New Zealand.

EN14 is the CIM (Complex Impedance Matching) version offered only in Australia and New Zealand.

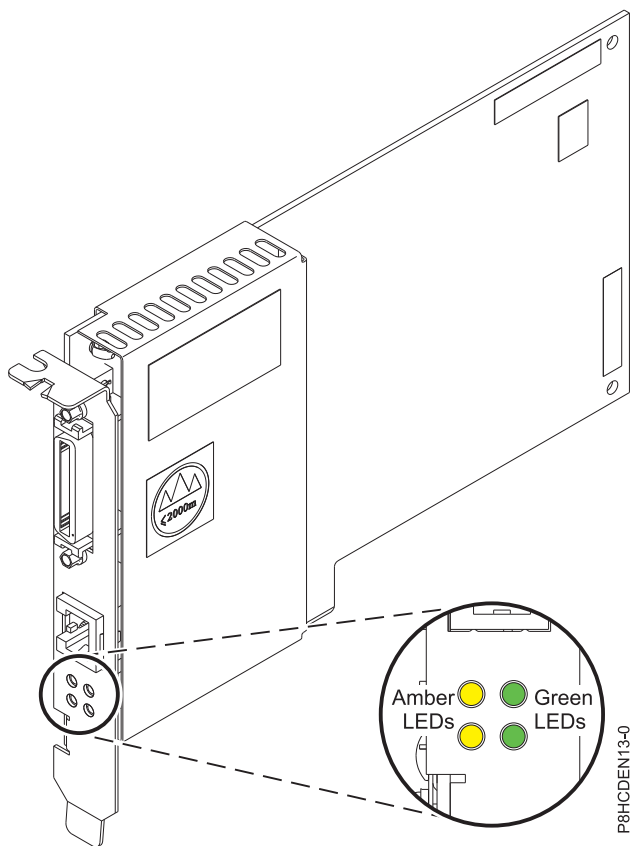**Note:** FC EN13 and EN14 are only supported in the IBM i operating system.

Figure 146. PCIe Binary Synchronous Adapter

Adapter type
  Short, x4, PCIe

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems, depending on the system you are using:
- IBM i
  - IBM i Version 7.1, Technology Refresh 9, or later on 9080-MHE, 9080-MME, 9119-MHE, or 9119-MME
  - IBM i Version 7.1, Technology Refresh 8, or later on 8286-42A or 8286-41A
  - IBM i Version 7.2, Technology Refresh 1, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 4-port 10 GbE SR Adapter (FC EN15; CCIN 2CE3)
Learn about the specifications and operating system requirements for the feature code (FC) EN15 adapter.

Overview

The FC EN15 and EN16 are the same adapter. FC EN15 is a full-height adapter, and FC EN16 is a low-profile adapter. The names of these two adapters are:
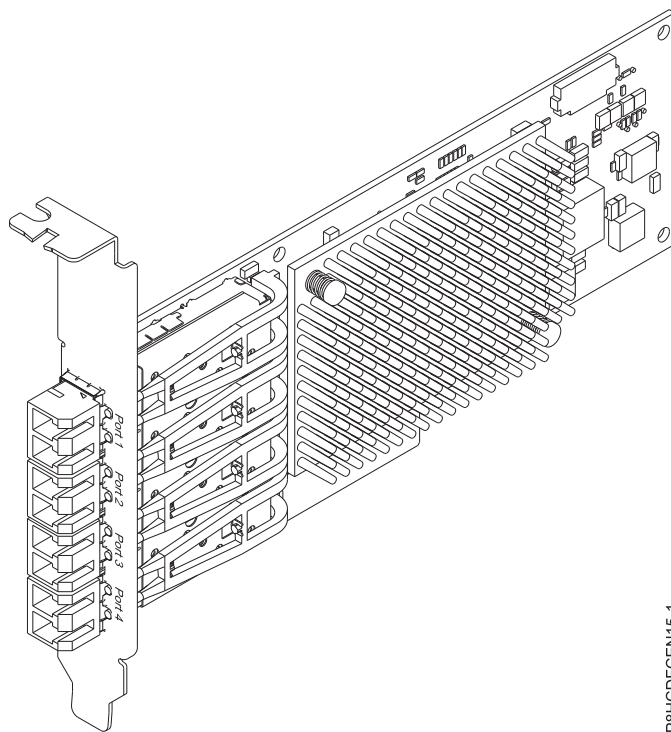- FC EN15: PCIe3 4-port 10 GbE SR Adapter
- FC EN16: PCIe3 LPX 4-port 10 GbE SR Adapter

The PCIe3 4-port 10 GbE SR Adapter is a PCI Express generation 3 (PCIe3), x8, short form-factor adapter. The adapter provides four 10 Gb small form-factor pluggable (SFP+) optical SR transceiver ports, as shown in Figure 147 on page 413. The ports have little connector (LC) duplex-type connectors and utilize shortwave laser optics and MMF-850nm fiber cabling. See "Cables" on page 414 for more information about the optical cables. The adapter supports the Ethernet network interface controller (NIC) function and also provides SR-IOV NIC support. SR-IOV capability for the NIC function is supported with the appropriate firmware and operating system level for any of the four ports. Enabling the SR-IOV function requires an HMC.

The adapter provides the following features:
- Four 10 Gb ports that can function in the NIC mode
- AIX Network Installation Management (NIM) support

- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 147. FC EN15 adapter

Specifications

Item   Description

Adapter FRU number

00ND466 (Designed to comply with RoHS requirement)

Full-height tailstock part number: 00ND462

Wrap plug FRU number

12R9314 (SFP+ SR wrap plug)

Note: The wrap plug is not included with the card, but can be purchased from IBM.

I/O bus architecture

PCIe3 x8

Slot requirement

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" for details.

Voltage

3.3 V

Form factor

Short, full-height tailstock, low-profile capable

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:

- OM3 or OM4: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables only can be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 or OM4 cables. However, if an OM2 cable is connected to an OM3 or OM4 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 109. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
10 Gbps	0.5 meters to 33 meters (1.64 feet to 108.26 feet)	0.5 meters to 82 meters (1.64 feet to 269.02 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)

Adapter LED

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. The green LED indicates link activity and the yellow LED signifies the link state. Table 110 summarizes the LED states for this adapter.

Table 110. LED states

Green LED	Yellow LED	State
Off	Off	No Power or Normal Link Down

Table 110. LED states (continued)

Green LED	Yellow LED	State
Off	On	POST Failure or Invalid SFP Configuration
Off	On	Normal Link Up with No activity on the link
Blink	On	Normal Link Up with activity on the link

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
* AIX
  – AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  – AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  – AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  – AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
* Linux
  – Red Hat Enterprise Linux Version 7.1, or later
  – Red Hat Enterprise Linux Version 7.1, little endian, or later
  – Red Hat Enterprise Linux Version 6.6, or later
  – SUSE Linux Enterprise Server 11, Service Pack 4, or later
  – SUSE Linux Enterprise Server 12, or later
  – Ubuntu Server 16.04, or later
  – Ubuntu Server 14.04.3, or later
* IBM i
  – IBM i Version 7.2, Technology Refresh 2, or later
  – IBM i Version 7.1, Technology Refresh 10, or later
* VIOS
  – VIOS 2.2.3.51, or later

Related information:

➟ IBM Prerequisite website

➟ Installing, removing, or replacing PCIe adapters

➟ PCIe adapter placement

➟ PCIe adapter information by feature type

PCIe3 LPX 4-port 10 GbE SR Adapter (FC EN16; CCIN 2CE3)
Learn about the specifications and operating system requirements for the feature code (FC) EN16 adapter.
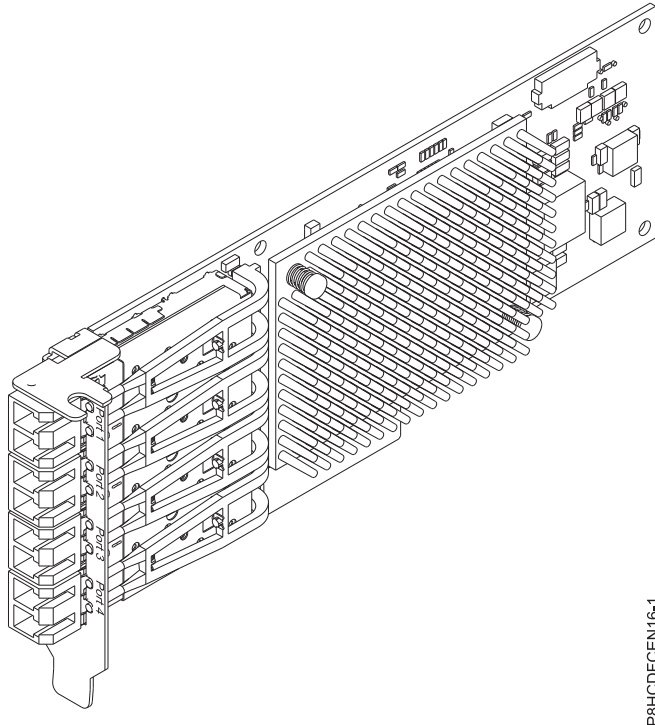
Overview

The FC EN16 and EN15 are the same adapter. FC EN16 is a low-profile adapter and FC EN15 is a full-height adapter. The names of these two adapters are:
- FC EN16: PCIe3 LPX 4-port 10 GbE SR Adapter
- FC EN15: PCIe3 4-port 10 GbE SR Adapter

The PCIe3 LPX 4-port 10 GbE SR Adapter is a PCI Express (PCIe) generation 3, x8, short form-factor adapter. The adapter provides four 10 Gb small form-factor pluggable (SFP+) optical SR transceiver ports, as shown in Figure 148 on page 417. The ports have little connector (LC) duplex-type connectors and utilize shortwave laser optics and MMF-850nm fiber cabling. See "Cables" on page 418 for more information about the optical cables. The adapter supports the Ethernet network interface controller (NIC) function and also provides SR-IOV NIC support. SR-IOV capability for the NIC function is supported with the appropriate firmware and operating system level for any of the four ports. Enabling the SR-IOV function requires an HMC.

The adapter provides the following features:
- Four 10 Gb ports that can function in the NIC mode
- AIX Network Installation Management (NIM) support
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Figure 148. FC EN16 adapter

Specifications

Item   **Description**
Adapter FRU number
    00ND466 (Designed to comply with RoHS requirement)

    Low-profile tailstock
Wrap plug FRU number
    12R9314 (SFP+ SR wrap plug)

    Note: The wrap plug is not included with the card, but can be purchased from IBM.
I/O bus architecture
    PCIe3 x8
Slot requirement
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot
    priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
    p8eab_mtm_pciplacement.htm) and select the system you are working on.
Cables
    See "Cables" on page 418 for details.
Voltage
    3.3 V
Form factor
    Short, low-profile tailstock
Maximum number
    For details about the maximum number of adapters that are supported, see PCIe adapter
    placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
    p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

Use multimode fiber optic cables with shortwave lasers that adhere to the following specifications:

- OM3 or OM4: Multimode 50/125 micron fiber, 2000 MHz x km bandwidth
- OM2: Multimode 50/125 micron fiber, 500 MHz x km bandwidth
- OM1: Multimode 62.5/125 micron fiber, 200 MHz x km bandwidth

Because core sizes are different, OM1 cables only can be connected to other OM1 cables. For best results, OM2 cables must not be connected to OM3 or OM4 cables. However, if an OM2 cable is connected to an OM3 or OM4 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following table shows the supported distances for the different fiber optic cable types at different link speeds.

Table 111. Supported distances for multimode fiber optic cables

Header	Cable Type and Distance		
Rate	OM1	OM2	OM3
10 Gbps	0.5 meters to 33 meters (1.64 feet to 108.26 feet)	0.5 meters to 82 meters (1.64 feet to 269.02 feet)	0.5 meters to 300 meters (1.64 feet to 984.25 feet)

Adapter LED

Green and yellow LEDs can be seen through openings in the mounting bracket of the adapter. The green LED indicates link activity and the yellow LED signifies the link state. Table 112 summarizes the LED states for this adapter.

Table 112. LED states

Green LED	Yellow LED	State
Off	Off	No Power or Normal Link Down
Off	On	POST Failure or Invalid SFP Configuration
Off	On	Normal Link Up with No activity on the link
Blink	On	Normal Link Up with activity on the link

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:

- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later

– Red Hat Enterprise Linux Version 7.1, little endian, or later
 – Red Hat Enterprise Linux Version 6.6, or later
 – SUSE Linux Enterprise Server 11, Service Pack 4, or later
 – SUSE Linux Enterprise Server 12, or later
 – Ubuntu Server 16.04, or later
 – Ubuntu Server 14.04.3, or later
- IBM i
 – IBM i Version 7.2, Technology Refresh 2, or later
 – IBM i Version 7.1, Technology Refresh 10, or later
- VIOS
 – VIOS 2.2.3.51, or later

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe3 4-port 10 GbE SFP+ Copper Adapter (FC EN17; CCIN 2CE4)

Learn about the specifications and operating system requirements for the feature code (FC) EN17 adapter.

Overview

The FC EN17 and EN18 are the same adapter. FC EN17 is a full-height adapter, and FC EN18 is a low-profile adapter. The names of these two adapters are:

- FC EN17: PCIe3 4-port 10 GbE SFP+ Copper Adapter
- FC EN18: PCIe3 LPX 4-port 10 GbE SFP+ Copper Adapter

The PCIe3 4-port 10 GbE SFP+ Copper Adapter is a PCI Express (PCIe) generation 3, x8, short form-factor adapter. The adapter provides four 10 Gb small form-factor pluggable (SFP+) ports into which copper twinax transceivers will be placed. See Figure 149 on page 420. Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A transceiver is included with these cables. See "Cables" on page 421 for details. The adapter supports the Ethernet network interface controller (NIC) function and also provides SR-IOV NIC support. SR-IOV capability for the NIC function is supported with the appropriate firmware and operating system level for any of the four ports. Enabling the SR-IOV function requires an HMC.

The adapter provides the following features:

- Four 10 Gb ports that can function in the NIC mode
- AIX Network Installation Management (NIM) support
- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
 – IEEE 802.3ae in the 10 GbE ports
 – 802.3ab in the 1 GbE ports
 – Ether II and IEEE 802.3 for encapsulated frames
 – 802.1p for setting up priority levels in tagged VLAN frames

- – 802.1Q for VLAN tagging
- – 802.3x for flow control
- – 802.3ad for load-balancing and failover
- – IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
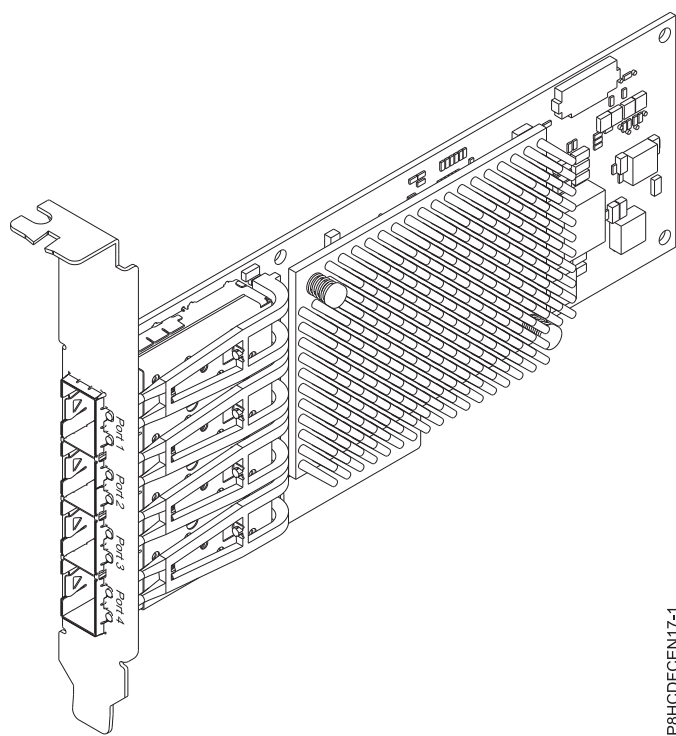

Figure 149. FC EN17 adapter

Specifications

Item   Description
Adapter FRU number
00ND463 (Designed to comply with RoHS requirement)

Full-height tailstock part number: 00ND465
Wrap plug FRU number
74Y7010 (Twinax wrap plug)
I/O bus architecture
PCIe3 x8
Slot requirement
For details about slot priorities and placement rules, see PCIe adapter placement rules and slot

priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/
p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

See "Cables" for details.

Voltage

3.3 V

Form factor

Short, full-height tailstock, low-profile capable

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter
placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/
p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet
cables. See Figure 150 for a view of the cable top and cable bottom. These cables are compliant with
industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM
requirements.

Note: These cables are EMC Class A compliant.

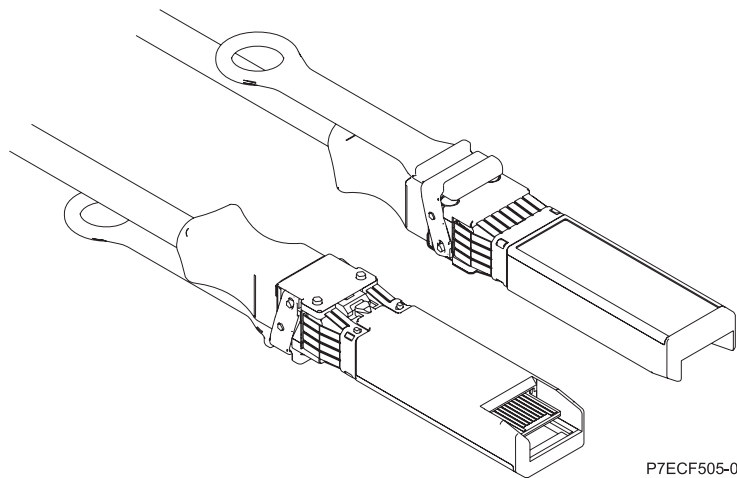See Table 113 for details about the feature codes.

P7ECF505-0

Figure 150. Top and bottom view of the cable

Table 113. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new
feature and that you determine whether any prerequisites must be met for this feature and attaching
devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/
eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
* AIX
  – AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  – AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  – AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  – AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
* Linux
  – Red Hat Enterprise Linux Version 7.1, or later
  – Red Hat Enterprise Linux Version 7.1, little endian, or later
  – Red Hat Enterprise Linux Version 6.6, or later
  – SUSE Linux Enterprise Server 11, Service Pack 4, or later
  – SUSE Linux Enterprise Server 12, or later
  – Ubuntu Server 16.04, or later
  – Ubuntu Server 14.04.3, or later
* IBM i
  – IBM i Version 7.2, Technology Refresh 2, or later
  – IBM i Version 7.1, Technology Refresh 10, or later
* VIOS
  – VIOS 2.2.3.51, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe3 LPX 4-port 10 GbE SFP+ Copper Adapter (FC EN18; CCIN 2CE4)

Learn about the specifications and operating system requirements for the feature code (FC) EN18 adapter.

Overview

The FC EN18 and EN17 are the same adapter. FC EN18 is a low-profile adapter, and FC EN17 is a full-height adapter. The names of these two adapters are:
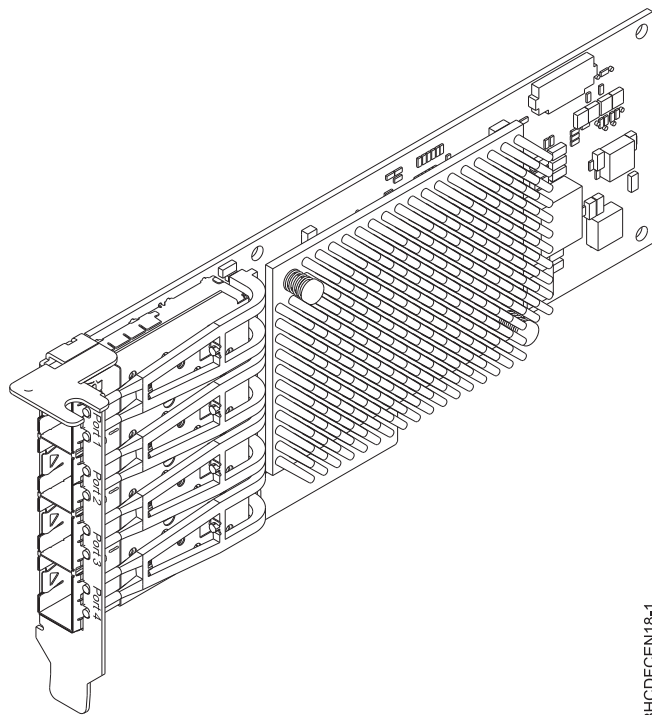* FC EN18: PCIe3 LPX 4-port 10 GbE SFP+ Copper Adapter
* FC EN17: PCIe3 4-port 10 GbE SFP+ Copper Adapter

The PCIe3 4-port 10 GbE SFP+ Copper Adapter is a PCI Express (PCIe) generation 3, x8, short form-factor adapter. The adapter provides four 10 Gb small form-factor pluggable (SFP+) ports into which copper twinax transceivers will be placed. See Figure 151 on page 423. Active Copper twinax cables up to 5 meter in length are supported such as provided by feature codes EN01, EN02 or EN03. A transceiver is included with these cables. See "Cables" on page 424 for details. The adapter supports the Ethernet network interface controller (NIC) function and also provides SR-IOV NIC support. SR-IOV capability for the NIC function is supported with the appropriate firmware and operating system level for any of the four ports. Enabling the SR-IOV function requires an HMC.

The adapter provides the following features:
* Four 10 Gb ports that can function in the NIC mode
* AIX Network Installation Management (NIM) support

- The adapter supports interrupt moderation to deliver increased performance while significantly reducing processor utilization
- The adapter supports multiple media-access control (MAC) per interface.
- The adapter supports integrated media-access control (MAC) and physical layer (PHY).
- The adapter supports the following standards for the different ports and functions:
  - IEEE 802.3ae in the 10 GbE ports
  - 802.3ab in the 1 GbE ports
  - Ether II and IEEE 802.3 for encapsulated frames
  - 802.1p for setting up priority levels in tagged VLAN frames
  - 802.1Q for VLAN tagging
  - 802.3x for flow control
  - 802.3ad for load-balancing and failover
  - IEEE 802.3ad and 802.3 for link aggregation
- The adapter provides message signal interrupts (MSI), MSI-X, and support of legacy pin interrupts.
- The adapter supports jumbo frames up to 9.6 KB.
- The adapter supports TCP checksum offload transmission control protocol (TCP), user datagram protocol (UDP), TCP segmentation Offload (TSO) for IPv4 and IPv6.
- Supports TCP segmentation or large send offload
- Supports EEPROM-SPI and single EEPROM
- Compliant with European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

P8HCDFCEN18-1

Figure 151. FC EN18 adapter

Specifications

Item   Description

Adapter FRU number
>00ND463 (Designed to comply with RoHS requirement)

>Low-profile tailstock

Wrap plug FRU number
>74Y7010 (Twinax wrap plug)

I/O bus architecture
>PCIe3 x8

Slot requirement
>For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables
>See "Cables" for details.

Voltage
>3.3 V

Form factor
>Short, low-profile tailstock

Maximum number
>For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Cables

This adapter feature requires the use of compatible SFP+, 10 Gbps, copper, twinaxial, active, Ethernet cables. See Figure 152 for a view of the cable top and cable bottom. These cables are compliant with industry standard specifications SFF-8431 Rev 4.1 and SFF-8472 Rev 10.4, and all applicable IBM requirements.

Note: These cables are EMC Class A compliant.

See Table 114 for details about the feature codes.
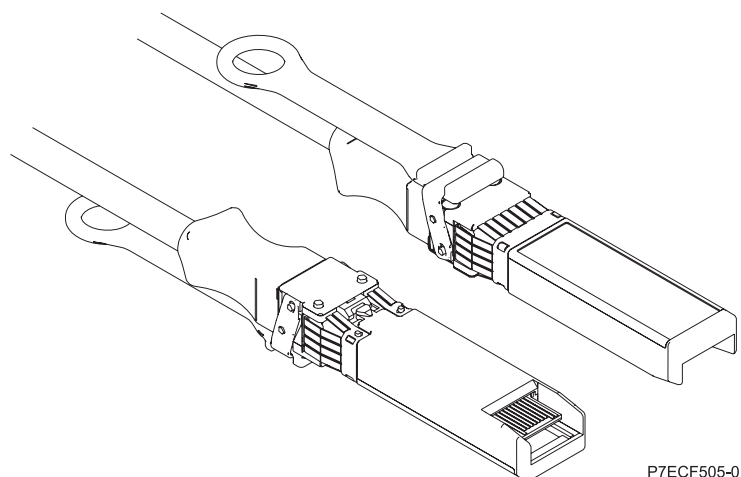

P7ECF505-0

Figure 152. Top and bottom view of the cable

Table 114. Feature code, CCIN, and part number for varying lengths of the cable

Cable length	Feature code	CCIN	Part number
1 m (3.28 ft)	EN01	EF01	46K6182

Table 114. Feature code, CCIN, and part number for varying lengths of the cable (continued)

Cable length	Feature code	CCIN	Part number
3 m (9.84 ft)	EN02	EF02	46K6183
5 m (16.4 ft)	EN03	EF03	46K6184

Operating system or partition requirements

If you are installing a new feature, ensure that you have the software that is required to support the new feature and that you determine whether any prerequisites must be met for this feature and attaching devices. To check for the prerequisites, see IBM Prerequisite website (www-912.ibm.com/e_dir/eServerPrereq.nsf).

The adapter is supported on the following versions of the operating systems:
- AIX
  - AIX 6.1 with the 6100-09 Technology Level and Service Pack 5 and APAR IV68443, or later
  - AIX 7.1 with the 7100-03 Technology Level and Service Pack 5 and APAR IV68444
  - AIX 7.1 with the 7100-02 Technology Level and Service Pack 7, or later
  - AIX 6.1 with the 6100-08 Technology Level and Service Pack 7, or later
- Linux
  - Red Hat Enterprise Linux Version 7.1, or later
  - Red Hat Enterprise Linux Version 7.1, little endian, or later
  - Red Hat Enterprise Linux Version 6.6, or later
  - SUSE Linux Enterprise Server 11, Service Pack 4, or later
  - SUSE Linux Enterprise Server 12, or later
  - Ubuntu Server 16.04, or later
  - Ubuntu Server 14.04.3, or later
- IBM i
  - IBM i Version 7.2, Technology Refresh 2, or later
  - IBM i Version 7.1, Technology Refresh 10, or later
- VIOS
  - VIOS 2.2.3.51, or later
  - VIOS supports NIC capability only

Related information:

[→] IBM Prerequisite website

[→] Installing, removing, or replacing PCIe adapters

[→] PCIe adapter placement

[→] PCIe adapter information by feature type

PCIe 2-port Async EIA-232 Adapter (FC EN27; CCIN 57D4)

Learn about the specifications and operating system requirements for the feature code (FC) EN27 adapter.

Overview

PCIe 2-port Async EIA-232 Adapter (FC EN27) is a full-height adapter. The FC EN27 is a 2-port EIA-232 asynchronous serial communications PCI Express (PCIe) adapter that can be installed in the PCIe slots. The adapters are based on the PCIe 1.1 host-bus interface. The parallel port function is not available on this adapter.

Each of the two Universal Asynchronous Receiver/Transmitter (UART) channels contain 128 byte receiver-transmitter, first-in first-out (FIFO), full modem-control signaling, and standard-host interrupts. If either of the two UART interrupts is active, the host can be interrupted through a single PCI interrupt. The two-port adapter provides RJ45 Ethernet ports, which are connected by DB-9 connectors.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   **Description**
Adapter FRU number
    000ND487 (Designed to comply with RoHS requirement)
I/O bus architecture
    PCIe 3
Slot requirement
    For the slot priorities, see the PCI adapter placement topic collection for your system.
Cables
    Cat 5 unshielded twisted-pair cables
Voltage
    3.3 V
Form factor
    Short
Maximum number
    For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

This adapter is supported for the following versions of the operating systems:

- AIX:
  - AIX 7.1, or later
  - AIX 6.1, Technology Level 9, or later
- IBM i:
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- Linux:
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.
  - Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
  - SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Related information:

 IBM Prerequisite website

 Installing, removing, or replacing PCIe adapters

 PCIe adapter placement

PCIe adapter information by feature type

PCIe 2-port Async EIA-232 LP Adapter (FC EN28; CCIN 57D4)

Learn about the specifications and operating system requirements for the feature code (FC) EN28 adapter.

Overview

PCIe 2-port Async EIA-232 LP Adapter (FC EN28) is a low-profile adapter. The FC EN28 is a 2-port EIA-232 asynchronous serial communications PCI Express (PCIe) adapter that can be installed in the PCIe slots. The adapters are based on the PCIe 1.1 host-bus interface. The parallel port function is not available on this adapter.

Each of the two Universal Asynchronous Receiver/Transmitter (UART) channels contain 128 byte receiver-transmitter, first-in first-out (FIFO), full modem-control signaling, and standard-host interrupts. If either of the two UART interrupts is active, the host can be interrupted through a single PCI interrupt. The two-port adapter provides RJ45 Ethernet ports, which are connected by DB-9 connectors.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
      000ND487 (Designed to comply with RoHS requirement)
I/O bus architecture
      PCIe 3
Slot requirement
      For the slot priorities, see the PCI adapter placement topic collection for your system.
Cables
      Cat 5 unshielded twisted-pair cables
Voltage
      3.3 V
Form factor
      Short
Maximum number
      For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

This adapter is supported for the following versions of the operating systems:
- AIX:
  - AIX 7.1, or later
  - AIX 6.1, Technology Level 9, or later
- IBM i:
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later
- Linux:
  - Red Hat Enterprise Linux Version 7, or later, with current maintenance updates available from Red Hat.

- Red Hat Enterprise Linux Version 6.5, or later, with current maintenance updates available from Red Hat.
- SUSE Linux Enterprise Server 11, Service Pack 3, or later, with current maintenance updates available from SUSE.
- For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- PowerKVM:
  - IBM PowerKVM 2.1.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe 2-port Async EIA-232 Adapter (FC EN29; CCIN 57D4)

Learn about the specifications and operating system requirements for the feature code (FC) EN29 adapter.

Overview

FC EN29 is functionally equivalent to the earlier FC 5289 Async adapters.

The PCIe 2-port Async EIA-232 Adapter is a 2-port EIA-232 asynchronous serial communications PCI Express (PCIe) adapter that can be installed in the PCIe slots. The adapter is full-height and is based on the PCIe 1.1 host bus interface. The parallel port function is not implemented on this adapter.

Each of the two Universal Asynchronous Receiver/Transmitter (UART) channels contain 128 byte receiver-transmitter, first-in first-out (FIFO), full modem-control signaling, and standard host interrupts. If either of the two UART interrupts is active, the host can be interrupted through a single PCI interrupt. The two-port adapter provides RJ45 Ethernet ports, which are connected by DB-9 connectors.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description
Adapter FRU number
        74Y4084 (Designed to comply with RoHS requirement)
I/O bus architecture
        PCIe 1.1
Slot requirement
        For the slot priorities, see the PCI adapter placement topic collection for your system.
Cables
        Cat 5 unshielded twisted-pair cables
Voltage
        3.3 V
Form factor
        Short
Maximum number
        For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Operating system or partition requirements

This adapter is supported for the following versions of the operating systems:
- IBM i
    - IBM i Version 7.3, or later
    - IBM i Version 7.2, or later
    - IBM i Version 7.1, or later

Related information:

➥ IBM Prerequisite website

➥ Installing, removing, or replacing PCIe adapters

➥ PCIe adapter placement

➥ PCIe adapter information by feature type

PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6 Gb (FC ESA3; CCIN 57BB)
Learn about the specifications and operating system requirements for the feature code (FC) ESA3 adapters.

Overview

The PCIe2 1.8 GB Cache RAID SAS Adapter Tri-port 6 Gb is a PCI Express generation-2 (PCIe2) adapter that provides high-performance capabilities and supports the attachment of serial-attached SCSI (SAS) disks and SAS solid-state drives (SSDs) through three mini SAS high-density (HD) connectors. The FC ESA3 adapter is a large cache PCIe2 SAS adapter. The FC ESA3 has a 1.8 GB write-cache. The adapter must be installed in pairs and must be used in a high availability, multi-initiator RAID configuration with two adapters in dual-controller mode (dual storage IOA configuration). Two FC ESA3 adapters provide additional performance and adapter redundancy with mirrored write-cache data and mirrored RAID parity footprints between the adapters. If the FC ESA3 pairing is broken, the write cache is disabled. Integrated flash memory with capacitors protects the write cache during a power failure, without the need for batteries.

To provide the highest bandwidth between two paired feature ESA3 adapters for the mirroring of cache data and parity update footprints, a SAS Adapter-to-Adapter (AA) cable is required by default on the third adapter port until maximum device quantity attachment is required. When all three connectors are attached to SAS drives, the communication between the adapter pair is performed through the SAS fabric via the I/O drawer and cables.

The FC ESA3 is a single wide, full-height, short adapter.

Every FC ESA3 requires another 6 Gbps SAS RAID adapter (FC ESA3) on the server it is attached to, or on another server, which pairs with the SAS RAID adapter and enables the onboard caches to function. The FC ESA3 adapter is shown in Figure 153 on page 431.

Systems that are running the AIX or Linux operating systems support either having both the FC ESA3 adapters in the same system or partition, or in two separate systems or partitions. Systems that are running the IBM i operating system do not support the pairing of adapters on different servers or different partitions, so both the FC ESA3 adapters must be installed in the same system or partition.

For details about slot priorities and placement rules, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on.

Specifications

Item   Description

Adapter FRU number

74Y7131 (Designed to comply with RoHS requirement)

I/O bus architecture

PCIe2.0 x8

Slot requirement

One PCIe x8 slot per adapter.

Adapters are installed in pairs.

For higher availability, place adapters in separate enclosures where supported.

Cables

Specific X , YO, AA, or AT SAS cables with HD connectors are used to attach to the expansion drawers.

SAS device attachment requires specific cables that are provided with the subsystem or device features being attached. Special cabling is required for multi-initiator and high availability configurations. See Serial attached SCSI cable planning.

Voltage

3.3 V

Form factor

Short, full-height

Maximum number

For details about the maximum number of adapters that are supported, see PCIe adapter placement rules and slot priorities (http://www.ibm.com/support/knowledgecenter/POWER8/ p8eab/p8eab_mtm_pciplacement.htm) and select the system you are working on..

Attributes provided

- Provides three mini-SAS high-density (HD) connectors for attaching the SAS drives in the FC 5887 EXP24S. A maximum of three EXP24S can be attached to the same FC ESA3 pair.
- Supports a maximum of 24 SSDs.
- An AA SAS cable with HD connectors attached to the FC ESA3 pair provides a higher performance path for mirrored write-cache data and mirrored RAID parity footprints between the adapters and is required unless all three ports are being used to attach EXP24S drawers.

   Note: Solid-state drives (SSDs) are not allowed on the top port (T2).
- Support of the SAS Serial SCSI Protocol (SSP) and Serial Management Protocol (SMP).
- Provides RAID 0, RAID 5, RAID 6, and RAID 10 with hot-spare capability. System level mirroring through the operating system is also supported. JBOD functionality (512 byte) is not supported except for the initial formatting to 528 bytes of new devices, as required.
- A single pair of FC ESA3 adapters is not supported to attach to both halves of an FC 5887 EXP24S drawer that is configured in mode 2.

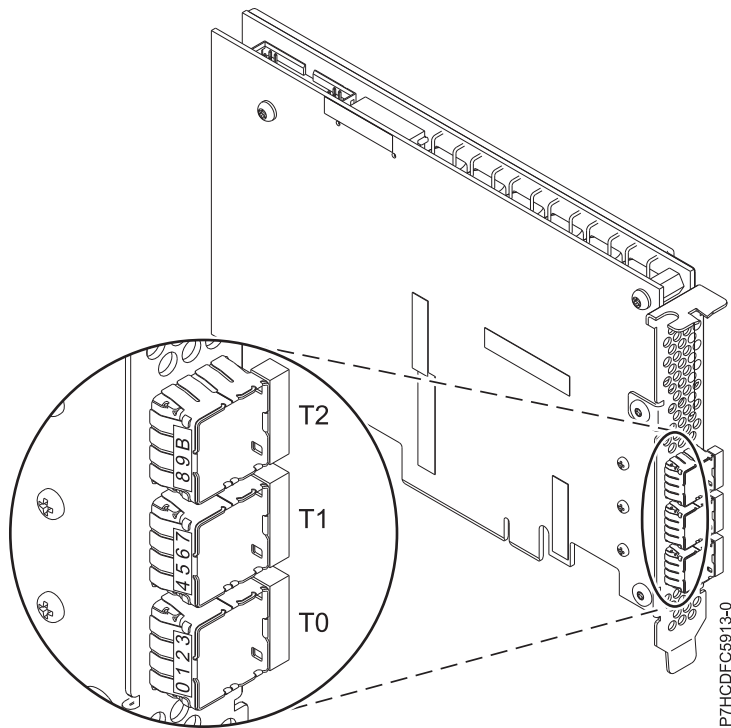Figure 153 on page 431 shows the adapter.

Figure 153. ESA3 Adapter

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:

- AIX
  - AIX Version 7.1 with the 7100-03 Technology Level, or later
  - AIX Version 7.1 with the 7100-02 Technology Level with Service Pack update, or later
  - AIX Version 7.1 with the 7100-01 Technology Level with Service Pack update, or later
  - AIX Version 6.1 with the 6100-09 Technology Level, or later
- Linux
  - Red Hat Enterprise Linux 6.1 for POWER, or later
  - Red Hat Enterprise Linux 5.7 for POWER, or later
  - SUSE Linux Enterprise Server 11, Service Pack 1, or later (with update package)
  - SUSE Linux Enterprise Server 10, Service Pack 4, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- IBM i
  - IBM i Version 7.2 or later
  - IBM i Version 7.1, or later

Other important requirements for adapter installation

- If you are attaching a new or existing FC 5887 to an FC ESA3 adapter, verify that the latest System Enclosure Services (SES) code is applied to the FC 5887 before attaching to the FC ESA3 adapter, see the IBM Prerequisites website.
- If you are migrating existing SAS disk enclosures and devices from existing previous SAS adapters, an automatic sector conversion takes place for use with the new FC ESA3 adapters. For information about the migrating procedures, see Upgrading the adapter in the POWER7 IBM Knowledge Center.

• FC ESA3 is not compatible with FC 5913 and so must not be connected in same adapter pair.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

LSI SAS 9206-16e 6 Gb/s/s Host Bus Adapter in the IBM Elastic Storage Server (FC ESA4)

Learn about the specifications and operating system requirements for the feature code (FC) ESA4 adapter in the IBM Elastic Storage Server.

Overview

The LSI SAS 9206-16e 6 Gb/sps host bus adapter is a PCI Express (PCIe) generation 3 (Gen3), SAS 4-port 6 Gb/s Adapter. The adapter provides high performance achieving over 1 million Input/Output Operations for Second (IOPS) for high-end servers and storage applications. This SAS adapter provides high performance capabilities and supports the attachment of serial-attached SCSI (SAS) disks and SAS solid-state drives through four mini SAS HD (high density) connectors.
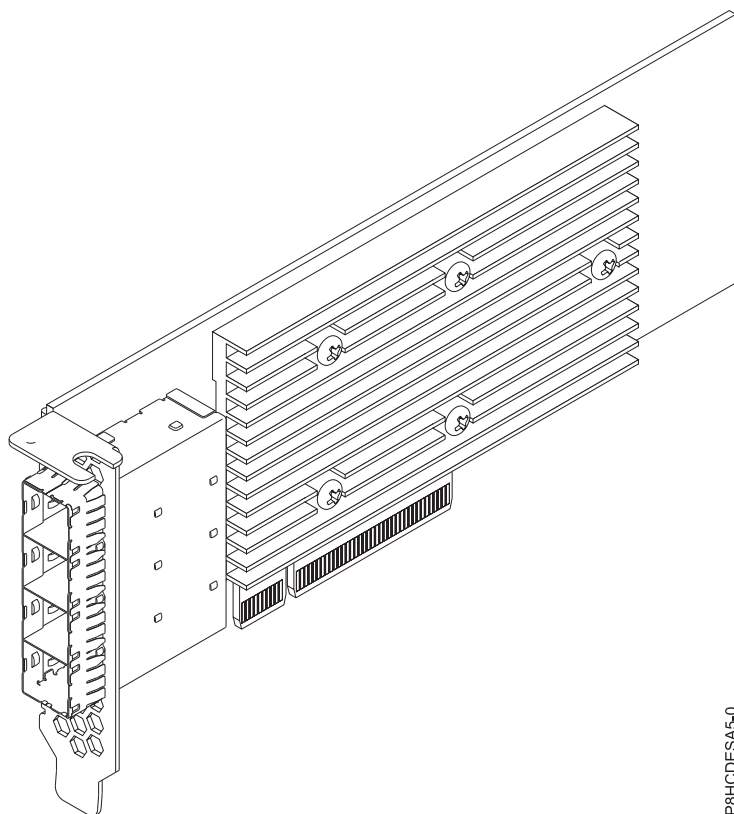
Figure 154. LSI SAS 9206-16e 6 Gb/s Host Bus Adapter

Specifications

Item   Description
Adapter FRU number
        00MH942 (Designed to comply with RoHS requirement)

I/O bus architecture
    PCIe3 x8
Slot requirement
    One PCIe x8 slot

    FC ESA4 is installed in slots P1-C2, P1-C3, and P1-C11
Cables
    Four AE SAS cables are used to attach to the EXP24S drawer
Voltage
    3.3 V
Form factor
    Short, with full-height tailstock
Maximum number
    A maximum of three FC ESA4 adapters in the IBM Elastic Storage Server.
Attributes provided
    Provides 16 lanes of 6 Gb/s SAS data transfer rates

    Provides PCIe3 compliant 8 Gb/s per lane for high-bandwidth applications

    Provides four mini-SAS HD connectors for attaching the SAS drives in the EXP24S drawer

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:
- Linux
  - Red Hat Enterprise Linux 7, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

PCIe adapters

Find information about using and managing the Peripheral Component Interconnect (PCI) Express (PCIe) adapters that are supported for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, 8286-42A, 8408-44E, 8408-E8E, 9080-MHE, 9080-MME, 9119-MHE, 9119-MME, and EMX0 PCIe Gen3 I/O expansion drawer. Also, find information about specifications and installation notes for specific adapters.

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

LSI SAS 9305-16e 12 Gb/s Host Bus Adapter in the IBM Elastic Storage Server (FC ESA5)

Learn about the specifications and operating system requirements for the feature code (FC) ESA5 adapter in the IBM Elastic Storage Server.

Overview

The LSI 9305-16e 12 Gb/s Host Bus Adapter is a PCI Express (PCIe) generation 3 (Gen3), SAS 4-port 12 Gb/s Adapter. The LSI 9305-16e 12 Gb/s Host Bus Adapter is a single-chip low-profile adapter that provides up to 16 direct external drive connections or full scalability using expanders. The adapter is capable of over 1.5 million input/output operations per second (IOPS) and delivers the performance and scalability that is needed for critical applications. For a graphic of the adapter, see Figure 155.
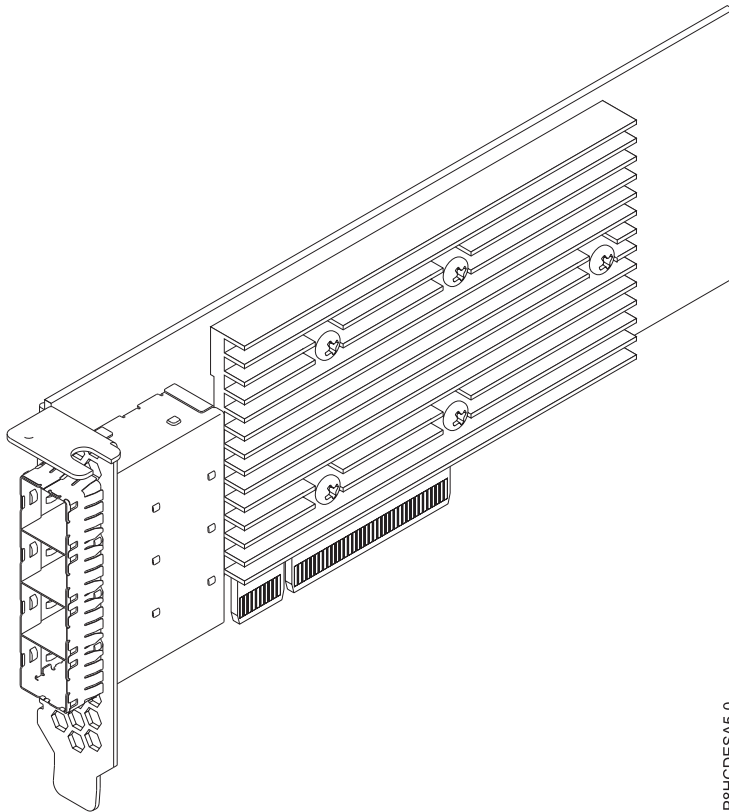
P8HCDESA5-0

Figure 155. LSI 9305-16e 12 Gb/s Host Bus Adapter

Specifications

Item   Description
Adapter FRU number
> 01DH561 (Designed to comply with RoHS requirement)

I/O bus architecture
> PCIe3 x8

Slot requirement
> One PCIe x8 slot
>
> Three FC ESA5 adapters are required for 5148-22L systems
>
> FC ESA5 is installed in slots P1-C2, P1-C3, and P1-C11

Cables
> 3 M 12 Gb/s SAS cables with universal key

Supported Systems
> IBM Elastic Storage Server
> * 5148-22L and 8247-22L

Voltage
> 3.3 V, 12 V

Form factor

Short, with full-height tailstock

Maximum number

A maximum of three FC ESA5 adapters in the IBM Elastic Storage Server

Attributes provided

Connects up to 1024 SAS and SATA devices with 16 external 12 Gb/s SAS ports

Provides maximum connectivity and performance for external JBOD and external RAID enclosures

Capable of achieving more than 1.5 million IOPS for performance-sensitive applications

Operating system or partition requirements

This adapter is supported for the following versions of operating systems:

- Linux
  - Red Hat Enterprise Linux 7.2, little-endian, or later, with mpt3sas driver update provided from Red Hat 6, or later
  - For support details, see the Linux Alert website (www14.software.ibm.com/webapp/set2/sas/f/lopdiags/info/LinuxAlerts.html).
- Other Environments
  - Bare Metal Systems (indicated by FC EC16): Red Hat Enterprise Linux 7.2, little-endian, or later, with mpt3sas driver update provided from Red Hat
  - PowerKVM 3.1 Systems (indicated by FC EC40): Not Supported
  - KVM for POWER (indicated by FC EC70): Not Supported

Related information:

➡ IBM Prerequisite website

➡ Installing, removing, or replacing PCIe adapters

➡ PCIe adapter placement

➡ PCIe adapter information by feature type

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Accessibility features for IBM Power Systems servers

Accessibility features assist users who have a disability, such as restricted mobility or limited vision, to use information technology content successfully.

Overview

The IBM Power Systems servers include the following major accessibility features:
- Keyboard-only operation
- Operations that use a screen reader

The IBM Power Systems servers use the latest W3C Standard, WAI-ARIA 1.0 (www.w3.org/TR/wai-aria/), to ensure compliance with US Section 508 (www.access-board.gov/guidelines-and-standards/ communications-and-it/about-the-section-508-standards/section-508-standards) and Web Content Accessibility Guidelines (WCAG) 2.0 (www.w3.org/TR/WCAG20/). To take advantage of accessibility features, use the latest release of your screen reader and the latest web browser that is supported by the IBM Power Systems servers.

The IBM Power Systems servers online product documentation in IBM Knowledge Center is enabled for accessibility. The accessibility features of IBM Knowledge Center are described in the Accessibility section of the IBM Knowledge Center help (www.ibm.com/support/knowledgecenter/doc/ kc_help.html#accessibility).

Keyboard navigation

This product uses standard navigation keys.

Interface information

The IBM Power Systems servers user interfaces do not have content that flashes 2 - 55 times per second.

The IBM Power Systems servers web user interface relies on cascading style sheets to render content properly and to provide a usable experience. The application provides an equivalent way for low-vision users to use system display settings, including high-contrast mode. You can control font size by using the device or web browser settings.

The IBM Power Systems servers web user interface includes WAI-ARIA navigational landmarks that you can use to quickly navigate to functional areas in the application.

Vendor software

The IBM Power Systems servers include certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for accessibility information about its products.

Related accessibility information

In addition to standard IBM help desk and support websites, IBM has a TTY telephone service for use by deaf or hard of hearing customers to access sales and support services:

TTY service
800-IBM-3383 (800-426-3383)
(within North America)

For more information about the commitment that IBM has to accessibility, see IBM Accessibility (www.ibm.com/able).

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Electronic emission notices

When attaching a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices supplied with the monitor.

Class A Notices

The following Class A statements apply to the IBM servers that contain the POWER8 processor and its features unless designated as electromagnetic compatibility (EMC) Class B in the feature information.

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

CAN ICES-3 (A)/NMB-3(A)

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot

accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
email: halloibm@de.ibm.com

Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

VCCI Statement - Japan

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。　　　　　　　　　　　　　　　　　　　　　VCCI−A

The following is a summary of the VCCI Japanese statement in the box above:

This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

Japan Electronics and Information Technology Industries Association Statement

This statement explains the Japan JIS C 61000-3-2 product wattage compliance.

（一社）電子情報技術産業協会　高調波電流抑制対策実施
要領に基づく定格入力電力値：　Knowledge Centerの各製品の
仕様ページ参照

This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格　JIS C 61000-3-2 適合品

This statement explains the JEITA statement for products greater than 20 A, single phase.

This statement explains the JEITA statement for products greater than 20 A per phase, three-phase.

Electromagnetic Interference (EMI) Statement - People's Republic of China

Declaration: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may need to perform practical action.

Electromagnetic Interference (EMI) Statement - Taiwan

The following is a summary of the EMI Taiwan statement above.

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user will be required to take adequate measures.

IBM Taiwan Contact Information:

台灣IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路7號3樓
電話：0800-016-888

Electromagnetic Interference (EMI) Statement - Korea

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Germany Compliance Statement

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaatenund hält die Grenzwerte der EN 55022 / EN 55032 Klasse A ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung von IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung von IBM gesteckt/eingebaut werden.

EN 55022 / EN 55032 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: "Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse A

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road

Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 / EN 55032 Klasse A.

Electromagnetic Interference (EMI) Statement - Russia

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать
радиопомехи, для снижения которых необходимы
дополнительные меры

Class B Notices

The following Class B statements apply to features designated as electromagnetic compatibility (EMC) Class B in the feature installation information.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult an IBM-authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM-authorized dealers. IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

CAN ICES-3 (B)/NMB-3(B)

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
email: halloibm@de.ibm.com

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　取扱説明書に従って正しい取り扱いをして下さい。　　　　ＶＣＣＩ－Ｂ

Japan Electronics and Information Technology Industries Association Statement

This statement explains the Japan JIS C 61000-3-2 product wattage compliance.

（一社）電子情報技術産業協会　高調波電流抑制対策実施
要領に基づく定格入力電力値：　Knowledge Centerの各製品の
仕様ページ参照

This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格　JIS C 61000-3-2 適合品

This statement explains the JEITA statement for products greater than 20 A, single phase.

高調波電流規格　JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。
・回路分類 ： 6（単相、ＰＦＣ回路付）
・換算係数 ： 0

This statement explains the JEITA statement for products greater than 20 A per phase, three-phase.

高調波電流規格　JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。
・回路分類 ： 5（3相、ＰＦＣ回路付）
・換算係数 ： 0

IBM Taiwan Contact Information

台灣IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路7號3樓
電話：0800-016-888

Germany Compliance Statement

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaatenund hält die Grenzwerte der EN 55022/ EN 55032 Klasse B ein.

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse B

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022/ EN 55032 Klasse B.

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