



# IBM High IOPS Adapter Hardware User Guide

for Driver Release 2.2.3

5.4.2011

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## IBM High IOPS Hardware User Guide for Driver Version 2.2.3

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Part Number D0003073-000\_1C

# 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
<ol style="list-style-type: none"> <li>1. Turn everything OFF.</li> <li>2. First, attach all cables to devices.</li> <li>3. Attach signal cables to connectors.</li> <li>4. Attach power cords to outlet.</li> <li>5. Turn device ON.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn everything OFF.</li> <li>2. First, remove power cords from outlet.</li> <li>3. Remove signal cables from connectors.</li> <li>4. Remove all cables from devices.</li> </ol>

# Introduction

## Overview

Congratulations on your purchase of a IBM solid-state storage device. This guide explains how to install, troubleshoot and maintain your IBM High IOPS Adapter.

**NOTE** Throughout this manual, when you see a reference to an "IBM High IOPS Adapter," you may substitute your device.

"IBM High IOPS Duo Adapter" refers to devices with two memory modules, including the IBM High IOPS SD/MD Class SSD PCIe Adapters.

Designed around a revolutionary silicon-based storage architecture, the IBM High IOPS Adapter is the world's most advanced NAND flash storage device, with performance comparable to DRAM and storage capacity on par with today's hard disks—giving you the power to improve storage performance by orders of magnitude. The IBM High IOPS Adapter allows every computer to exceed the I/O performance of an enterprise SAN.

The IBM High IOPS Adapter is a data accelerator designed specifically to improve the bandwidth for I/O-bound applications. The IBM High IOPS Adapter is a no-compromise solution for the toughest computational challenges faced by data centers today, putting it in a league of its own.

## IBM High IOPS Adapters

### IBM High IOPS Adapter Options

Feature Code	Option Part Number	Description
0096	46M0877	IBM 160GB High IOPS SS Class SSD PCIe Adapter
0097	46M0878	IBM 320GB High IOPS SD Class SSD PCIe Adapter
1649	46M0898	IBM 320GB High IOPS MS Class SSD PCIe Adapter
5985	81Y4519	640GB High IOPS MLC Duo Adapter for IBM System x
A1NE	81Y4535	320GB High IOPS SLC Adapter for IBM system x
A1ND	81Y4539	640GB High IOPS SLC Duo Adapter for IBM System x
A1NC	81Y4531	640GB High IOPS MLC Adapter for IBM System x
A1NB	81Y4527	1.28TB High IOPS MLC Duo Adapter for IBM System x

## Memory Attributes

Feature Code	NAND Type <sup>[1]</sup>	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 <sup>[2]</sup>
1649	MLC	320GB	1	320GB	4PB	4PB
5985	MLC	640GB	2	320GB	4PB	8PB <sup>[2]</sup>
A1NE	SLC	320GB	1	320GB	50PB	50PB
A1ND	SLC	640GB	2	320GB	50PB	100PB <sup>[2]</sup>
A1NC	MLC	640GB	1	640GB	10PB	10PB
A1NB	MLC	1.28TB	2	640GB	10PB	20PB <sup>[2]</sup>

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

## Performance Attributes

Feature Code	NAND Type <sup>[1]</sup>	Read Bandwidth	Write Bandwidth	IOPS <sup>[2]</sup>	Access Latency
0096	SLC	770 MB/s	750 MB/s	123,000	26 $\mu$ s
0097	SLC	1.5 GB/s	1.5 GB/s	238,000	26 $\mu$ s
1649	MLC	735 MB/s	510 MB/s	67,000	29 $\mu$ s
5985	MLC	1.5 GB/s	1.0 GB/s	138,000	29 $\mu$ s
A1NE	SLC	770 MB/s	790 MB/s	119,000	26 $\mu$ s
A1ND	SLC	1.5 GB/s	1.5 GB/s	236,000	26 $\mu$ s
A1NC	MLC	750 MB/s	550 MB/s	74,000	30 $\mu$ s
A1NB	MLC	1.5 GB/s	1.1 GB/s	150,000	30 $\mu$ s

1. Single Level Cell (SLC), Multi Level Cell (MLC).
2. IOPS with 75/25 mixed read/write and 512B packet sizes.

## System Requirements

### Supported Operating Systems

All operating systems must be 64-bit x86 architecture to support the IBM High IOPS Adapter. Running the latest Service Pack of a release is strongly recommended.

**Attention** UPGRADE WARNING: Version 2.2 and later of the driver software, including ioMemory VSL, are not backward-compatible with any driver version earlier than 2.2. When you install version 2.2 or later, you cannot revert to any driver version before 2.2.

### Supported Linux Distributions

- Red Hat Enterprise Linux (RHEL) 5, 6
- SUSE Linux Enterprise Server (SLES) 10, 11

### Supported Windows Operating Systems

- Microsoft Windows 2003 Server 64-Bit (with SP2 or higher)
- Microsoft Windows 2008 Server 64-Bit, R1 (with SP2 or higher)
- Microsoft Windows 2008 Server 64-Bit, R2

**NOTE** IBM High IOPS Adapters cannot be used as hibernation devices.

## Hardware Requirements

### IBM High IOPS Adapter Requirements

The IBM High IOPS Adapter requires at least:

- A PCI-Express (PCIe) Gen1 x4 slot.  
The IBM High IOPS Adapter is a half-height, half-length, PCIe 1.1 x4 card and for full performance, it must reside in a PCIe slot where at least 4 lanes are electrically active.

- Adequate system cooling.  
To maximize the longevity and performance of an IBM High IOPS Adapter, we recommend at least 300 Linear Feet per Minute (LFM) of airflow through the system.

In order to protect against thermal damage, the IBM High IOPS Adapter monitors the temperature of its onboard controller chip (This is reported by the `fio-status` command line utility as "Internal temperature").

The IBM High IOPS Adapter will start throttling write performance once the controller temperature reaches 78°C. If the controller temperature continues to rise, the IBM High IOPS Adapter will shut down once the controller temperature reaches 85°C.

**NOTE** If you experience write-performance throttling due to high temperatures, consult your server's documentation for details on increasing airflow within your system .

- Sufficient system memory (RAM).  
The amount of RAM the VSL requires varies according to the average block size written to the device. Using the average block size table below, you can estimate the amount of system memory needed. You can reduce worst-case memory use by formatting your IBM High IOPS Adapter with a 4K sector size and thereby force the average written block size to be 4K or greater.

Note however, that for many systems, even those formatted with 512 byte sectors, actual memory utilization typically tracks with I/O operations on 4k or larger chunks of data.

At various block sizes, the following table shows the upper limit of RAM that may be required of your system for every 80 GB of IBM High IOPS Adapter storage space used.

Average Written Block Size (bytes)	RAM Usage (MB) per 80GB of storage space
8192	225
4096 (Most common)	425
2048	825
1024	1600
512	3175

For example, if your system is equipped with a IBM High IOPS Duo Adapter, formatted to use 4,096 byte sectors, your system may require as much as:  
 $(425 \text{ MB of RAM} / 80 \text{ GB}) \times (640 \text{ GB}) = \mathbf{3,400 \text{ MB (or around 3.32 GB) of system RAM}$  for use by the IBM High IOPS Duo Adapter driver.

## IBM High IOPS Duo Adapter Requirements

In addition to the IBM High IOPS Duo Adapter cooling and RAM requirements given above, the IBM High IOPS Duo Adapter requires at least:

- A PCIe Gen1 x8 slot or a PCIe Gen2 x4 slot.

- A minimum of a *full-height*, half-length slot with a x8 physical connection. For systems with PCI 1.1, all 8 signaling lanes must be active for full IBM High IOPS Duo Adapter performance. For systems with PCIe 2.0, only 4 signaling lanes must be active for full performance.

## In the Box

Your IBM High IOPS Adapter comes with these items:

- IBM High IOPS Adapter
- USB Key
- Quick Start Instructions
- IBM High IOPS Adapter half-height bracket (used on low-profile systems; the IBM High IOPS Duo Adapter does not use a half-height bracket)
- Important Notices document

On the USB Key are the following items:

- IBM High IOPS Adapter User Guide for Linux
- IBM High IOPS Management Application User Guide
- Environmental Notices document
- Important Notices document

# IBM High IOPS Adapter Installation

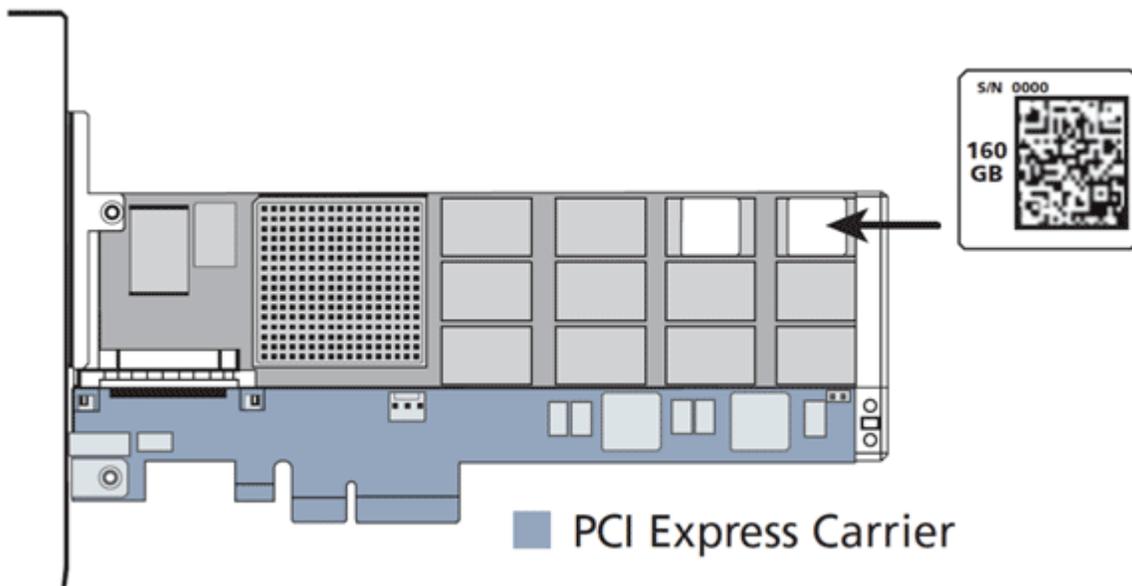
**NOTE** To install the IBM High IOPS Duo Adapter, see the next section [IBM High IOPS Duo Adapter Installation](#).

For IBM High IOPS Adapter requirements, please see [Hardware Requirements](#).

## Installation Instructions

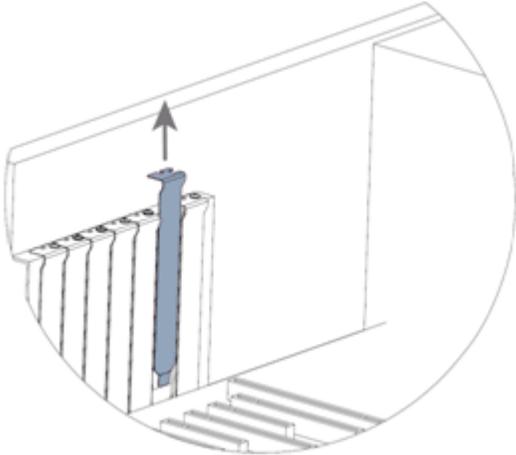
**Attention** Electrostatic discharge (ESD) can damage electronic components. Be sure that you are properly grounded before beginning any hardware installation procedure.

1. If you are installing the IBM High IOPS Adapter in a low-profile system, you need to use the half-height bracket. Please refer to the [Half-Height Bracket Installation](#) section for details.
2. Locate the serial number on your IBM High IOPS Adapter and record it for future reference.

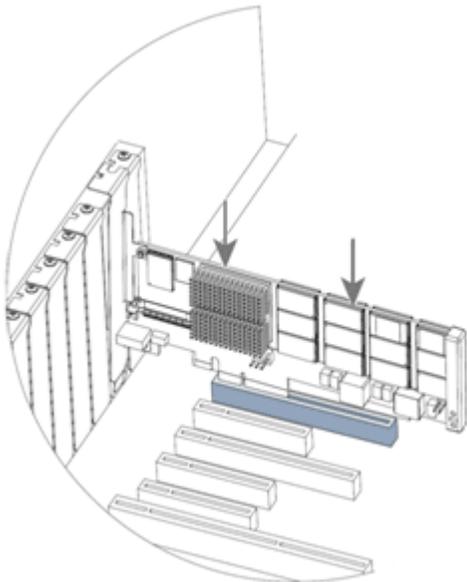


3. Turn off the computer and disconnect the power cable.
4. Remove the computer's access panel. Locate an available x4 PCIe slot. (Consult your computer's documentation for details on removing the panel and identifying PCIe slots.)

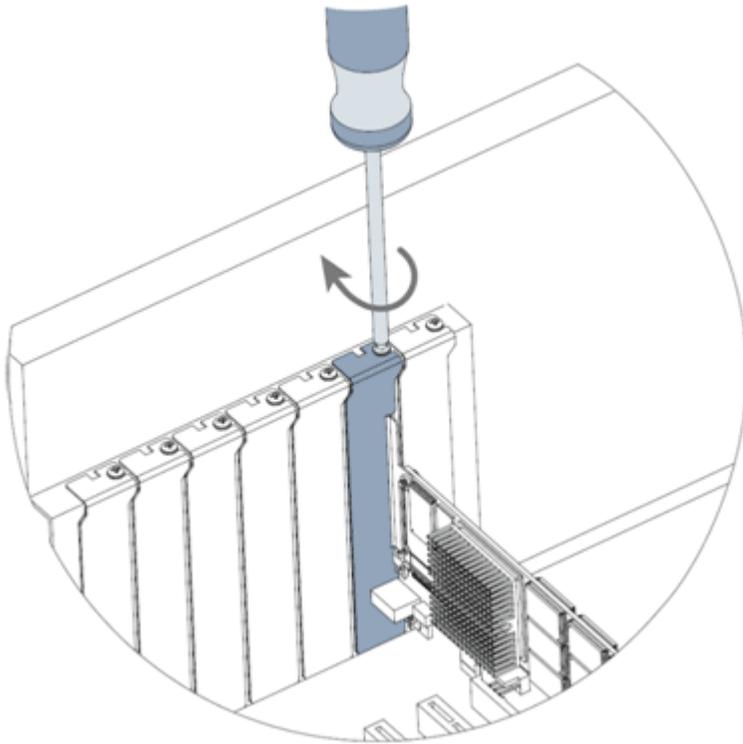
- Remove the cover slot (if applicable).



- You now have the option to install the external HDD LED connection. If you choose to do this, proceed to the [External Hard Drive LED \(optional\)](#) section of this guide. Otherwise, continue with these steps to complete the hardware installation.
- Grasp the IBM High IOPS Adapter by the top edge and seat it gently but firmly in the available PCIe slot:



- Secure the IBM High IOPS Adapter's retaining bracket using a screw or lever (depending on how your hardware is configured):



- Replace the computer's access panel.
- Plug in the power cable and turn on the computer.
- 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**.

You are now ready to install the driver and utilities software. See the IBM High IOPS Adapter user guide based on your operating system.

## Half-Height Bracket Installation

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.

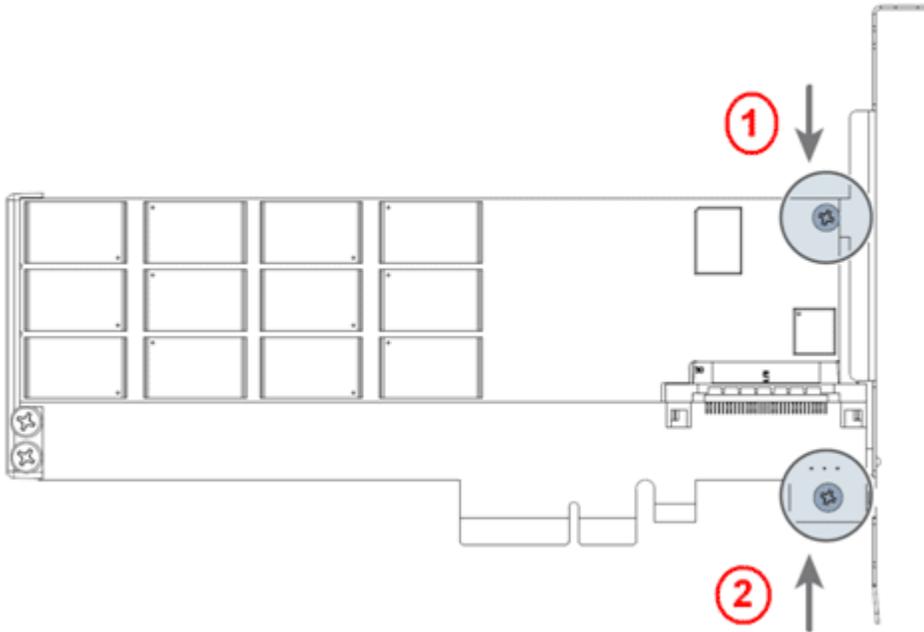
**Attention** Electrostatic discharge (ESD) can damage electronic components. Be sure you are properly grounded before starting any hardware installation procedure.

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



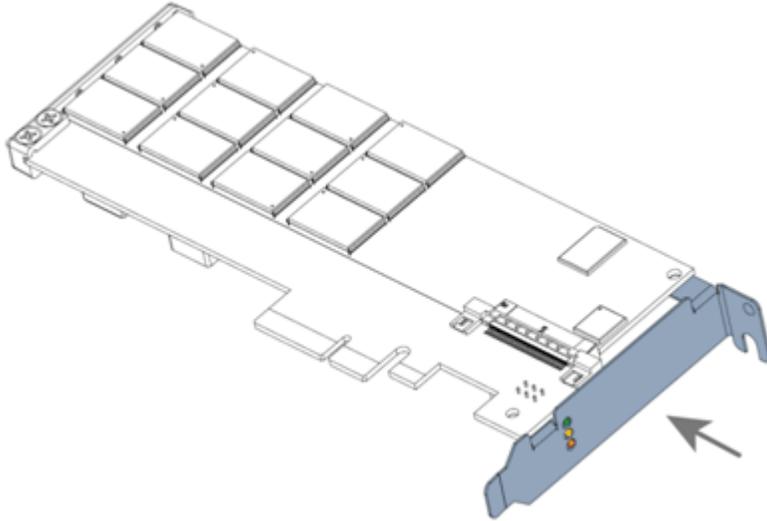
**Attention** Use care in removing the retaining screws. Do not twist or pull on the bracket until both screws are out as this can cause damage to the components.

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 in the order shown.



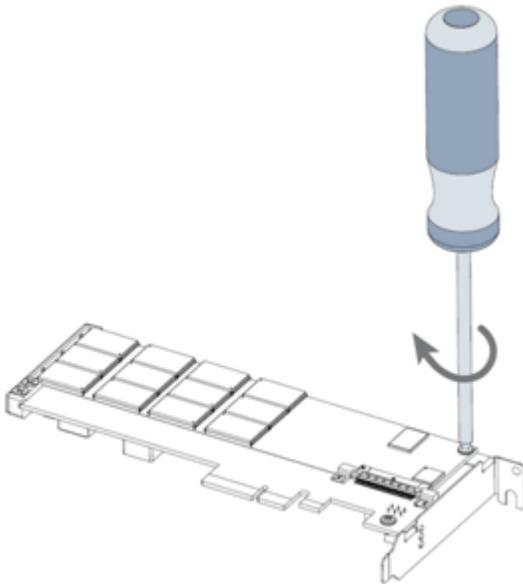
3. Remove the bracket carefully from the device.

- Align the LEDs on the IBM High IOPS Adapter with the holes in the half-height bracket:



**NOTE** Be sure the bracket tabs are on the backside of the device (opposite of heat sink).

- Attach the half-height bracket using a Philips #1 tip screwdriver to tighten the two screws:



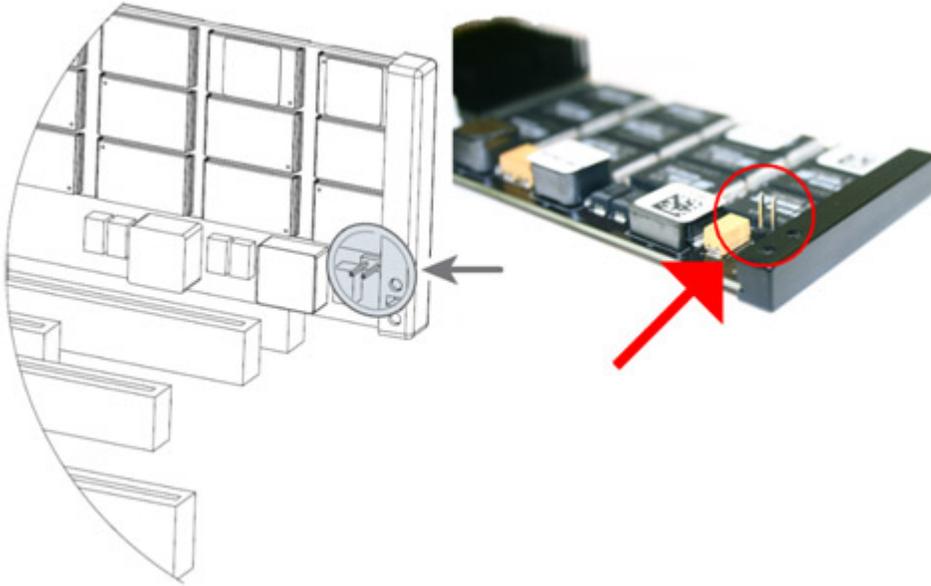
**Attention** Do not over-tighten! This can cause damage to the device.

- [Return](#) to Step 2 of the Hardware Installation section to complete the install.

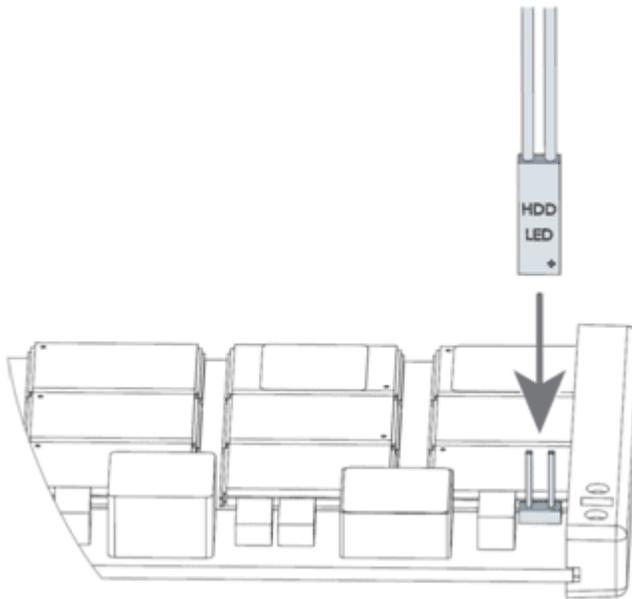
## External Hard Drive LED (optional)

The IBM High IOPS Adapter includes a two-pin LED pinout for attaching to an external HDD access light. To attach the LED:

1. Locate the two-pin pinout at the right of the IBM High IOPS Adapter:



2. Plug in the connector:



NOTE The pin closest to the PCIe connector is the negative pin.

3. Replace the computer's access panel.
4. Plug in the power cable and turn on the computer.

The external LED now displays both read and write operations performed on the IBM High IOPS Adapter.

Resume the installation of your IBM High IOPS Adapter

# IBM High IOPS Duo Adapter Installation

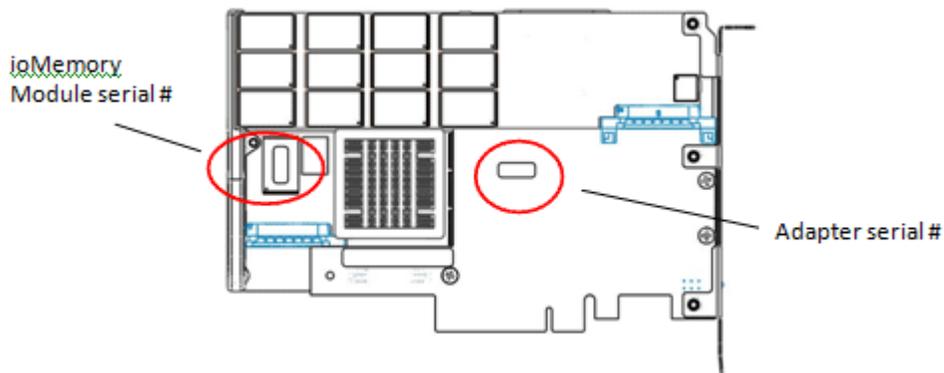
NOTE For IBM High IOPS Duo Adapter requirements, please see [Hardware Requirements](#).

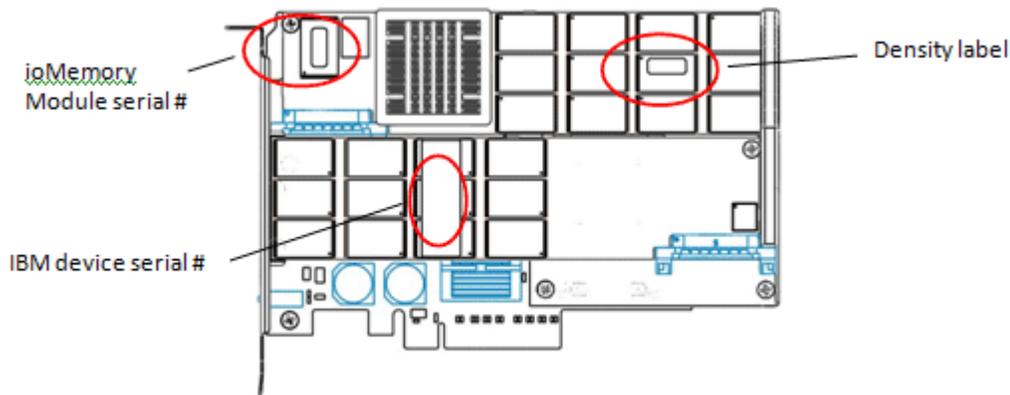
## Installation Instructions

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

1. Locate the serial and informational numbers on each side of your IBM High IOPS Adapter and record them for future reference.

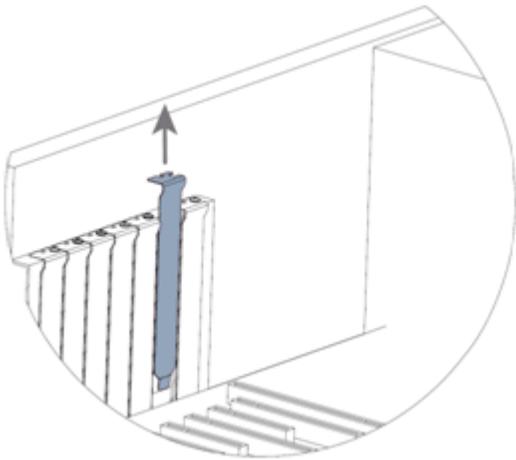
NOTE Record four serial numbers: one serial number for each of the two ioMemory modules, one for the adapter serial number and the IBM Device serial number.





2. Turn off the computer and disconnect the power cable.
3. Remove the computer's access panel. Locate an available Gen1 x8 or Gen2 x4 PCIe slot.\* (Consult your computer's documentation for details on removing the panel and identifying PCIe slots.)

*\*Gen1 slot with a minimum physical width of x8 and a minimum signaling width of x8, or a Gen2 slot with minimum physical width of x8 and minimum signaling width of x4.*

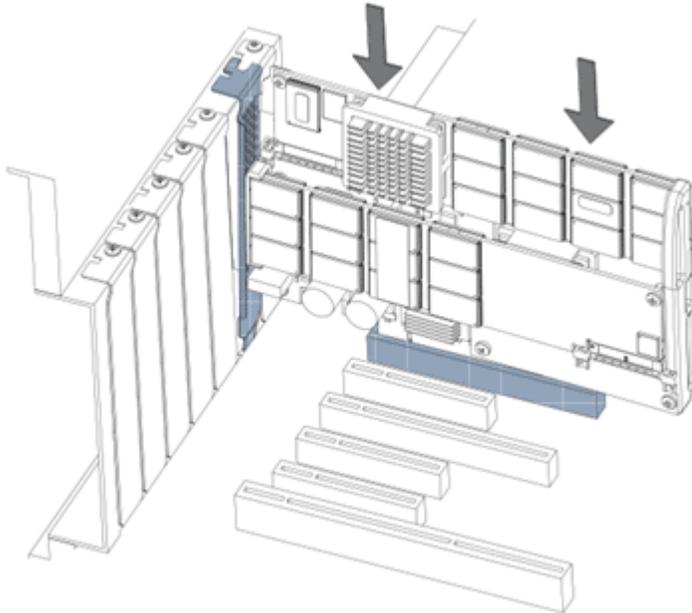


4. Plug in optional LED connector (if desired).

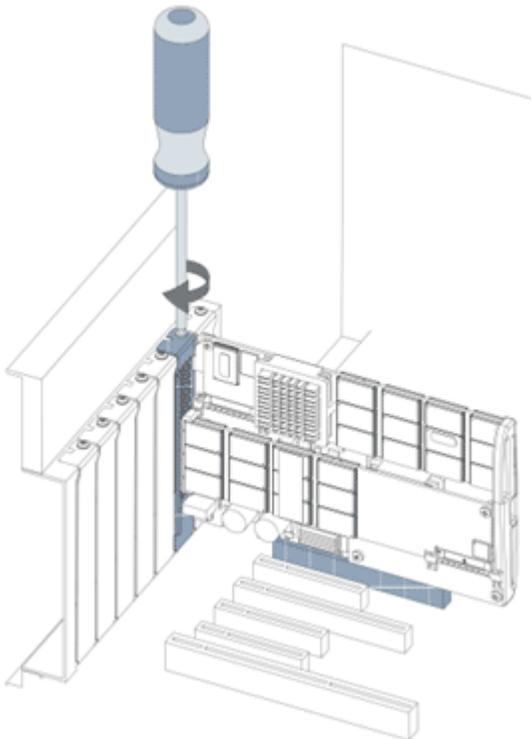
**NOTE** If you choose to use the optional [External Hard Drive LED](#) connector, make that optional connection before proceeding. It will be difficult to make that connection once the IBM High IOPS Adapter is installed.

Return to the next step after completing the connection.

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



6. Secure the IBM High IOPS Adapter's retaining bracket using a screw or lever (depending on how your hardware is configured):



7. Replace the computer's access panel.

8. Plug in the power cable and turn on the computer.

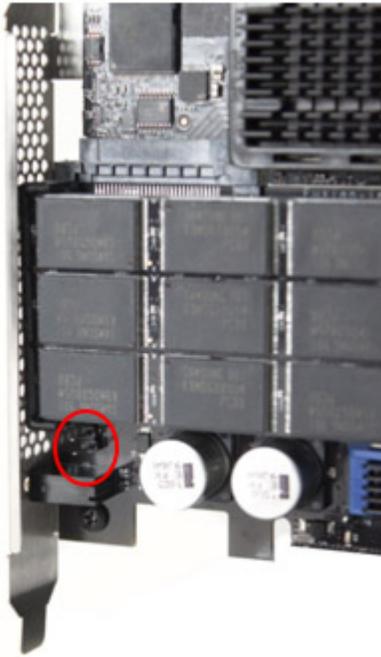
9. Your operating system may detect the device and ask if you want it to install a driver for the device. In that case, click **Cancel**.

You are now ready to install the driver and utilities software. See the IBM High IOPS Adapter user guide based on your operating system.

## External Hard Drive LED Cable (optional)

The IBM High IOPS Duo Adapter includes a two-pin LED pinout for attaching to an external HDD access light. To attach the LED,

1. Locate the two-pin pinout near the lower left corner of the The IBM High IOPS Duo Adapter, as shown in the diagram.
2. Plug in the connector.
3. Replace the computer's access panel.
4. Plug in the power cable and turn on the computer.



**NOTE** The pin closest to the PCIe connector is the positive pin.

The external LED now indicates a combination of both the reads and writes executing on the The IBM High IOPS Duo Adapter.

[Return](#) to the The IBM High IOPS Duo Adapter installation instructions.

## IBM Support

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IBM High IOPS Adapter Customer Support is available on the web at the following address:

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

IBM part number 60Y1443