IBM ioMemory VSL 4.1.0

io3 Flash Adapter Hardware Installation Guide

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IBM io3 Flash Adapter Hardware Installation Guide for ioMemory VSL 4.1.0

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 io3 Flash 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 io3 Flash Adapter**, you may substitute your particular device(s) from the *Support Devices* list located in the *IBM ioMemory VSL Release Notes*.

Software Compatibility

Compatible Software (Driver)

The ioMemory VSL software is more than just a hardware driver, it is the "secret sauce" that gives IBM io3 Flash Adapters their amazing performance. Each release of the ioMemory VSL software is compatible with certain IBM io3 Flash 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

io3 Enterprise Value Adapters

Feature Code	Option Part Number	Description	PCIe Slot Required	Controller Throttle Temp.	Controller Shutdown Temp.	NAND Board Throttle Temp.	NAND Board Shutdown Temp.
ARYK	00AE983	IBM 1250GB Enterprise Value io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYL	00AE986	IBM 1600GB Enterprise Value io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYM	00AE989	IBM 3200GB Enterprise Value io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYN	00AE992	IBM 6400GB Enterprise Value io3 Flash Adapter for Systems x	x8 slot* Full Height, Half Length	79°C	85°C	78°C	83°C

* A x8 slot is the minimum physical requirement. A Gen2 x8 slot is required for full performance.

Memory Attributes

Feature Code	NAND Type*	Total Memory	Maximum writes per device
ARYK	MLC	1250GB	4PB
ARYL	MLC	1600GB	5.5PB
ARYM	MLC	3200GB	11PB
ARYN	MLC	6400GB	22PB

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

io3 Enterprise Adapters

Feature Code	Option Part Number	Description	PCIe Slot Required	Controller Throttle Temp.	Controller Shutdown Temp.	NAND Board Throttle Temp.	NAND Board Shutdown Temp.
ARYP	00AE995	IBM 1000GB Enterprise io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYQ	00AE998	IBM 1300GB Enterprise io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYR	00JY001	IBM 2600GB Enterprise io3 Flash Adapter for Systems x	x8 slot* Low Profile	79°C	85°C	78°C	83°C
ARYS	00JY004	IBM 5200GB Enterprise io3 Flash Adapter for Systems x	x8 slot* Full Height, Half Length	79°C	85°C	78°C	83°C

* A x8 slot is the minimum physical requirement. A Gen2 x8 slot is required for full performance.

Memory Attributes

Feature Code	NAND Type*	Total Memory	Maximum writes per device
ARYP	MLC	1000GB	12PB
ARYQ	MLC	1300GB	16PB
ARYR	MLC	2600GB	32PB
ARYS	MLC	5200GB	64PB

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

In the Box

Your IBM io3 Flash Adapter comes with these items:

- IBM io3 Flash Adapter
- Quick Start Instructions

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

- Half-height bracket, used on low-profile systems or systems with low-profile PCIe slots

Hardware Requirements

Before you install your IBM io3 Flash Adapter(s) make sure your computer hardware meets these requirements.

NOTE-

For the latest IBM System x server configuration information and requirements for IBM io3 Flash Adapters, please see the URL below:

http://www.ibm.com/support/entry/portal/docdisplay?lndocid=SERV-IO3

Shipping Considerations

Shipping considerations for IBM io3 Flash Adapters are maintained at the following website:

http://www.ibm.com/support/entry/portal/docdisplay?lndocid=SERV-IO3

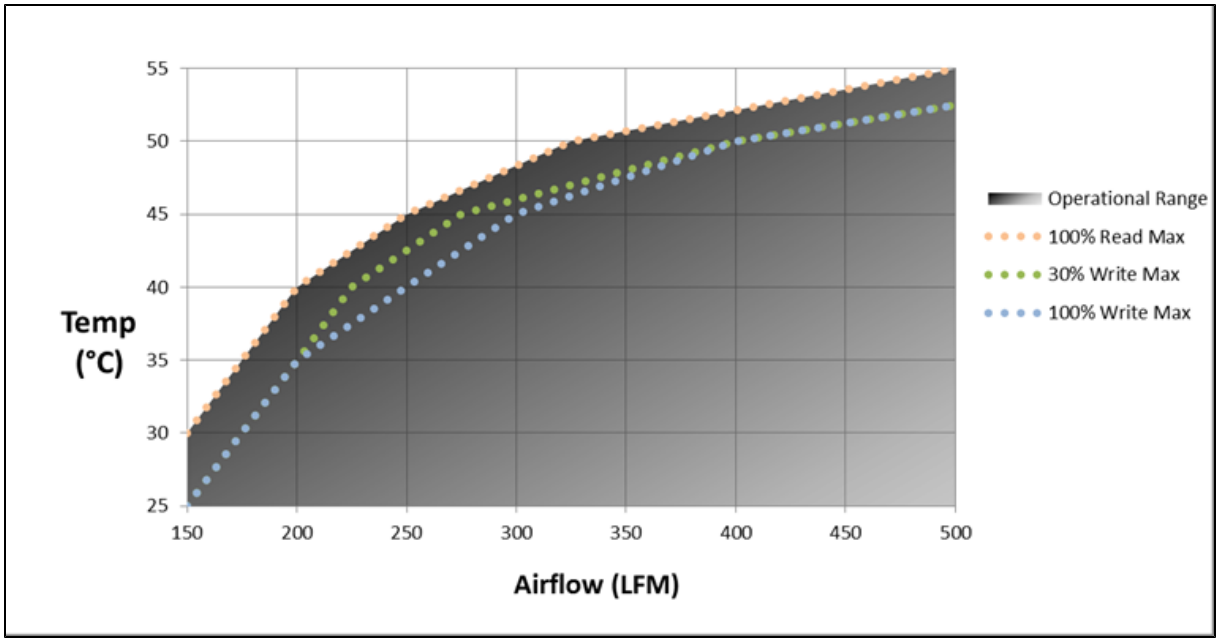
Adequate System Cooling

You must provide adequate system cooling to maximize the longevity and performance of IBM io3 Flash Adapters. System cooling is provided by both the ambient temperature as well as airflow across the devices.

The following graphs show the amount of cooling required for IBM io3 Flash Adapter depending on the physical design of the device (low profile or full-height, half-length devices).

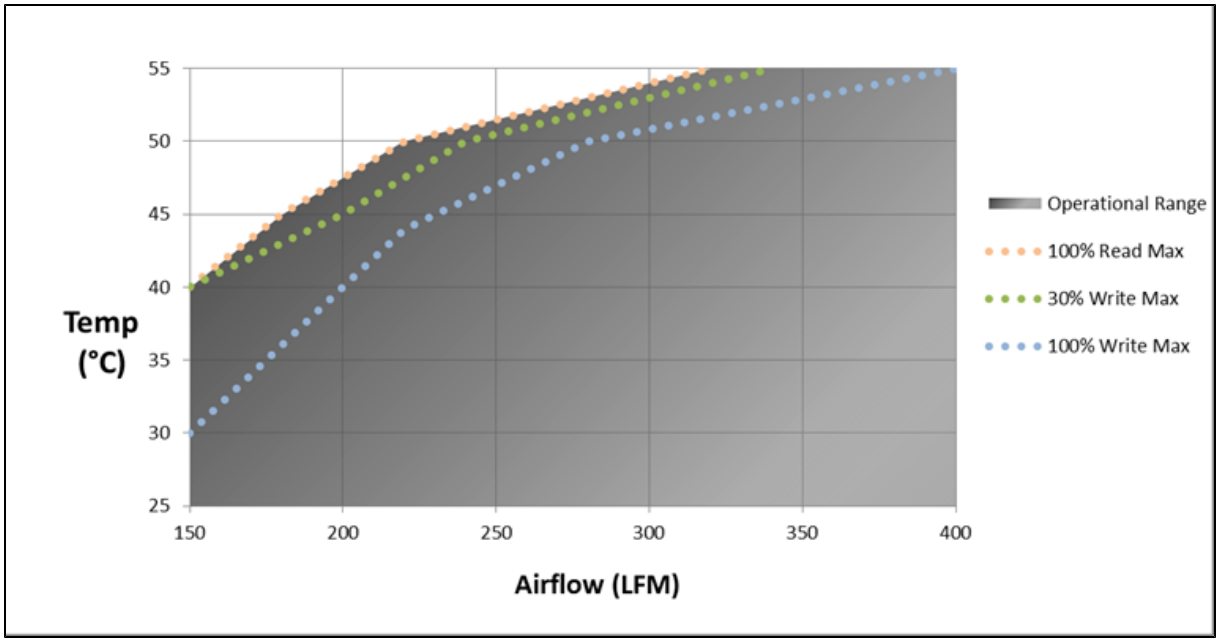
These graphs are based on tests performed in a ducted (3.13” x 3.50” cross-section) wind tunnel with generally laminar air flow (three units placed side-by-side in a ducted section, with data recorded from the center unit). Airflow and temperature profiles will vary in specific host environments. These graphs represent worst-case conditions.

Low Profile IBM io3 Flash Adapters



Where the temperature is the **ambient temperature** of the air, in °C, as it comes in contact with the device. For example, if your inlet temperature to the device was 48 °C, you would need airflow of at least 300 LFM in order to operate the device at 100% reads.

Full-height, Half-length IBM io3 Flash Adapters



Where the temperature is the **ambient temperature** of the air, in ºC, as it comes in contact with the device. For example, if your inlet temperature to the device was 48 ºC, you would need airflow of at least 220 LFM in order to operate the device at 100% reads.

Device Thermal Monitoring

In order to protect against thermal damage, all IBM io3 Flash Adapters monitor the temperature of its onboard controller chip (this is reported by the `fio-status` command-line utility as `Internal temperature`) as well as the NAND flash 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 `Controller Junction` 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 reaches a set temperature.
- If the controller or NAND temperature continues to rise, the software will shut down the device once the maximum operating temperature is reached.

The throttling and shutdown temperature may depend on the device.

To find these temperatures limits for your device, find your device in the section See IBM Adapters on page 7.

Attention!

High Performance/Power Mode

If your BIOS has a High Performance/Power Mode, enable it when using IBM io3 Flash 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 io3 Flash Adapters. IBM io3 Flash Adapters do not support ASPM.
2. Maintains higher fan speeds to prevent thermal throttling.

Adequate Power

Some IBM io3 Flash Adapters, such as io3 Enterprise Adapters, will benefit from more power than the minimum 25W provided by PCIe Gen2 x8 slots. These devices will still function properly with the minimum 25W of power, but device performance will be limited by the amount of available power.

NOTE-

io3 Enterprise Value Adapters are not designed to draw additional power.

For improved performance, you must use your io3 Enterprise Adapter(s) in a PCIe slot that provides additional power.

Automatic Power Draw

Some PCIe slots provide additional power (often up to 75W). If your slot is rated to provide more power than the standard 25W provided by PCIe Gen2 x8 slots, and the system BIOS correctly reports the power configuration of the slot, then the io3 Enterprise Adapter may draw up to 34W for short period under sustained write loads.

The ioMemory VSL software will report the additional power draw in the system logs.

Sufficient System Memory (RAM)

The ioMemory VSL software requires enough RAM to accelerate your IBM io3 Flash Adapter. The RAM requirements depend on how your operating system tracks I/O's (average written block sizes), the capacity of your IBM io3 Flash Adapters, and the version of the ioMemory VSL software.

For more information, including a chart on RAM required per GB of IBM io3 Flash 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 io3 Flash 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 *IBM ioMemory VSL Release Notes* for upgrade considerations.

Attention!

Do not downgrade the IBM io3 Flash 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.

Installing the Device

NOTE-

Please read the See Hardware Requirements on page 10 if you have not done so.

Attention!

Only Transport This Product in the IBM Provided Packaging or a Safe Shipping Configuration

We recommend saving the product box and ESD bag in case you need to store, transport, or return your device. The IBM io3 Flash Adapter product box is the safest way to store or transport your IBM io3 Flash Adapter. It is made of ESD-safe materials and protects the device from damage in shipping.

Do not transport the IBM io3 Flash Adapter without replacing it in the IBM provided packaging, unless you have ensured that the alternative mode of transportation is safe and will not damage the IBM io3 Flash Adapter. Specifically, transporting an IBM io3 Flash Adapter once it has been installed into a server or workstation (as applicable) may damage the device or interfere with its proper installation and operation. Transportation configurations should be tested carefully prior to putting the IBM io3 Flash Adapter at risk of damage. Damage to the IBM io3 Flash Adapter caused when transported within a server or workstation, transported in inadequate packaging, or resulting from general physical mishandling will void the warranty for the product.

Installation Instructions

Attention!

Electrostatic discharge (ESD) can damage electronic components. Be sure that you are properly grounded (by observing all ESD precautions, including using an ESD wrist or footstrap) before beginning any hardware installation procedure. When the device is not installed in a a server, you must store the device in the ESD bag and product box.

Attention!

Do Not Disassemble the Device

If you disassemble your IBM io3 Flash Adapter, you will void the product warranty.

These installation instructions are for any IBM IBM io3 Flash 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.

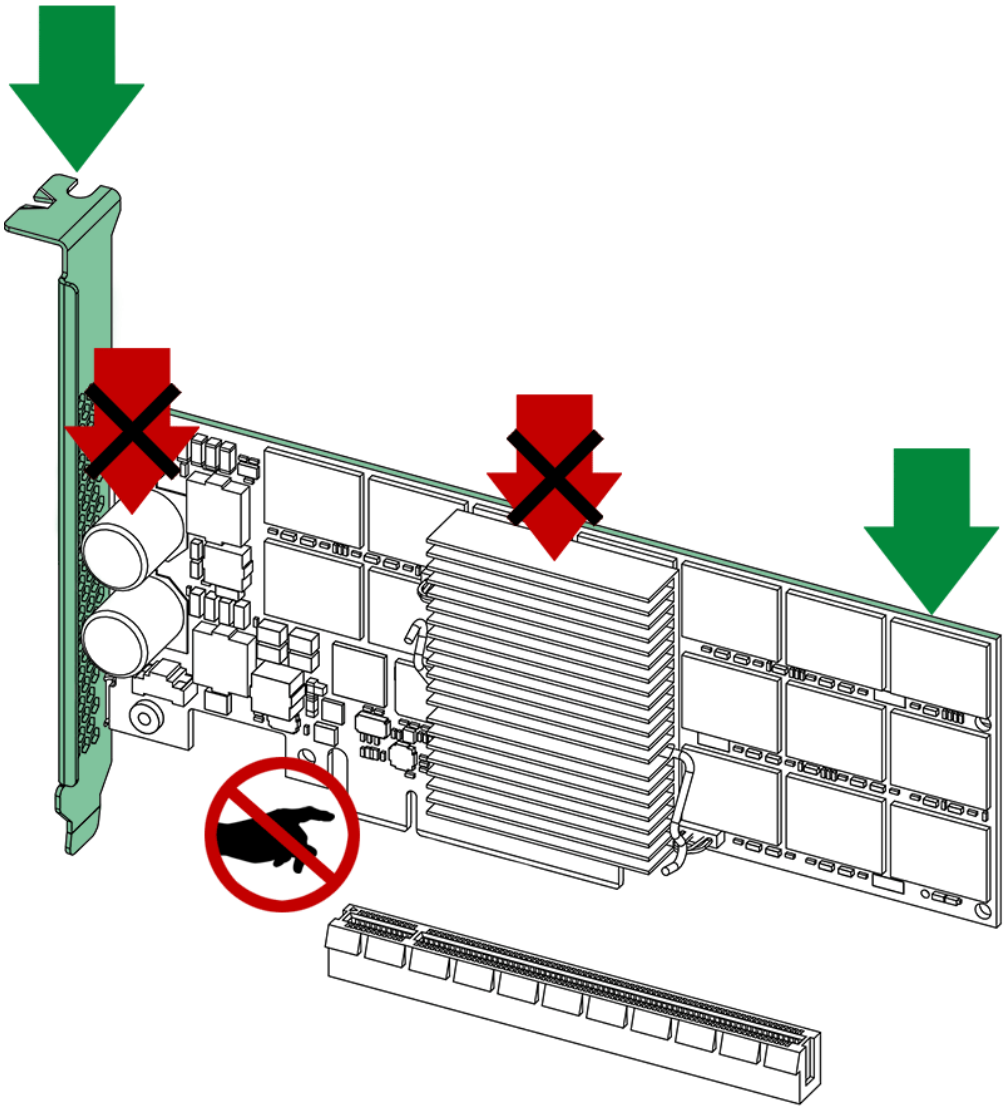
2. Turn off the computer and disconnect the power cable.
3. Remove the computer's access panel. Locate an available PCIe slot compatible with the device. See See Hardware Requirements on page 10 for PCIe slot requirements.

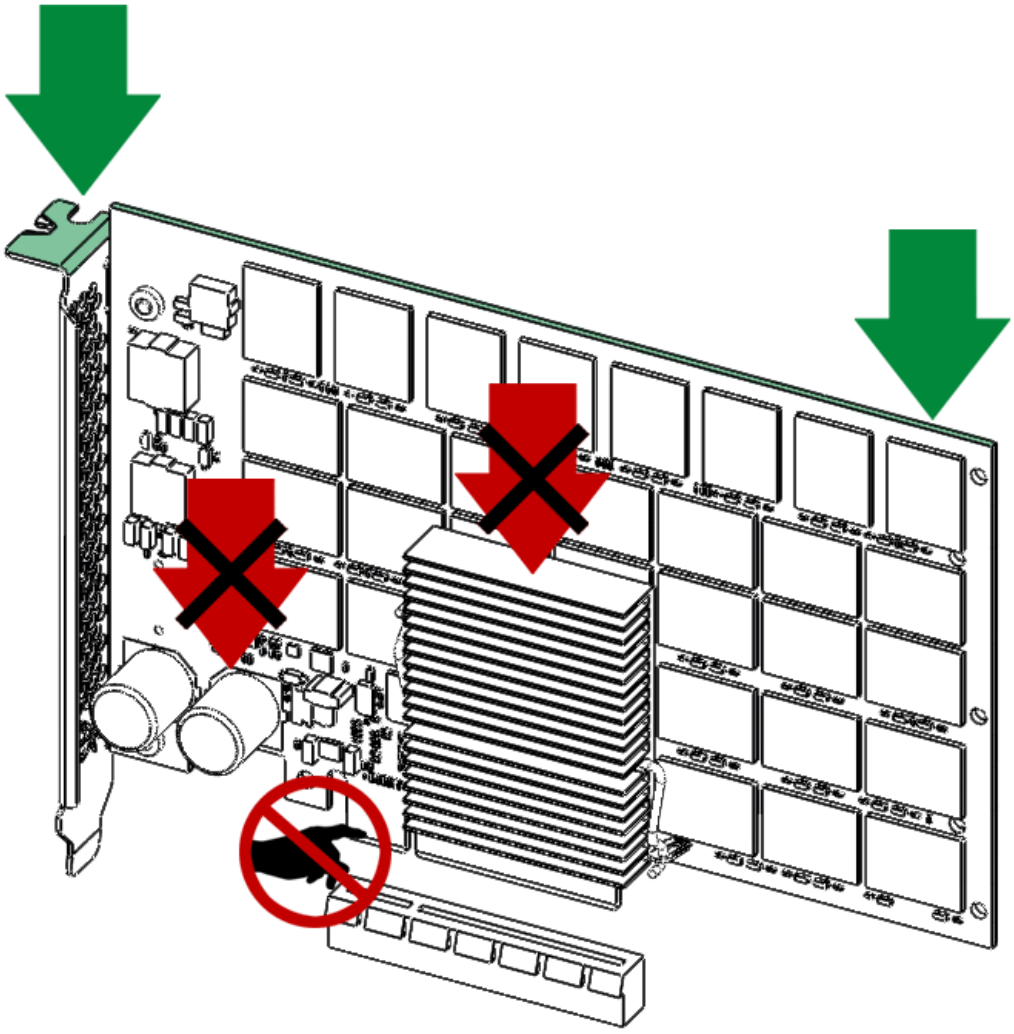
NOTE-

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, 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 See Installing the Half-Height Bracket on page 18 and then return to this section.

6. **Again, ensure you are following all ESD procedures** and grasp the IBM io3 Flash Adapter by the top edge and seat it gently but firmly in the available PCIe slot, for example:





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). Do **not** touch the gold-plated PCIe connectors.

Attention!

These illustrations are examples of of IBM io3 Flash Adapter, your specific device will install in the same manner.

7. Secure the IBM io3 Flash Adapter's retaining bracket using a screw, lever, clasp, or other method

(depending on how your hardware is configured, consult your computer's documentation).

8. Replace the computer's access panel.
9. Plug in the computer's power cable and turn on the computer.
10. Your operating system may detect the IBM io3 Flash Adapter and ask if you want it to install a hardware driver for the device. In that case, click **Cancel**.

NOTE-

Uninstalling

To remove the IBM io3 Flash 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.

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1. Locate the half-height bracket in your IBM io3 Flash 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.

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2. To prevent damage to the IBM io3 Flash Adapter, use only a Philips #1 tip screwdriver. Remove the two screws holding the full-height bracket to the IBM io3 Flash Adapter

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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.

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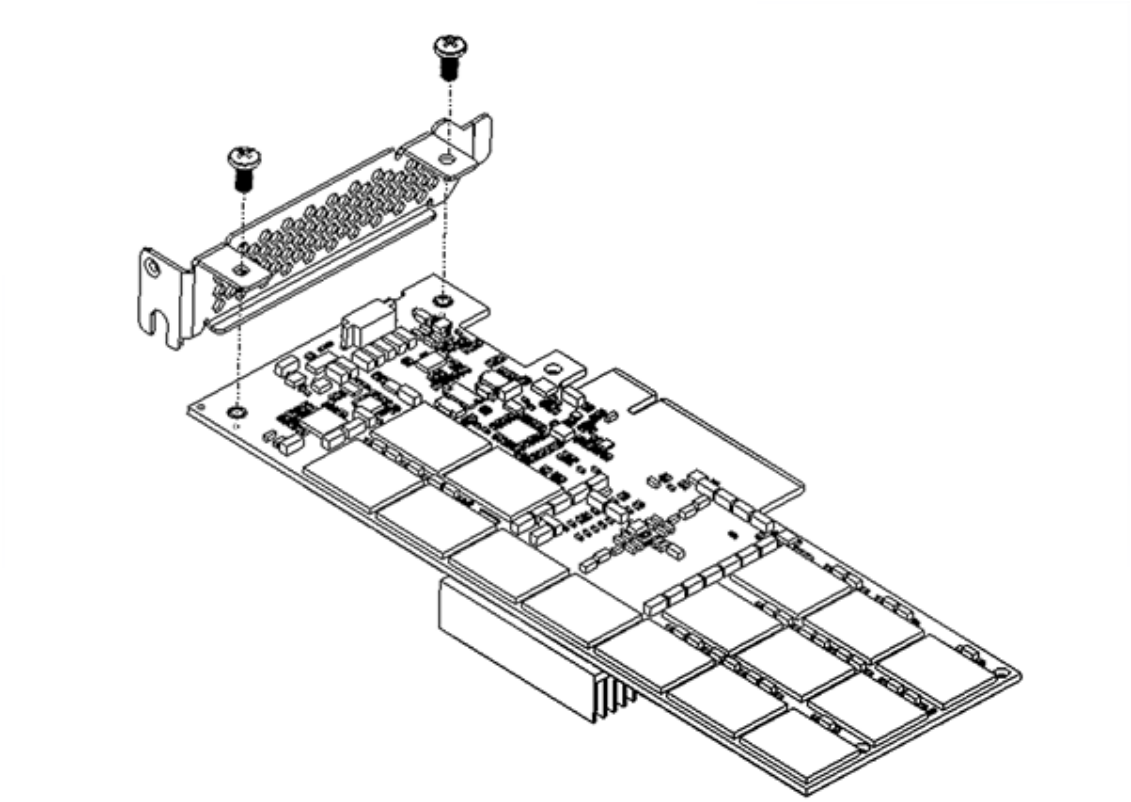
3. Remove the bracket carefully from the device.

4. Insert the bracket screw holes in the same manner as the full height bracket was inserted. Example:



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.

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6. Return to the installation instructions here to complete the install.

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 io3 Flash 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 and io3 software matrix**).