

The logo consists of the letters 'VSL' in a bold, white, sans-serif font, with a small 'TM' trademark symbol to the right. The logo is centered within a blue header area that features a dynamic, abstract background of overlapping geometric shapes and lines in various shades of blue, creating a sense of motion and technology.

Dell Fusion ioMemory VSL 3.2.15

IOMEMORY HARDWARE INSTALLATION GUIDE

Tuesday, April 11, 2017



SanDisk
a Western Digital brand



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Dell ioMemory Hardware Installation Guide for Fusion ioMemory VSL 3.2.15

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The following information boxes are used throughout the user guide to present important information:

NOTE-

Indicates a special note.

ATTENTION!

Indicates cautions to take into consideration when using the device and software.

WARNING!

Indicates warnings to take into consideration when using the device and software.

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.



CAUTION— Safety Instructions

Use the following safety guidelines to help ensure your own personal safety and to help protect your system and working environment from potential

NOTE-

For complete information on U.S. Terms and Conditions of Sale, Limited Warranties and Returns, Export Regulations, Software License Agreement, Safety, Environmental and Ergonomic Instructions, Regulatory Notices, and Recycling Information, see the Safety, Environmental and Regulatory Information (SERI), End User License Agreement (EULA), and Warranty and Support Information (WSI) that shipped with your system.

Protecting Against Electrostatic Discharge

Electrostatic discharge (ESD) events can harm electronic components inside your system. Under certain conditions, ESD may build up on your body or an object, such as a peripheral, and then discharge into another object, such as your system. To prevent ESD damage, you must discharge static electricity from your body before you interact with any of your system's internal electronic components, such as a memory module. You can protect against ESD by touching a metal grounded object (such as an unpainted metal surface on your system's I/O panel) before you interact with anything electronic. When connecting a peripheral (including handheld digital assistants) to your system, you should always ground both yourself and the peripheral before connecting it to the system. Additionally, as you work inside the system, periodically touch an I/O connector to remove any static charge your body may have accumulated.

You can also take the following steps to prevent damage from electrostatic discharge:

- When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until you are ready to install the component. Just before unwrapping the antistatic package, be sure to discharge static electricity from your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all electrostatic sensitive components in a static-safe area.

SAFETY— General

- Observe and follow service markings. Do not service any product except as explained in your user documentation. Opening or removing covers that are marked with the triangular symbol with a lightning bolt may expose you to electrical shock. Components inside the compartments must be serviced only by a trained service technician.
- If any of the following conditions occur, unplug the product from the electrical outlet, and replace the part or contact your trained service provider:
 - The power cable, extension cable, or plug is damaged.
 - An object has fallen in the product.
 - The product has been exposed to water.
 - The product has been dropped or damaged.
 - The product does not operate correctly when you follow the operating instructions.
 - Use the product only with approved equipment.



- Operate the product only from the type of external power source indicated on the electrical ratings label. If you are not sure of the type of power source required, consult your service provider or local power company.
- Handle batteries carefully. Do not disassemble, crush, puncture, short external contacts, dispose of in fire or water, or expose batteries to temperatures higher than 60° Celsius (140° Fahrenheit). Do not attempt to open or service batteries; replace batteries only with batteries designated for the product.

SAFETY— When Working Inside Your System

Before you remove the system covers, perform the following steps in the sequence indicated.

ATTENTION!

Except as expressly otherwise instructed in Dell documentation, only trained service technicians are authorized to remove the system cover and access any of the components inside the system.

NOTE-

To help avoid possible damage to the system board, wait 5 seconds after turning off the system before removing a component from the system board or disconnecting a peripheral device.

1. Turn off the system and any connected devices.
2. Disconnect your system and devices from their power sources. To reduce the potential of personal injury or shock, disconnect any telecommunication lines from the system.
3. Ground yourself by touching an unpainted metal surface on the chassis before touching anything inside the system.
4. While you work, periodically touch an unpainted metal surface on the chassis to dissipate any static electricity that might harm internal components.

In addition, take note of the following safety guidelines when appropriate:

- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs. If you are disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, when you connect a cable, make sure both connectors are correctly oriented and aligned.
- Handle components and cards with care. Do not touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a microprocessor chip by its edges, not by its pins.



Introduction

Overview

Congratulations on your purchase of a Dell | SanDisk solid-state storage device. This guide explains how to install your Fusion ioMemory device.

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

NOTE-

Throughout this manual, when you see a reference to an **Fusion ioMemory device**, you may substitute your particular device(s), such as Fusion ioMemory ioDrive2 devices or Fusion ioMemory ioDrive Duo devices.

Software Compatibility

Compatible Software (Driver)

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

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

Compatible Operating Systems

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

For more information, consult the *Dell Fusion ioMemory VSL Release Notes*.

Hardware Requirements

Before you install your Fusion ioMemory device(s) make sure your computer hardware meets these requirements.

PCIe Slot Requirements

The minimum slot requirements for your Fusion ioMemory device depends on the type of product.

ATTENTION!

Once you have installed the Fusion ioMemory VSL software, you can use the `fio-pci-check` utility on most operating systems to see if the PCIe slot meets the bandwidth requirements.



Fusion ioMemory ioDrive devices require at least:

- A PCI-Express (PCIe) Gen1 x4 slot, with at least 4 lanes that are electrically active.
- Clearance for a half-height, half-length PCI device.

Fusion ioMemory ioDrive2 devices require at least:

- A PCI-Express (PCIe) Gen2 x8 slot, with at least 4 lanes that are electrically active.
- Clearance for a half-height, half-length PCI device.

NOTE-

3.0TB Fusion ioMemory ioDrive2 devices require A minimum of a **full-height**, half-length slot.

Fusion ioMemory ioDrive Duo devices require at least:

- A PCIe Gen1 x8 slot or Gen2 x4 slot.
- A minimum of a **full-height**, half-length slot.

Fusion ioMemory ioDrive2 Duo devices require at least:

- A PCIe Gen2 x8 slot.
- A minimum of a **full-height**, half-length slot.

Adequate Power for Fusion ioMemory ioDrive2 Duo devices

Fusion ioMemory ioDrive2 Duo devices 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 Fusion ioMemory ioDrive2 Duo devices. For more information on providing additional power via a power cable, see [Installing Power Cables on page 18](#).

Products with multiple Fusion ioMemory devices, such as the Fusion ioMemory ioDrive Duo device, require more power than products with a single Fusion ioMemory device.

Fusion ioMemory ioDrive Duo devices may benefit from improved performance when additional power is provided. Fusion ioMemory ioDrive2 Duo devices, require more power than the minimum 25W provided by PCIe Gen2 slots to properly function, and therefore **must** receive additional power. Without additional power, function will be limited.

You may increase power to the device by doing one of the following:

- **Power Cable:** Connect the device to an auxiliary power source via the external power connector and the external power cable. See [Installing Power Cables on page 18](#) for more details.



NOTE-

When a power cable is used, all of the power is drawn from the cable, and no power is drawn from the PCIe slot.

- **Enabling Full Slot Power Draw:** Some PCIe slots provide additional power (often up to 75W of power). If your slot is rated to provide at least 55W, then you may allow the device to draw full power from the PCIe slot by setting a VSL module parameter. For more information on enabling this override parameter, see the **Enabling PCIe Power Override** section in the *Dell Fusion ioMemory VSL User Guide* for your operating system.
-

NOTE-

This parameter overrides the setting that prevents device(s) from drawing more than 25W from the PCIe slot. The parameter is enabled per device (using device serial numbers). Once the setting is overridden, each device may draw up to the full 55W needed for peak performance.

WARNING!**WARNING**

If the slot is not capable of providing the needed amount of power, then enabling full power draw from the PCIe slot may result in malfunction or even damage server hardware. You are responsible for any damage to equipment due to improper use of this override parameter and Dell expressly disclaims any liability for any damage arising from such improper use. Contact Customer Support if you have any questions or concerns about the override parameter use.

Before you enable this override parameter, ensure that each PCIe slot you will use is rated to provide enough power for all slots, devices, and server accessories. Refer to the **12G PowerEdge Server Slot Support Matrix** PDF located at <http://dell.fusionio.com> for information on supported 75W PCIe slots.

ATTENTION!

Refer to the matrix to determine if your slot provides 75W. The `fio-status` and `fio-pci-check` utilities may incorrectly display a 75W slot as a 25W slot.

The following are important considerations:

- If you are installing more than one dual Fusion ioMemory device, and enabling the override parameter for each device, make sure the motherboard is rated to provide 55W power to each slot used.
-

ATTENTION!

For example, some motherboards safely provide up to 75W to any one slot, but run into power constraints when multiple slots are used to provide that much power. Installing multiple devices in



this situation may also result in server hardware damage.

- The override parameter, if enabled correctly, will persist in the system, and will enable full power draw on an enabled device even if the device is removed and then placed in a different slot within the same system. If the device is placed in a slot that is not rated to provide 55W of power, then you may damage your server hardware.
- This override parameter is a setting for the Fusion ioMemory VSL software per server, and is not stored in the device. When moved to a new server, the device will default to the 25W power limit until an external power cable is added or this override parameter is enabled for that device in the new server. Consult with the manufacturer to determine the total PCIe slot power available for the new server.

Adequate System Cooling

300 LFM: To maximize the longevity and performance of Fusion ioMemory devices, 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 Fusion ioMemory devices 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 Fusion ioMemory ioDrive2 devices, 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 Fusion 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.

Devices	Controller Throttle Temp.	Controller Shutdown Temp.	NAND Board Throttle Temp.	NAND Board Shutdown Temp.
Fusion ioMemory ioDrive2 devices and Fusion ioMemory ioDrive2 Duo devices	93°C	100°C	78°C*	83°C*
Fusion ioMemory ioDrive devices and Fusion ioMemory ioDrive Duo devices	78°C	85°C	N/A	N/A

* 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.



NOTE-

If your system logs indicate write-performance throttling due to high temperatures, consult your server's documentation for details on increasing airflow within your system (for example, by increasing the fans to **maximum** speed within the system via a BIOS setting).

ATTENTION!**High Performance/Power Mode**

If your BIOS has a High Performance/Power Mode, enable it when using Fusion ioMemory devices. 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 Fusion ioMemory devices. Fusion ioMemory devices do not support ASPM.
 2. Maintains higher fan speeds to prevent thermal throttling.
-

Sufficient System Memory (RAM)

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

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

Firmware Requirements

The Fusion ioMemory device must have a certain level of firmware in order to work with particular versions of the Fusion ioMemory VSL software. Consult the *Upgrade Notes* section of <http://support.dell.com> for upgrade considerations.

WARNING!

Do not downgrade the Fusion ioMemory device 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 Fusion ioMemory device comes with these items:

- Fusion ioMemory device
- 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)

NOTE-

The external power cables are only compatible with the M610X or R910 servers. See [Installing Power Cables on page 18](#) for more information.



Installing the Device

NOTE-

Please read the [Hardware Requirements on page 7](#) if you have not done so.

WARNING!

Upgrade Previous Devices First

If you have Fusion ioMemory ioDrive devices configured for ioMemory VSL 2.x or earlier that you wish to use with Fusion 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 *Dell Fusion ioMemory VSL Release Notes* for full Upgrade Notes.

WARNING!

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

We recommend saving the product box and electrostatic discharge (ESD) bag in case you need to store, transport, or return your device. The Fusion ioMemory device product box is the safest way to store or transport your Fusion ioMemory device. It is made of ESD-safe materials and protects the device from damage in shipping.

Do not transport the Fusion ioMemory device without replacing it in the Dell provided packaging, unless you have ensured that the alternative mode of transportation is safe and will not damage the Fusion ioMemory device. Specifically, transporting a Fusion ioMemory device 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 Fusion ioMemory device at risk of damage. Damage to the Fusion ioMemory device 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 before beginning any hardware installation procedure.

ATTENTION!

Do Not Disassemble the Device

If you disassemble your Fusion ioMemory device, 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 Dell Fusion ioMemory device.



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 Fusion ioMemory VSL software is installed, the device's serial number(s) will be visible in the `fio-status` Fusion 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 7](#) 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 Fusion ioMemory device), 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 or through the PCIe slot) is required for newer products with multiple Fusion ioMemory devices.

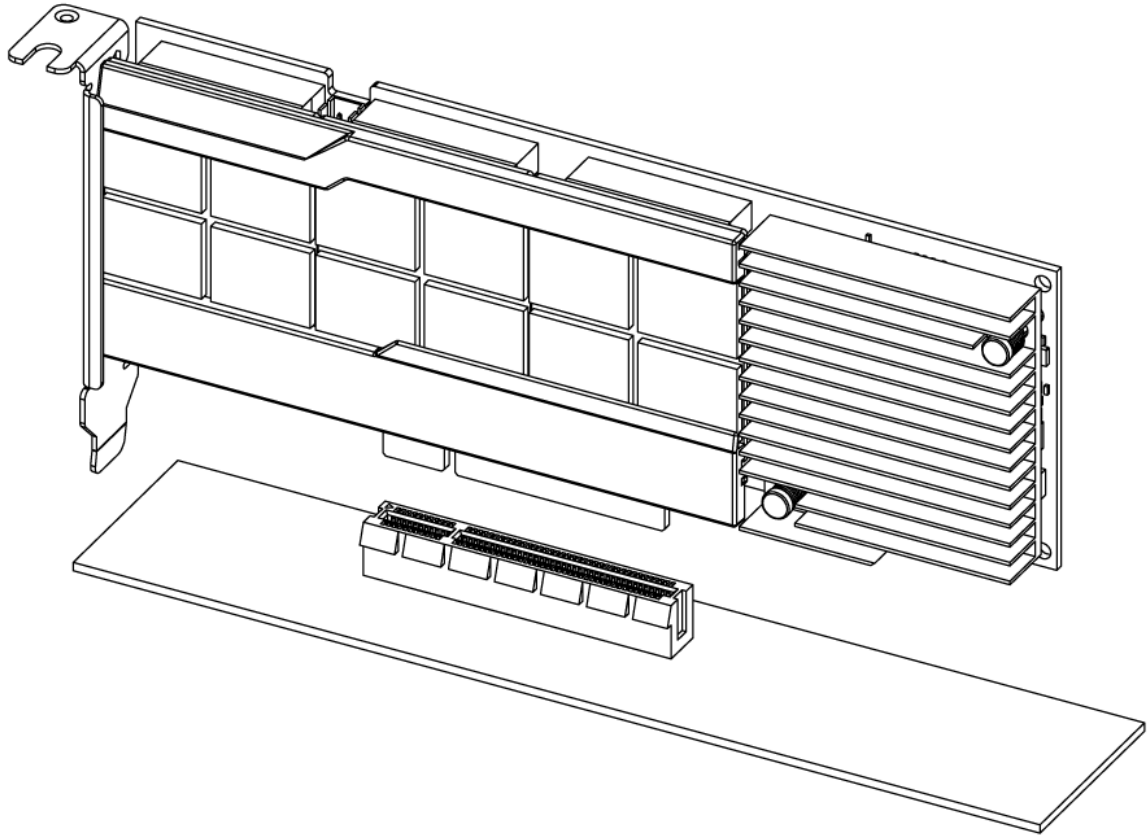
For best results, plug in the power cable. See [Installing Power Cables on page 18](#) for instructions and to see if the power cable is required for your device. For more information on using the PCIe slot to provide additional power, see [Adequate Power for Fusion ioMemory ioDrive2 Duo devices on page 8](#).

7. Grasp the Fusion ioMemory device 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 Fusion ioMemory device, 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 Fusion ioMemory device'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 Fusion ioMemory device 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 Fusion ioMemory device product box is the safest way to store and transport your Fusion ioMemory device. It is made of ESD-safe materials, and protects the device from damage in shipping.

To remove the Fusion ioMemory device, 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 *Dell Fusion 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 Fusion ioMemory device package:

ATTENTION!

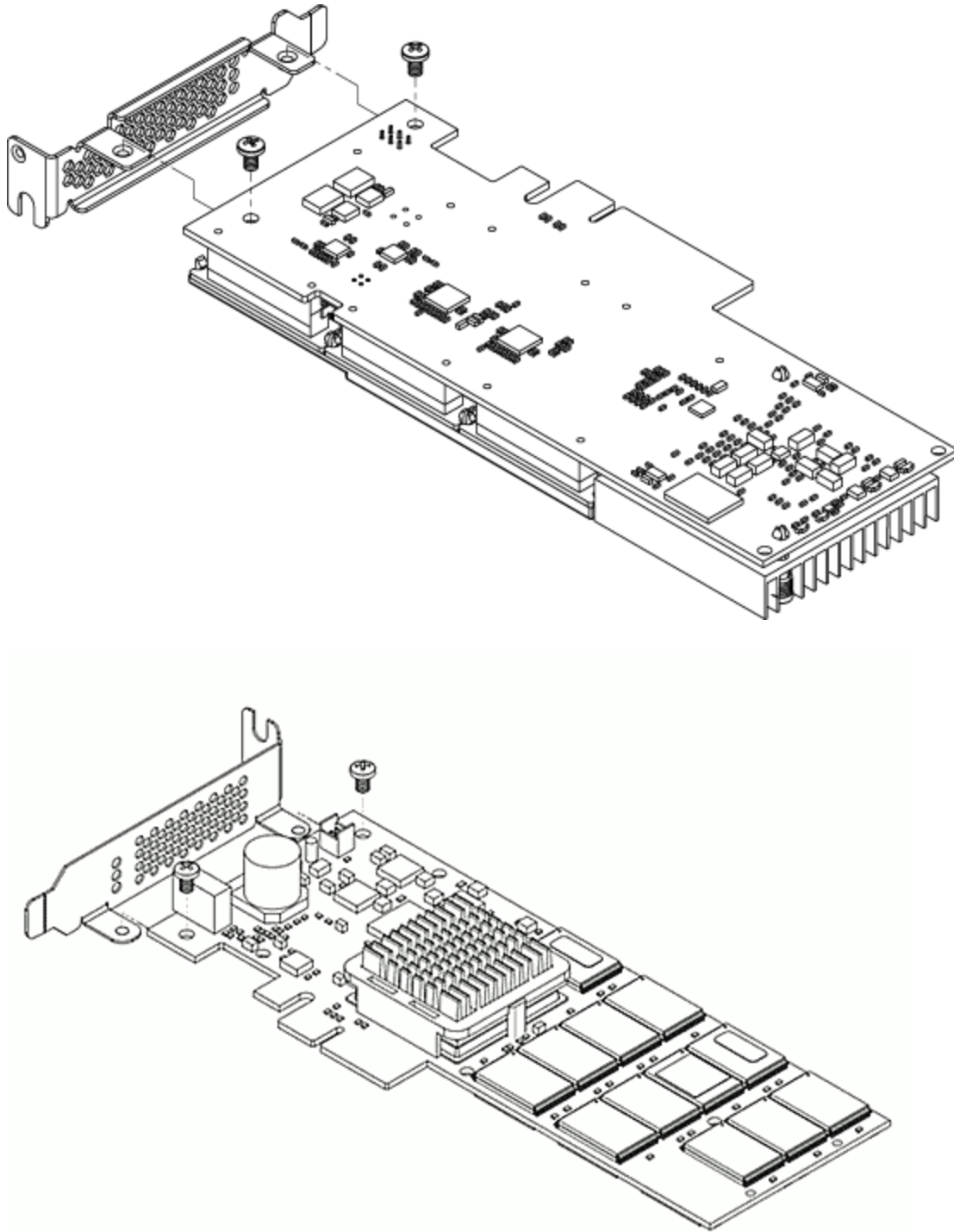
Use care in removing the retaining screws. Do not twist or pull on the bracket until both screws are out as this can cause damage to the components.

2. To prevent damage to the Fusion ioMemory device, use only a Philips #1 tip screwdriver. Remove the two screws holding the full-height bracket to the Fusion ioMemory device

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 Fusion ioMemory device 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 Fusion ioMemory devices 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. If your device came with a power cable, you should consider using it.

Peak Performance

Regardless of whether the external power cable is optional or required for your Fusion ioMemory device, the cable will ensure that the dual device has all of the power it needs to maintain peak performance (if more power is required, especially under heavy write workloads).

As a best practice, install the external power cables to ensure your device will function properly. If you wish to not install the cable(s), see the illustrations below to see if additional power is optional for your device.

If additional power (beyond the standard 25W) is required, and using the power cable is not an option, you may be able to enable full power draw from the PCIe slot. See [Adequate Power for Fusion ioMemory ioDrive2 Duo devices on page 8](#) for more information.

Installing the Cable

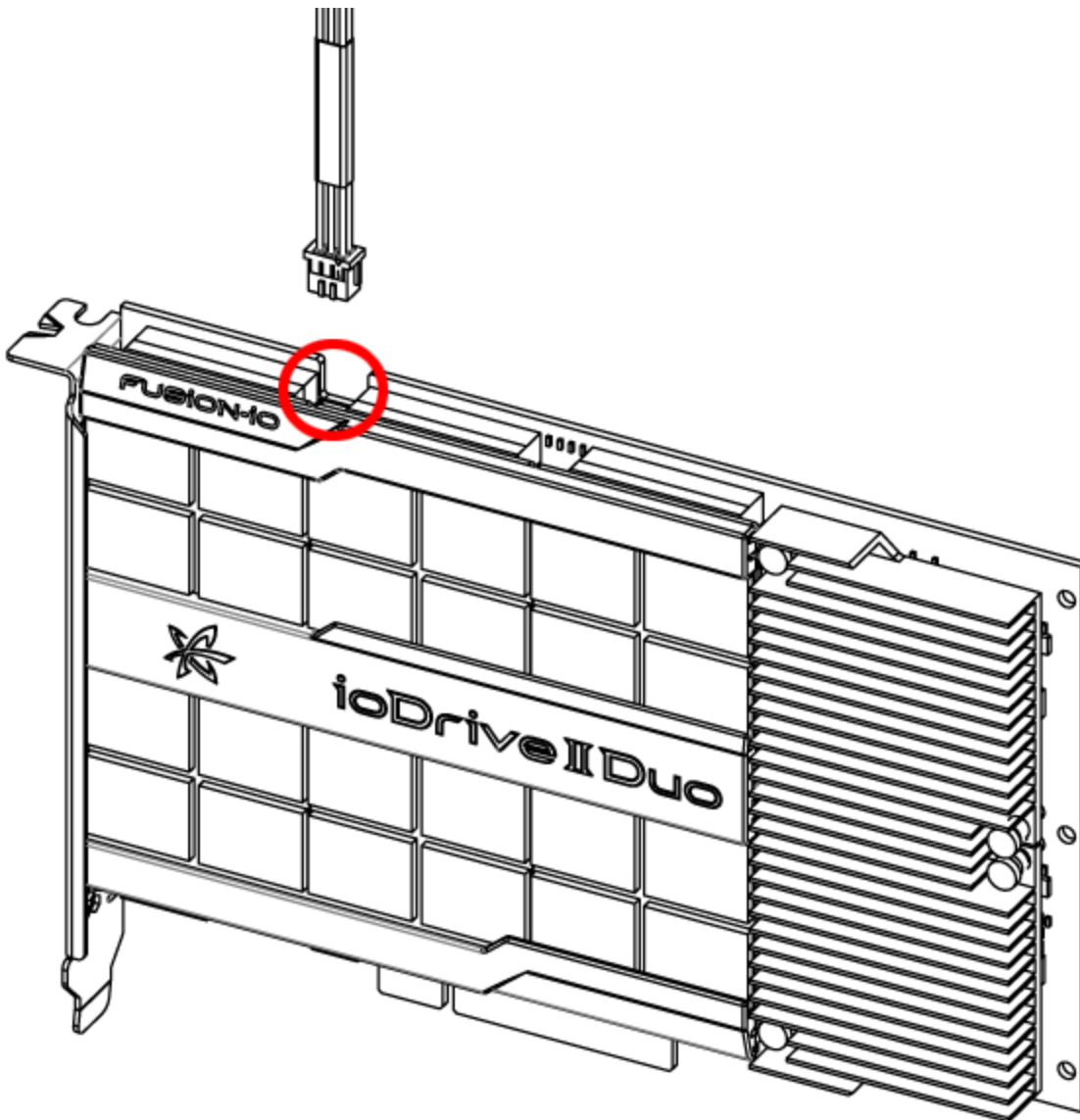
To use the external power cable, plug one end of the supplied cable into the product's power connection (circled below, refer to the example that matches your device configuration), and the other into the auxiliary power source.

Fusion ioMemory ioDrive2 Duo devices

Additional power is **required** on these devices, either through the external power cable or through the PCIe slot. 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.

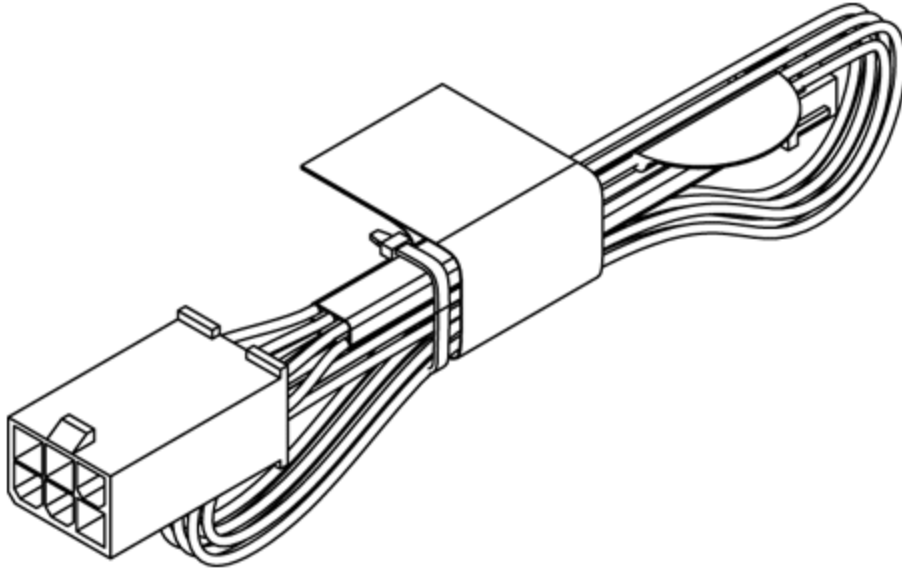


Fusion ioMemory ioDrive2 Duo devices:





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.



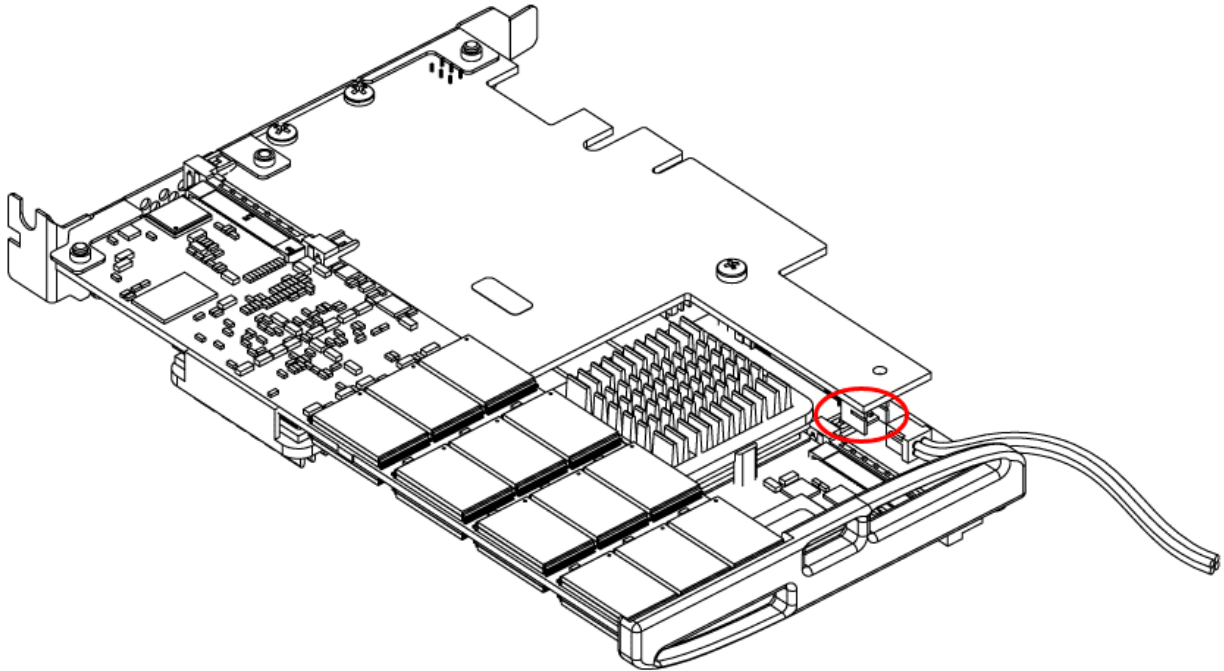
Return to the installation instructions [on page 14](#).

Previous ioDrive Devices

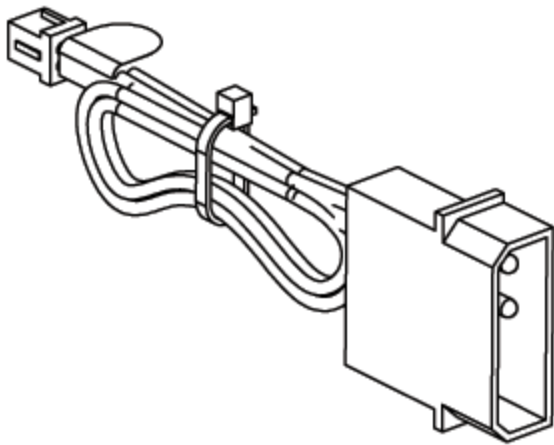
The external power cable is **optional** on the following devices (as is additional power through the PCIe slot). If the external power cable is used, the device can pull up to 36 watts from the 12V rail over the external cable. Make sure your system has sufficient power for the installed devices.



Fusion ioMemory ioDrive Duo devices:



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.



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, Dell 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).



Dell Support

Contacting Dell

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To get help with your ioDrive and ioDrive Duo, contact your Dell Technical Service representative or access the Dell Support website at <http://support.dell.com>.

Choose the method of contacting Dell that is convenient for you.

NOTE-

The safety information that shipped with your system provides important safety and regulatory information. Warranty information may be included within this document or as a separate document. To access Dell documentation, go to <http://support.dell.com/manuals>.

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