IBM ioMemory VSL 3.2.6

HIGH IOPS HARDWARE INSTALLATION GUIDE

DECEMBER 11, 2013

IBM

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IBM High IOPS Hardware Installation Guide for ioMemory VSL 3.2.6

Legal Notices

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FCC CFR 47 Part 15 Class A device:

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.

Safety Information

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- Connect all power cords to a properly wired and grounded electrical outlet.
- Connect to properly wired outlets any equipment that will be attached to this product.
- 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.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.

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

To Connect	To Disconnect
1. Turn everything OFF. 2. First, attach all cables to devices. 3. Attach signal cables to connectors. 4. Attach power cords to outlet. 5. Turn device ON.	1. Turn everything OFF. 2. First, remove power cords from outlet. 3. Remove signal cables from connectors. 4. Remove all cables from devices.

Introduction

Overview

Congratulations on your purchase of an IBM solid-state storage device. This guide explains how to install your IBM High IOPS Adapter.

For information on installing software for your device, consult the *IBM ioMemory VSL User Guide* for your operating system.

NOTE-

Throughout this manual, when you see a reference to an **IBM High IOPS Adapter**, you may substitute your particular device(s), such as an Second Generation IBM High IOPS Adapter or an IBM High IOPS Duo Adapter.

Software Compatibility

Compatible Software (Driver)

The ioMemory VSL software is more than just a hardware driver, it is the "secret sauce" that gives IBM High IOPS Adapters their amazing performance. Each release of the ioMemory VSL software is compatible with certain IBM High IOPS Adapters.

For a list of devices that are compatible with the version of the ioMemory VSL software that you are installing, consult the *IBM ioMemory VSL Release Notes* for that version.

Compatible Operating Systems

The operating system requirements depends on the version of ioMemory VSL software that you are installing with this device.

For more information, consult the *IBM ioMemory VSL Release Notes* for the version you wish to install.

IBM Adapters

Attention!

Some devices may report a `nand_thermal_deg_c` value of `0`. This means that the particular device is not set to throttle or shut down based on the NAND board temperature.

Enterprise Value IBM Flash Adapters

Feature Code	Option Part Number	Description	PCIe Slot Required	Controller Throttle Temp.	Controller Shutdown Temp.	NAND Board Throttle Temp.	NAND Board Shutdown Temp.
A4WR	00AE861	IBM Flash Adapter F825 Enterprise Value for System x	Gen2 x8* Half-height, half-length clearance	78°C	85°C	78°C	83°C
A4WS	00AE864	IBM Flash Adapter F1650 Enterprise Value for System x	Gen2 x8* Half-height, half-length clearance	78°C	85°C	78°C	83°C
A4WT	00AE867	IBM Flash Adapter F3200 Enterprise Value for System x	Gen2 x8* Full-height, half-length clearance	93°C	100°C	78°C	83°C

* Gen2 x8 slot with at least 4 lanes that are electrically active.

Memory Attributes

Feature Code	NAND Type [1]	Total Memory	Memory Modules	Module Capacity	Maximum writes per memory module	Maximum writes per card
A4WR	MLC	825GB	1	825GB	4PB	4PB
A4WS	MLC	1650GB	1	1650GB	8PB	8PB
A3DY	MLC	3.20TB	1	3.20TB	20PB	20PB

1. Single Level Cell (SLC), Multi Level Cell (MLC).

Second Generation Adapters

IBM High IOPS Adapter Options

Feature Code	Option Part Number	Description	PCIe Slot Required	Controller Throttle Temp.	Controller Shutdown Temp.	NAND Board Throttle Temp.	NAND Board Shutdown Temp.
A3J3	46C9078	IBM 365GB High IOPS MLC Mono Adapter	Gen2 x8* Half-height, half-length clearance	93°C	100°C	78°C	83°C

A3J4	46C9081	IBM 785GB High IOPS MLC Mono Adapter	Gen2 x8* Half-height, half-length clearance	93°C	100°C	78°C	83°C
A3DY	00D8407	IBM 1.2TB High IOPS MLC Mono Adapter	Gen2 x8* Half-height, half-length clearance	93°C	100°C	78°C	83°C
A3DZ	00D8408	IBM 2.4TB High IOPS MLC Duo Adapter	Gen2 x8* Full-height, half-length clearance	93°C	100°C	78°C	83°C

* Gen2 x8 slot with at least 4 lanes that are electrically active.

Memory Attributes

Feature Code	NAND Type [1]	Total Memory	Memory Modules	Module Capacity	Maximum writes per memory module	Maximum writes per card
A3J3	MLC	365GB	1	365GB	4PB	4PB
A3J4	MLC	785GB	1	785GB	11PB	11PB
A3DY	MLC	1.2TB	1	1.2TB	17PB	17PB
A3DZ	MLC	2.4TB	2	1.2TB	17PB	34PB [2]

1. Single Level Cell (SLC), Multi Level Cell (MLC).
2. Assumes uniform distribution of writes across both memory modules.

Legacy Devices

IBM High IOPS Adapter Options

Feature Code	Option Part Number	Description	PCIe Slot Required	Controller Throttle Temp.	Controller Shutdown Temp.
0096	46M0877	IBM 160GB High IOPS SS Class SSD PCIe Adapter	Gen1 x4 Half-height, half-length clearance	78°C	85°C
0097	46M0878	IBM 320GB High IOPS SD Class SSD PCIe Adapter	Gen1 x8 or Gen2 x4 Half-height, half-length clearance	78°C	85°C
1649	46M0898	IBM 320GB High IOPS MS Class SSD PCIe Adapter	Gen1 x4 Half-height, half-length clearance	78°C	85°C

5985	81Y4519	640GB High IOPS MLC Duo Adapter for IBM System x	Gen1 x8 or Gen2 x4 Full-height, half-length clearance	78°C	85°C
A1NE	81Y4535	320GB High IOPS SLC Adapter for IBM system x	Gen1 x4 Half-height, half-length clearance	78°C	85°C
A1ND	81Y4539	640GB High IOPS SLC Duo Adapter for IBM System x	Gen1 x8 or Gen2 x4 Full-height, half-length clearance	78°C	85°C
A1NC	81Y4531	640GB High IOPS MLC Adapter for IBM System x	Gen1 x4 Half-height, half-length clearance	78°C	85°C
A1NB	81Y4527	1.28TB High IOPS MLC Duo Adapter for IBM System x	Gen1 x8 or Gen2 x4 Full-height, half-length clearance	78°C	85°C

Memory Attributes

Feature Code	NAND Type [1]	Total Memory	Memory Modules	Module Capacity	Maximum writes per memory module	Maximum writes per card
0096	SLC	160GB	1	160GB	75PB	75PB
0097	SLC	320GB	2	160GB	75PB	150PB [2]
1649	MLC	320GB	1	320GB	4PB	4PB
5985	MLC	640GB	2	320GB	4PB	8PB [2]
A1NE	SLC	320GB	1	320GB	50PB	50PB
A1ND	SLC	640GB	2	320GB	50PB	100PB [2]
A1NC	MLC	640GB	1	640GB	10PB	10PB
A1NB	MLC	1.28TB	2	640GB	10PB	20PB [2]

1. Single Level Cell (SLC), Multi Level Cell (MLC).
2. Assumes uniform distribution of writes across both memory modules.

Hardware Requirements

Before you install your IBM High IOPS Adapter(s) make sure your computer hardware meets these requirements.

NOTE-

For the latest IBM System x server configuration information and requirements for IBM High IOPS Mono and Duo Adapters, please see the URL below:

http://www.ibm.com/support/entry/portal/docdisplay?lndocid=SERV-IOPS

Shipping Considerations

Legacy Adapters:

Legacy High IOPS adapters do not support shipping installed or transported inside IBM System x servers. The Legacy adapters must be packaged in the original box, electrostatic discharge (ESD) bag and packing materials. An alternate packaging equivalent intended for fragile ESD sensitive electronic devices may also be used. Configured Legacy adapters must be removed and repackaged before shipping. For more information, see the following websites:

High IOPS adapter shipping requirements: http://www.ibm.com/support/entry/portal/docdisplay?lndocid=migr-5092425

Second Generation Adapters:

Shipping considerations for Second Generation High IOPS adapters are maintained at the following website:

IBM High IOPS System x server configuration information and requirements:
http://www.ibm.com/support/entry/portal/docdisplay?lndocid=SERV-IOPS

Adequate Power for IBM High IOPS Duo Adapters

Second Generation IBM High IOPS Duo Adapters require more power than the minimum 25W provided by PCIe Gen2 slots to properly function, and therefore must receive additional power via the included power cable.

Without additional power, function will be limited with Second Generation IBM High IOPS Duo Adapters. For more information on providing additional power via a power cable, see Installing Power Cables on page 18.

Adequate System Cooling

300 LFM: To maximize the longevity and performance of IBM High IOPS Adapters, we recommend at least 300 Linear Feet per Minute (LFM) of airflow across the devices.

55°C Maximum: The ambient air temperature around the device should not exceed 55°C.

Device Thermal Monitoring: In order to protect against thermal damage, all IBM High IOPS Adapters monitor the temperature of its onboard controller chip (This is reported by the `fio-status` command-line utility as `Internal temperature`). Newer devices, such as Second Generation IBM High IOPS Adapters, also monitor the NAND boards to prevent overheating of the NAND flash components (reported by `fio-status`, using the `-fj` or `-fx` options, as `nand_thermal_deg_c`). If your device is throttled or shuts down due to thermal issues, the `fio-status` utility will print a warning and indicate whether the cause was the `FPGA Junction` (controller) or the `NAND Temperature`.

- In an attempt to contain temperatures within an optimal range, the ioMemory VSL software will start throttling write performance once the controller temperature or NAND board reaches a set temperature.
- If the controller or NAND board temperature continues to rise, the software will shut down the device once the maximum operating temperature is reached.

The throttling and shutdown temperature depends on the device. Some devices detect the NAND board temperature, while others do not.

To find these temperatures limits for your device, find your device in the section IBM Adapters on page 6.

Attention!

High Performance/Power Mode

If your BIOS has a High Performance/Power Mode, enable it when using IBM High IOPS Adapters. Also disable any power-saving modes. This improves performance in two ways:

1. Prevents operating systems and the BIOS from suspending PCIe devices (using ASPM), including IBM High IOPS Adapters. IBM High IOPS Adapters do not support ASPM.
2. Maintains higher fan speeds to prevent thermal throttling.

Sufficient System Memory (RAM)

The ioMemory VSL software requires enough RAM to accelerate your IBM High IOPS Adapter. The RAM requirements depend on how your operating system tracks I/O's (average written block sizes), the capacity of your IBM High IOPS Adapters, and the version of the ioMemory VSL software.

For more information, including a chart on RAM required per GB of IBM High IOPS Adapter capacity, consult the *IBM ioMemory VSL Release Notes* for the version of ioMemory VSL software that you will install with the device(s).

Firmware Requirements

The IBM High IOPS Adapter must have a certain level of firmware in order to work with particular versions of the ioMemory VSL software. Consult the *Upgrade Notes* section of the http://www.ibm.com/systems/support for upgrade considerations.

Attention!

Do not downgrade the IBM High IOPS Adapter to an earlier version of the firmware. Earlier versions of the firmware may not be compatible with the device, and downgrading the firmware will result in data loss. Contact Customer Support if you have issues with your upgrade.

In the Box

Your IBM High IOPS Adapter comes with these items:

- IBM High IOPS Adapter
- Quick Start Instructions

Additional Item(s)

Depending on your device, these additional items may be included (consult the installation instructions for item information):

- Half-height bracket, used on low-profile systems
- External Power Cable(s)

On the USB Key (if available) are the following items:

- Environmental Notices document
- Important Notices document

NOTE-

Please read the Hardware Requirements on page 9 if you have not done so.

Attention!

Upgrade Previous Devices First

If you have Legacy IBM High IOPS Adapters configured for ioMemory VSL 2.x or earlier that you wish to use with ioMemory VSL software version 3.x, you must upgrade the firmware on the previously installed devices before installing new devices in the system. See the *IBM ioMemory VSL Release Notes* for full Upgrade Notes.

Installation Instructions

Attention!

Electrostatic discharge (ESD) can damage electronic components. Be sure that you are properly grounded before beginning any hardware installation procedure.

Attention!

Do Not Disassemble the Device

If you disassemble your IBM High IOPS Adapter, you will void the product warranty. Removing (and replacing) the bracket as instructed in this guide is **not** considered disassembly.

These installation instructions are for any IBMIBM High IOPS Adapter.

1. Locate the serial number label(s) on your device and record the number(s) for future reference.

   NOTE-

   The serial number label(s) will have a number and a barcode.

   NOTE-

   Visible in fio-status

   Once the ioMemory VSL software is installed, the device's serial number(s) will be visible in the `fio-status`ioMemory VSL software utility.

2. Turn off the computer and disconnect the power cable.

3. Remove the computer's access panel. Locate an available PCIe slot compatible with the device. See

Hardware Requirements on page 9 for PCIe slot requirements.

NOTE-

Consult your computer's documentation for details on removing the panel and identifying PCIe slots.

4. Remove the cover slot (if applicable).
5. **Optional Half-height Bracket**: If your product includes a half-height bracket (included with products that has one IBM High IOPS Adapter), and you are installing the device in a low-profile system, replace the full-height bracket before installing the device. Follow the installation instructions in Installing the Half-Height Bracket on page 16 and then return to this section.
6. **Power Cable**: If your device includes a power cable (included with some products), you may install it now.

Attention!

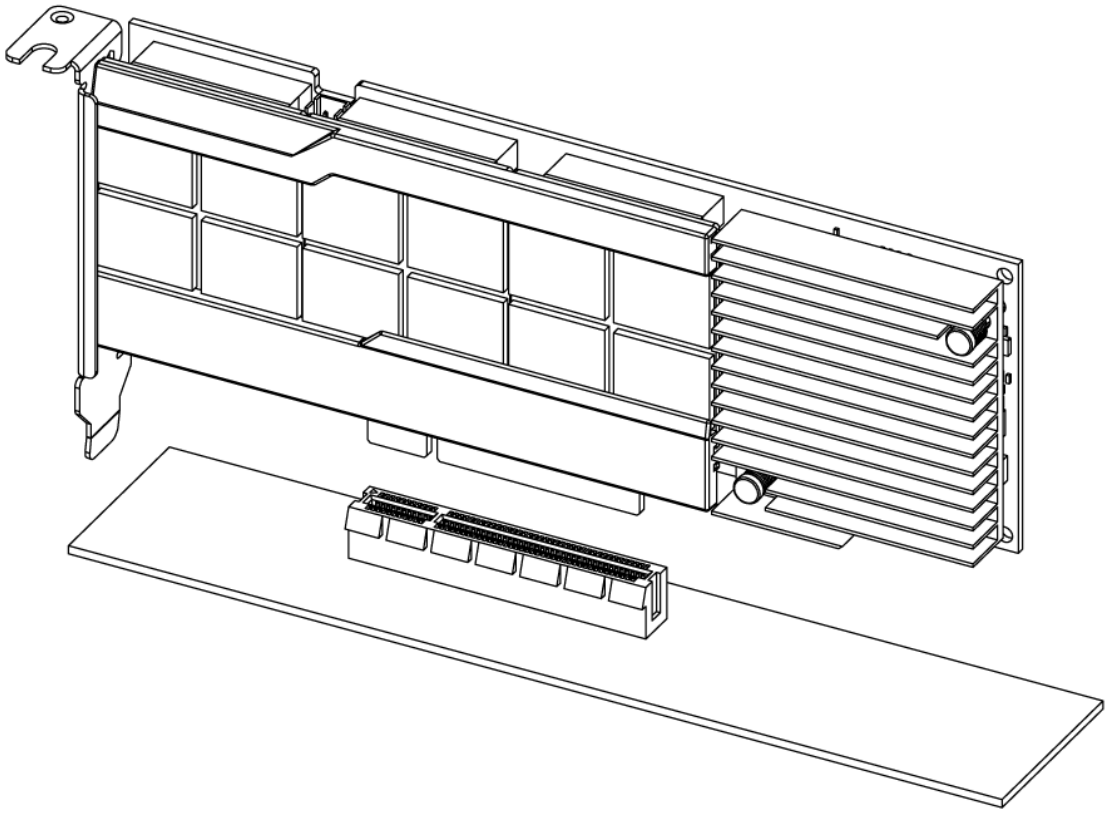
Additional power (through the cable) is required for newer products with multiple IBM High IOPS Adapters.

For best results, plug in the power cable. See Installing Power Cables on page 18 for instructions and to see if the power cable is required for your device.

7. Grasp the IBM High IOPS Adapter by the top edge and seat it gently but firmly in the available PCIe slot, for example:

Attention!

This illustration is an example of one type of IBM High IOPS Adapter, your specific device will install in the same manner.



Attention!

Apply pressure only to the circuit board and/or bracket. Do **not** apply pressure to the heat sink or any other components that are attached to the circuit board (with the exception of the bracket).

8. Secure the IBM High IOPS Adapter's retaining bracket using a screw, lever, clasp, or other method (depending on how your hardware is configured, consult your computer's documentation).
9. Replace the computer's access panel.
10. Plug in the computer's power cable and turn on the computer.
11. Your operating system may detect the IBM High IOPS Adapter and ask if you want it to install a hardware driver for the device. In that case, click **Cancel**.

NOTE-

Device Packaging

Note: We recommend saving the product box in case you need to store or return your device. The IBM High IOPS Adapter product box is the safest way to store and transport your ioMemory device. It is made of ESD-safe materials, and protects the device from damage in shipping.

To remove the IBM High IOPS Adapter, follow the above instructions in reverse. Be sure to place the

device in an ESD-safe package.

You are now ready to install the driver and utilities software. See the *IBM ioMemory VSL User Guide* based on your operating system.

Installing the Half-Height Bracket

For half-height installation (such as in low-profile systems), you need to replace the full-height retaining bracket with the included half-height bracket.

Attention!
Electrostatic discharge (ESD) can damage electronic components. Be sure you are properly grounded before starting any hardware installation procedure.

1. Locate the half-height bracket in your IBM High IOPS Adapter package:

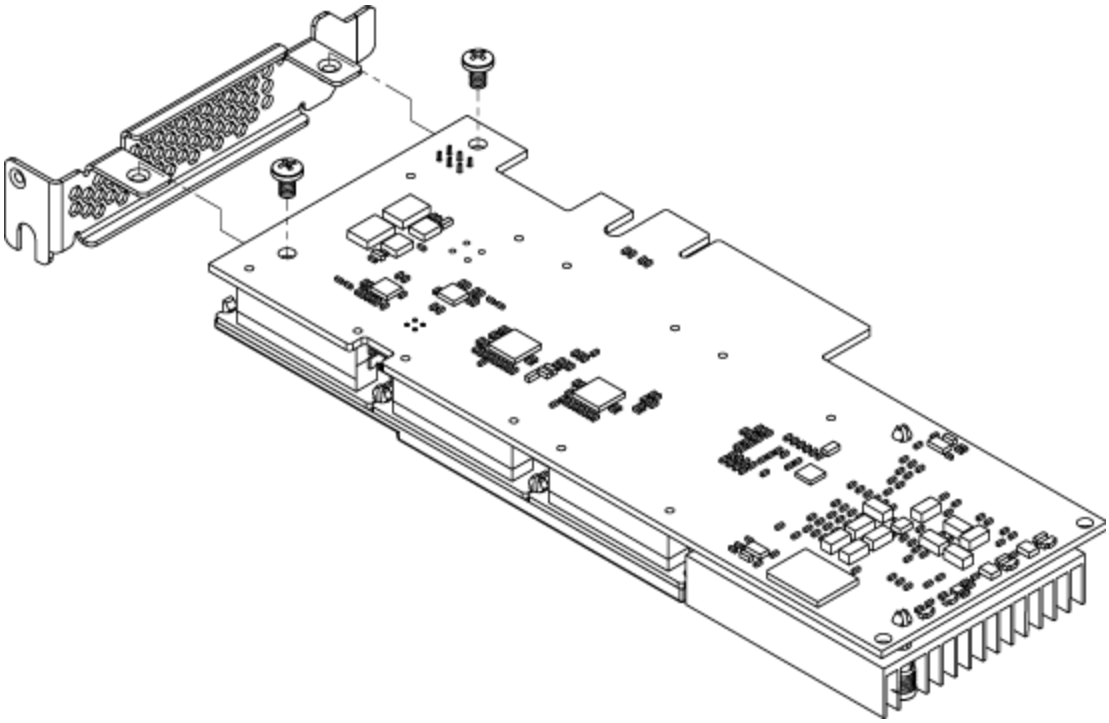
   Attention!
   Use care in removing the retaining screws. Do not twist or pull on the bracket until both screws are out as this can cause damage to the components.

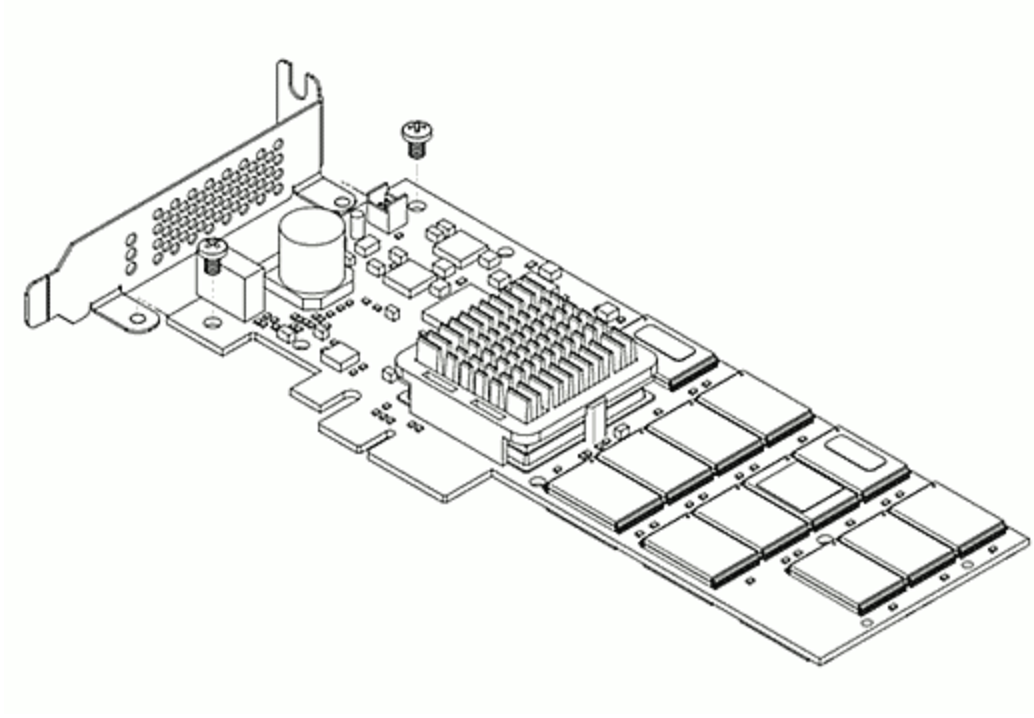
2. To prevent damage to the IBM High IOPS Adapter, use only a Philips #1 tip screwdriver. Remove the two screws holding the full-height bracket to the IBM High IOPS Adapter

   Attention!
   Take note of the position of the screws and how the bracket screw holes were inserted in the device. You must insert the half-height bracket holes in the same manner.

3. Remove the bracket carefully from the device.

4. Align the LEDs on the IBM High IOPS Adapter with the holes in the half-height bracket. Insert the bracket screw holes in the same manner as the full height bracket was inserted. Refer to the example below that matches your device configuration.





5. Attach the half-height bracket using a Phillips #1 tip screwdriver to tighten the two screws.

Attention!

Do not over-tighten! This can cause damage to the device.

6. Return to the installation instructions on page 14 to complete the install.

Installing Power Cables

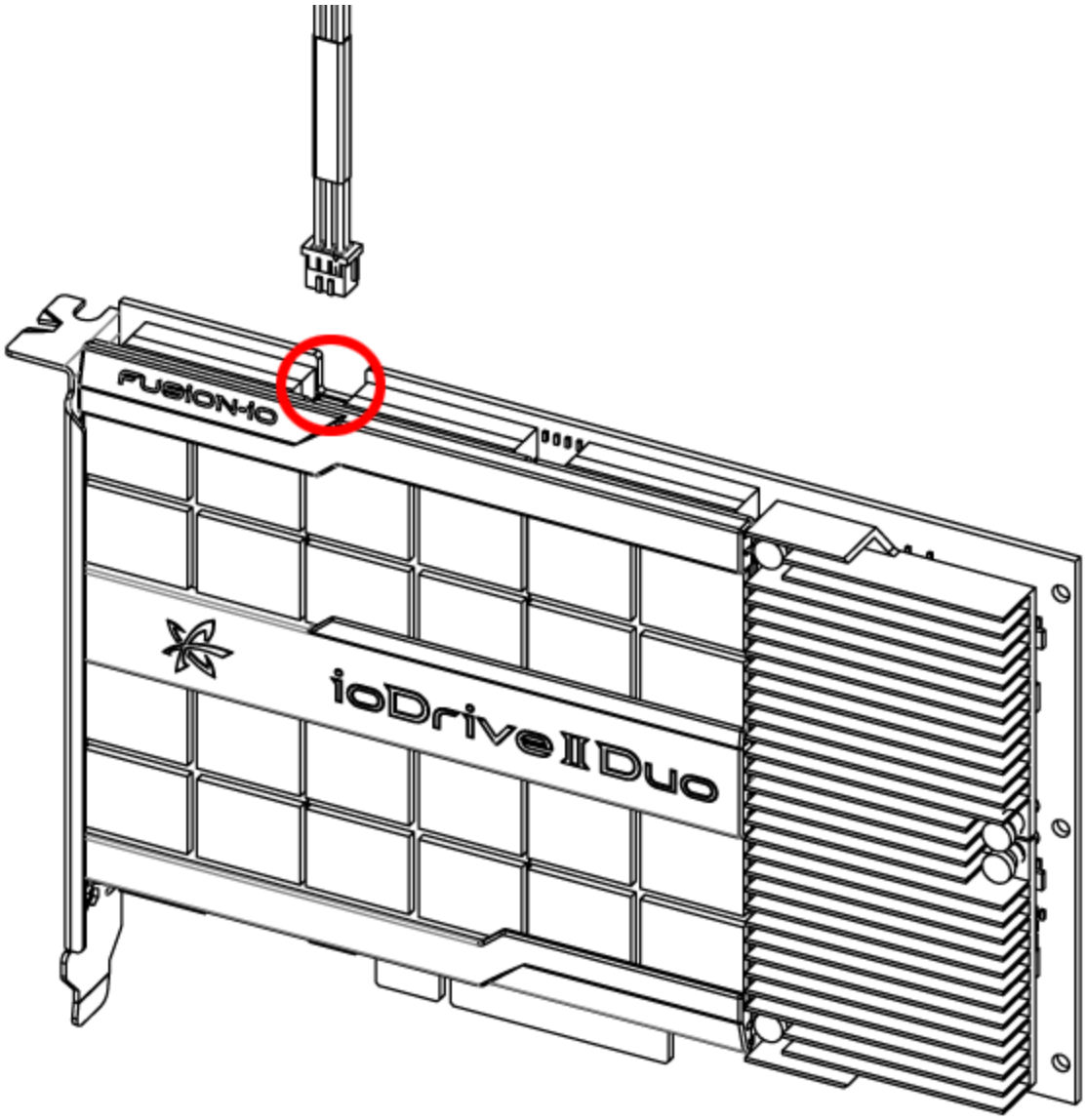
Some IBM High IOPS Adapters are compliant with the PCIe 2.0 bus specification of 25W and do not require external power in compliant PCIe slots. Other devices require more than the 25W to function. Second Generation IBM High IOPS Duo Adapters do require additional power through the provided power cable.

Installing the Cable

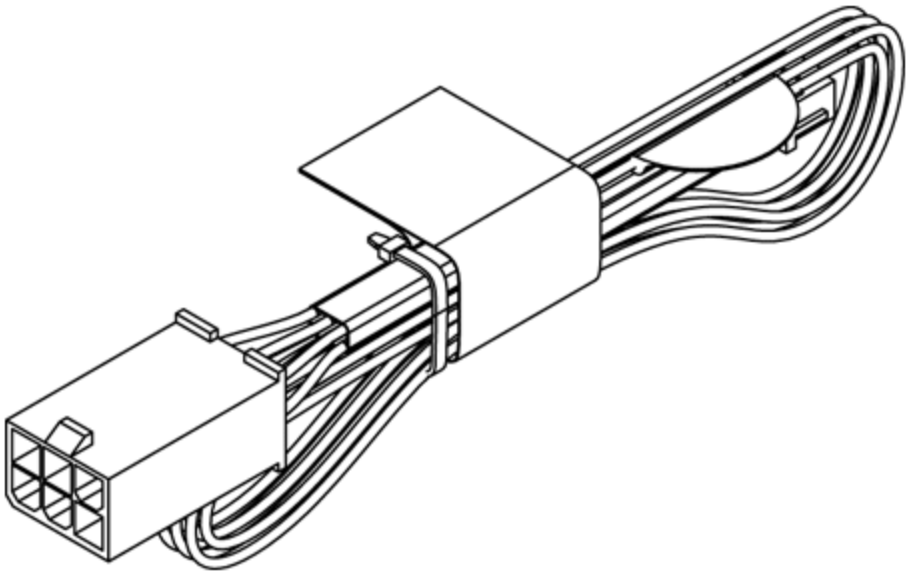
To use the external power cable, plug one end of the supplied cable into the product's power connection (circled below, refer to the example that matches your device configuration), and the other into the auxiliary power source.

Additional power is **required** on these devices. When the power cable is used, the device will draw 55 watts from the 12V rail over the external cable. Make sure your system has sufficient power for the installed devices.

IBM High IOPS Duo Adapters:



Plug the product end of the cable (shown above) into the device. Plug the other end of the cable (shown below) into an available power source cable. Consult your server documentation for available power options. Some servers may require alternative power sources and adapters to connect with the cable.



Attention!

There are two power cables supplied with the IBM High IOPS Duo Adapters, a 2x3 pin supporting one Duo and a 2x4 pin supporting three Duos. These power cables mate directly to the corresponding aux power connectors available in most IBM servers. However some IBM servers utilize a different aux power connector, typically white in color, which is physically a 2x4 but will not accept the 2x4 cable supplied. For these applications, the 2x3 pin cable is to be used. Care should be taken to insure that the 2x3 cable mates properly with the 2x4 aux power connector. Due to the square and "D" shaped housing of the power cable connector and corresponding holes in the aux power connector, they will only fit together one way.

Return to the installation instructions on page 14.

WEEE Advisement Disposal and Acknowledgment

In 2002 the European Union introduced the Directive on Waste Electrical and Electronic Equipment (WEEE). The main aim of the Directive is to ensure that WEEE is collected and treated separately. WEEE may contain hazardous substances that should not end-up in the (human) environment and can have adverse effects on it if they do.

Furthermore, WEEE is a vast source of raw materials. With the ever rising worldwide demand for new equipment and the ever decreasing volume of natural raw materials, letting this potential source go to waste is unacceptable.

If equipment is collected separately, the equipment can be recycled and up to 85 to 90% of the equipment can be re-used as new material, saving the use of virgin raw materials and energy of producing these.

For above reasons, Fusion-io Inc expects end-users to dispose of the material in an environmentally friendly way. Electrical and Electronic Equipment is labeled with the following "crossed-out wheeled bin" symbol indicating that the equipment should be disposed of, by the end-user, separate from other types of waste.

The EU Directive and national legislation define various situations and financing options for doing so.

End-users should contact their sales representative/dealer/distributor and our company on disposal, collection and recycling options and terms and conditions in your country.

Determining Manufacture Date

You can determine the week and year the device was manufactured by locating the serial number label on your device and interpreting the first four numbers of the serial number.

Example Label:

The first two numbers on the label indicate the last two numbers of the calendar year, and the next two numbers indicate the week of that year.

In this example, the first four numbers are `1113`, this stands for the year 2011 (`11`) and the 13th week of the year 2011 (`13`).

IBM Support

IBM High IOPS Adapter software and documentation are available on the web at the following address:

http://www.ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-65723 (follow that link and then select **IBM High IOPS software matrix**).

IBM part number 00AH229