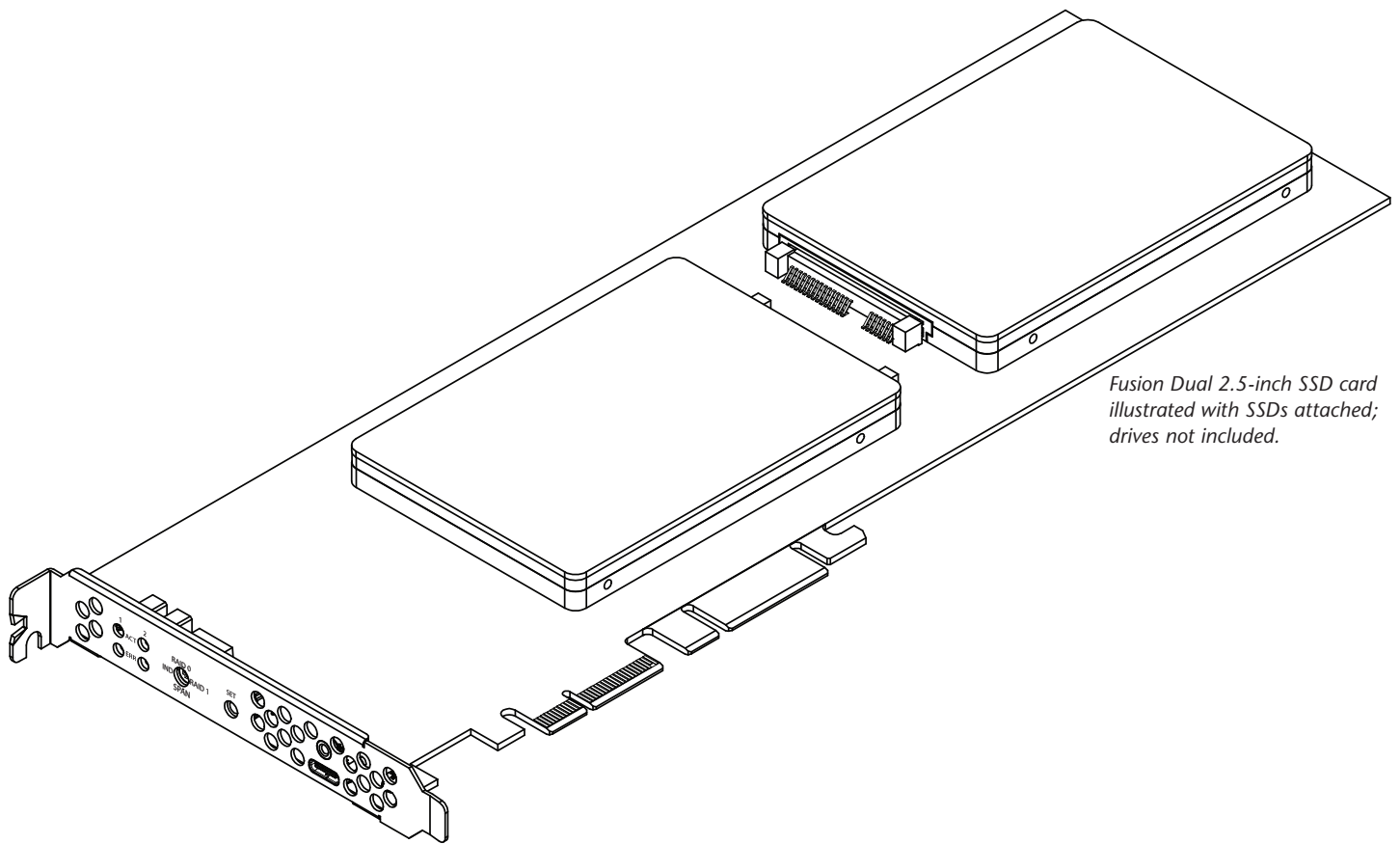# Quick Start Guide
for Fusion™ Dual 2.5-inch SSD RAID

Fusion Dual 2.5-inch SSD card illustrated with SSDs attached; drives not included.

SONNETTECH™

SERIAL ATA 6Gb/s

PCI EXPRESS®

SUPERSPEED+ CERTIFIED USB 10Gbps

Mac

For Windows

Introduction, Compatibility Information, USB Driver Information

Congratulations on your purchase! The Fusion™ Dual 2.5-inch SSD RAID card provides a handy way to install one or two 2.5-inch SATA SSDs (or HDDs) into a PCIe slot, and connect a USB device using a USB-C® cable. The built-in hardware RAID controller enables you to configure attached SSDs in RAID 0, RAID 1, Independent, and Span configurations; descriptions follow.

You Should Have
The following items should be included in your product package:
• One Fusion Dual 2.5-inch SSD RAID card
• Eight drive mount screws
• Quick Start Guide

The following items may be required for installation and setup:
• Medium Phillips screwdriver
• Small (1/8-inch or 3 mm) flat-head (–) screwdriver

Mac® Compatibility
• Mac Pro® 5,1 (Mid 2010 & Mid 2012)
• Mac Pro 7,1 (2019)*
• macOS® 10.12.6+ (macOS Monterey compatible)

Windows® Compatibility
• Computer with available full-length, full-height PCIe slot (PCIe 3.0 slot preferred)
• Windows 11, 10
• Windows Server 2019, 2016 (64-bit editions)

Linux® Compatibility
• Computer with available full-length, full-height PCIe slot (PCIe 3.0 slot preferred)
• Linux Kernel 5.4.0+
• Ubuntu 20.04.1+

Thunderbolt® Compatibility
• Mac (Intel® or M1 Max/M1 Pro/M1) computer with Thunderbolt ports via a Thunderbolt to PCIe card expansion system with available full-length PCIe slot
• Windows computer with Thunderbolt 4 or 3 ports via a Thunderbolt 3 to PCIe card expansion system with available full-length PCIe slot
• Linux computer with Thunderbolt ports via a Thunderbolt to PCIe card expansion system with available full-length PCIe slot

Supported USB Cables
• USB-C 10Gbps
• USB-C 5Gbps
• Thunderbolt 4
• Thunderbolt 3 (40Gbps); 0.5- or 0.7-meter only
• Thunderbolt 3 (20Gbps)

USB Driver Information
For Mac users, the standard drivers that enable the Fusion card to work in your computer* or Thunderbolt expansion chassis are installed as part of macOS 10.12.6 and later; the Fusion card is ready to use when you power on your computer.

For Windows users, to obtain the latest drivers that enable the Fusion card to work in your computer running supported versions of Windows, please go to www.sonnettech.com/support/kb/kb.php. Navigate to and click the Fusion Dual 2.5-inch SSD RAID link, and then click the Driver link. Locate, download, and install the appropriate drivers.

For Linux users, the drivers that enable the Fusion card to work in your computer running Linux Kernel 5.4.0+ or Ubuntu 20.04.1+ are installed automatically; the Fusion card is ready to use when you power on your computer.

> **Support Note:** This document was up to date at the time of printing. However, changes to the hardware or software may have occurred since then. Please check the Sonnet Web site for the latest documentation.
> 1. Go to www.sonnettech.com/support/kb/kb.php
> 2. Navigate to and click the Fusion Dual 2.5-inch SSD RAID link.
> 3. Click the Manual link.
> 4. Click the Fusion Dual 2.5-inch SSD RAID Quick Start Guide [English] link, and then check the Document Version information. If the version listed is later than this document (**revision J**), click the Download Now button for the latest version.

* When installed in a 2019 Mac Pro running macOS Big Sur (macOS 11) this card requires version macOS 11.3 or later; *macOS 11.1 – 11.2.2 are not compatible.*

Card Description and Package Contents
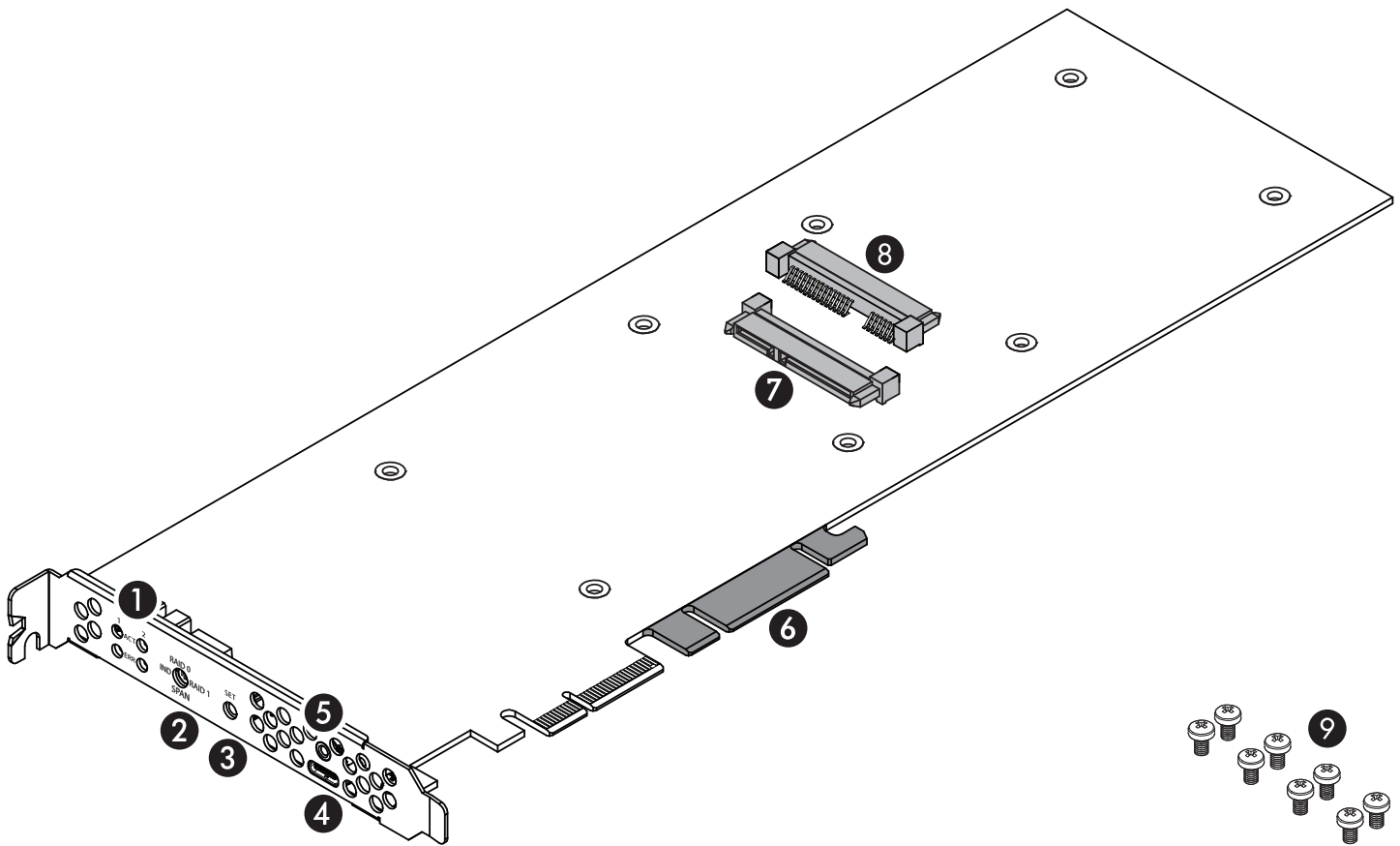
1 – Drive Activity and Error LEDs
The activity (ACT) LEDs indicate the attached drives' read and write activity. The error (ERR) LED's indicate a fault status.

2 – Drive Mode Selection Switch
Select the drive mode setting (RAID 0, RAID 1, IND [independent], Span) using this switch.

3 – Drive Configuration Set Button
This button is mounted behind the front of the PCIe bracket, and is depressed with a paper clip or small screwdriver to set the drive configuration.

4 – USB-C Port
Connect a USB device to this port.

5 – Threaded Nut for ThunderLok 3
When using a Sonnet 0.5- or 0.7-meter Thunderbolt 3 cable to attach a USB-C device, you may use a Sonnet ThunderLok 3 Thunderbolt connector retainer clip to secure the cable to the card (cables and ThunderLoks sold separately).

6 – Slot Support Tabs
In longer PCIe card slots, these tabs provide additional support for the Fusion Dual 2.5-inch SSD RAID card. In some installations, it may be necessary for you to snap off one or more of the tabs to enable the card to fit properly.

7 – Drive Connector 1
Plug in a 2.5-inch SATA SSD or hard disk drive to this connector.

8 – Drive Connector 2
Plug in a 2.5-inch SATA SSD or hard disk drive to this connector.

9 – Drive Mount Screws
Eight screws are provided to attach SSDs to the card.

SSD Installation and Card Installation Steps

Support Notes: When handling computer products, you must take care to prevent components from being damaged by static electricity. Before opening your computer or removing parts from their packages, always ground yourself first by touching a metal part of the computer, such as a port access cover, and work in an area free of static electricity; avoid carpeted areas. Handle all electronic components by their edges, and avoid touching connector traces and component pins.

1. Remove your SSDs from their packaging.

2. Place an SSD on top of the Fusion 2.5-inch SSD RAID card with the SSD's and card's connectors aligned with each other **(Figure 1)**.

3. Push the SSD's connector into the Fusion card's connector until the SSD is completely seated **(Figure 1)**.

4. Holding the SSD firmly against the card, flip the Fusion card over again.

5. Using four of the eight screws provided, secure the SSD to the Fusion card; do not overtighten the screws **(Figure 2)**.

Figure 1

Figure 2

6. Flip the Fusion card over again, and then place the second SSD on top of the card with the SSD's and card's connectors aligned with each other **(Figure 3)**.

7. Push the SSD's connector into the Fusion card's connector until the SSD is completely seated **(Figure 3)**.

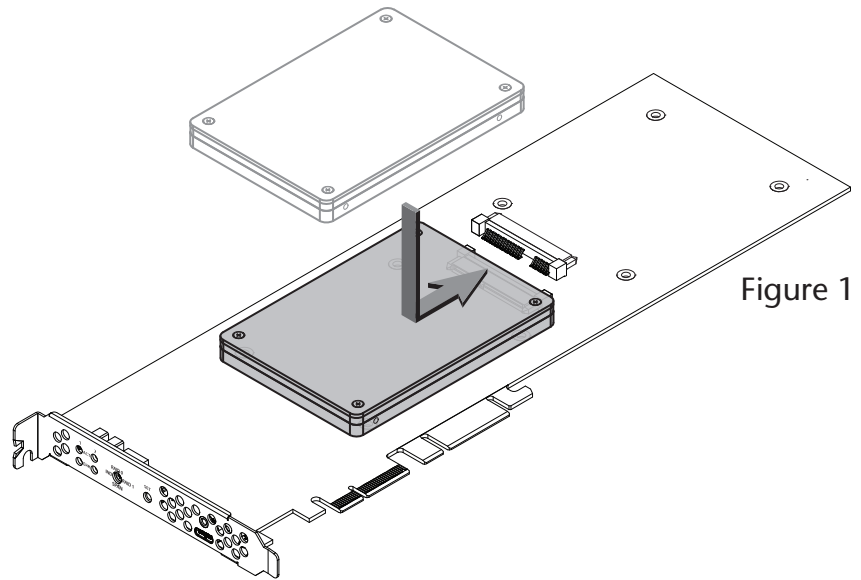**8.** Holding the SSD firmly against the card, flip the Fusion card over again.
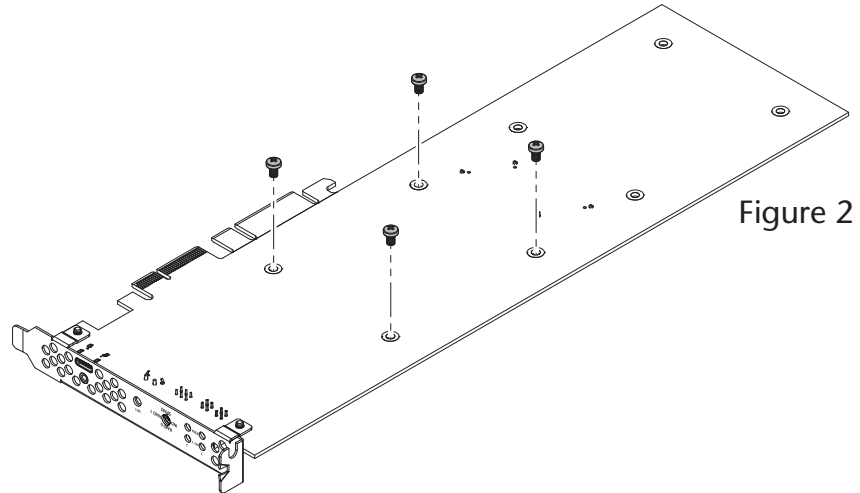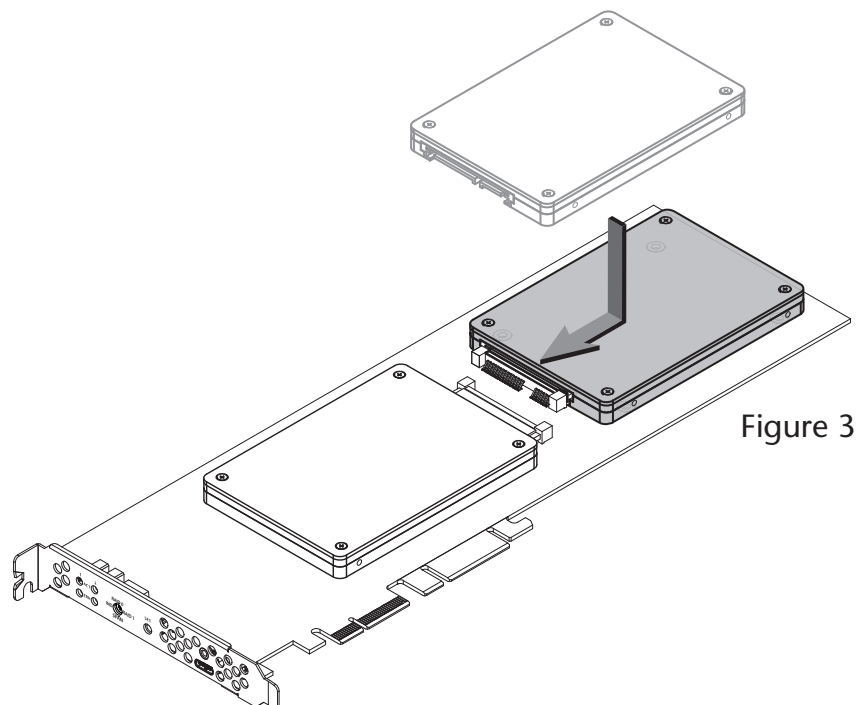

Figure 3

SSD Installation and Card Installation Steps

9. Using the remaining four screws, secure the SSD to the card; do not overtighten the screws **(Figure 4)**.

10. The Fusion Dual 2.5-inch SSD RAID card is ready for installation.

> **Support Note:** There is no need for you to change the Drive Mode Selection Switch setting prior to installing the Fusion card in your computer or Thunderbolt expansion system; you may change the switch setting after installing the card into your system.
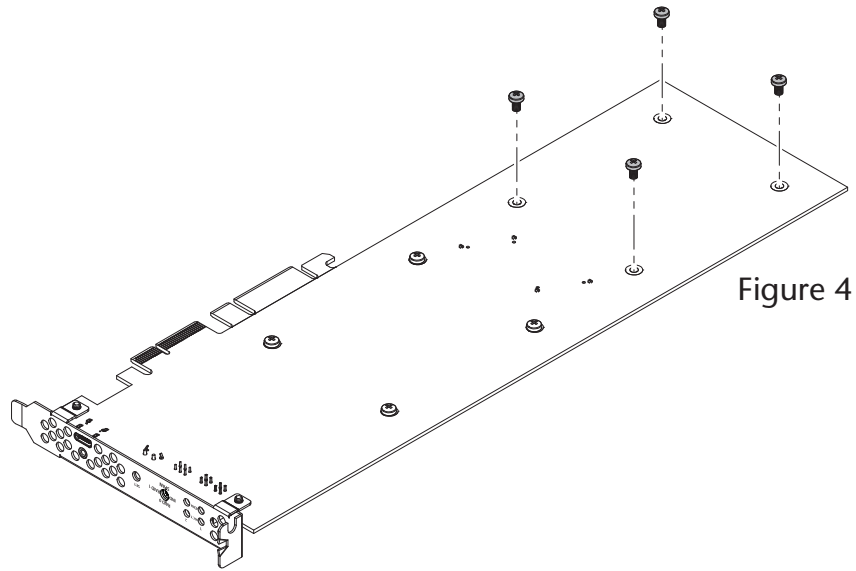
Figure 4

Card Installation Steps

1. Shut down your computer or expansion chassis, disconnect its power cable, and then open it to access the expansion card area (PCIe slots); refer to the users manual for specific information.

2. Locate an available PCIe slot and remove its access cover if necessary:

 • Mac Pro (2019) users should install the card into slot 5. Mac Pro (Mid 2012 and Mid 2010) users may install the card into any available slot.

> **Support Note:** If you have a Mac Pro 5,1 (Mid 2010 or 2012) computer, you will need to move what Apple refers to as the "PCI slider" in order to install the Sonnet card. Simply press the indicated button and then move the slider to the left **(Figure 5)**. After installing the card, move the slider back to the right.

 • Windows and Linux computer users should install the card into a PCIe 3.0 slot when available for best performance.

 • Thunderbolt expansion chassis users may install the card into any available slot.

3. Install the Fusion Dual 2.5-inch SSD RAID card with attached SSDs into the slot; **make sure the card is firmly seated and secured (use the computer's PCIe card retaining latch if present)**. If necessary, break off one or more support tabs to allow the card to be installed in your computer or expansion chassis.

4. Close your computer or expansion chassis.

5. Reconnect the computer's or expansion chassis' power cable and other cables if necessary.
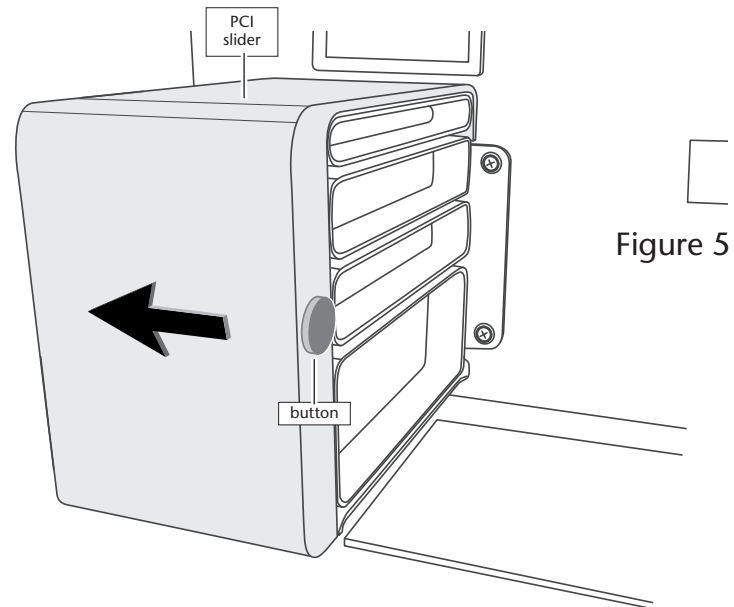
PCI slider

button

Figure 5

Drive Mode Configuration Steps

When you first turn on your system after installing the Fusion card, select a mode to configure the attached drives before using your operating system to format and prepare them for use.

> ⚠ **WARNING:** Configuring the drives attached to your Fusion card results in them having to be reformatted. **Reformatting the drives will erase any data on them!** If there is any data on them, back it up first before configuring the drives attached to the Fusion card.

1. Using a small flat-head (-) screwdriver, turn the Drive Mode Selection switch to select a mode **(Figure 5)**:

- **RAID 0**: Striping, No Redundancy
  RAID 0 (striping) is best used by applications requiring high performance for non-critical data, with increased performance achieved by simultaneously accessing data across both drives. This increases data transfer rates while reducing average access time by overlapping drive seeks; drives are accessed alternately, as if stacked one on top of the other. **RAID 0 provides no data protection**, but offers the full capacity of the drives. **If one drive fails, all data within that set is lost**.

- **RAID 1**: Mirror of Two Drives
  RAID 1 ensures security by writing the exact same data simultaneously to both drives. Should one drive fail, the data is accessible on the remaining good drive. RAID 1 offers the capacity of one drive.

- **Span**: Concatenation, Volume Spans Both Drives
  Span mode creates a single, large volume that spans both drives, writing files to the capacity of the first drive, and then to the second drive. **Span mode provides no data protection**. Span formatting offers the full capacity of the two drives.

- **IND**: Independent
  IND configuration enables both drives to be available for normal storage operations and accessed individually. IND mode provides no data protection. IND offers the full capacity of each drive.

2. Press and hold the Set button for six seconds (until the ACT and ERR LEDs flash), and then release it; drive configuration is complete **(Figure 5)**. You may now format the drives using your computer's operating system drive formatting application.
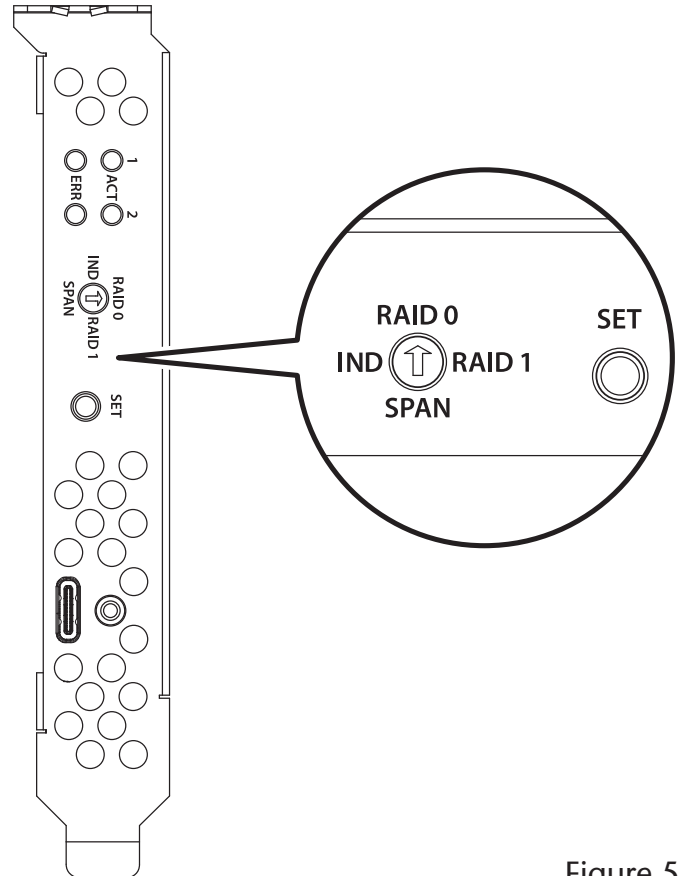
Figure 5

SSD Formatting and Operation, USB, and Support Information

Formatting SSDs

> ☎ **Support Note:** SSDs attached to the Fusion Dual 2.5-inch SSD RAID card appear to operating systems as external drives. Under macOS, they are identified as USB drives; under Windows, they are identified as SCSI drives.

macOS:
Use Disk Utility (found in the Utilities folder within the Applications folder) to format installed SSDs.

Windows:
To format installed SSDs using Disk Management, you may locate instructions by typing "initialize disk" in Windows Help.

Linux
Use the tools or utilities you would normally use to format internal drives.

Booting From Attached SSDs?

The Fusion Dual 2.5-inch SSD RAID card does not support booting from attached SSDs.

Detecting and Replacing a Failed SSD in RAID 1 (Mirror) Mode

A red ERR light will flash when an SSD has failed. If the top ERR LED (1) flashes, the SSD in connector J2 (nearer to the PCIe bracket) needs to be replaced. It the bottom ERR LED (2) flashes, the SSD in connector J1 (farther from the PCIe bracket) needs to be replaced.

1. Shut down and remove card from your system.

2. Remove the faulted SSD and replace it with a new SSD. The new SSD's capacity must be equal to or greater than that of the original SSD. The rebuild process will wipe out any data on the replacement SSD.

3. Plug the card into your computer and boot.

4. The RAID volume will rebuild automatically. While the RAID is rebuilding, the green ACT LEDs of both SSDs will flash and the red ERR LED of the new drive will stay lit. It may take several hours to rebuild a RAID 1 array (a rule of thumb is an hour per TB). *Do not shut down or sleep your computer during the rebuild process.*

5. When the process is complete, the red ERR light will go out and both ACT LEDs will turn solid green, reverting to flashing only when the SSDs are being accessed.

USB-C Port Power

The Fusion card's USB-C port supports USB-C bus-powered SSD, SSD RAID, and hard drive devices with up to 15W (3.0A) power.

Known Limitations for Mac Users

• macOS 10.12.6 erroneously reports a 5Gbps connection when connected at 10Gbps. macOS 10.13+ reports connections correctly.

• macOS includes a power-saving specification which causes power to be removed from PCIe cards during sleep. As a result, SSDs connected internally (and bus-powered storage devices connected externally) to this card lose power when the computer is put to sleep. This power loss causes the connected SSDs and storage devices to disconnect upon wake from sleep, and macOS to display a Disk Not Ejected Properly message. But, because macOS flushes all caches before entering sleep, these disconnects should never result in any loss of data. After wake from sleep, the connected storage devices will automatically remount.

• When this card is installed in a 2019 Mac Pro, the cables, adapters and thumbdrives you can connect to the USB-C port are limited to those with connector overmolds (the non-metal part of the USB connector) no thicker than 6.5 mm. Due to its non-conventional PCIe backplate opening, the 2019 Mac Pro prevents connectors with larger overmolds from fully connecting to the port on the Sonnet card.

6.5mm max
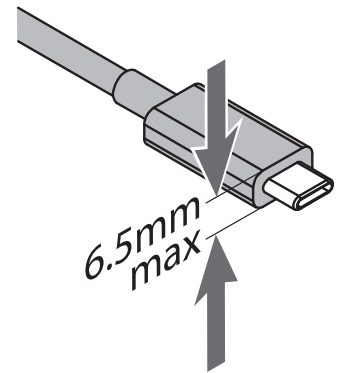
• There is no provision in macOS to make SSDs installed on a PCIe card to appear as internal and non-ejectable. If you want to prevent accidental ejection, open a file on the volume with Text Edit. Doing so will prevent macOS from ejecting the volume because the file will be in use.

Known Limitations and Advice—All Users

USB peripherals have some limitations you should be aware of, and we have listed some additional advice here. Refer to the peripheral manufacturers' Web sites for more information.

• Most USB 3.2 (formerly 3.1) devices come in two varieties, Gen 1, and Gen 2. Gen 1 devices support data transfer speeds up to 5Gbps, while Gen 2 devices (such as this Sonnet adapter card) support data transfer speeds up to 10Gbps.

• The use of USB-C to USB-A cables is supported, but data transfer speeds are limited to speeds supported by the cable and device.

• The Fusion card's USB-C port does not support Thunderbolt 3 only peripheral devices, even though they use the same connector. If the peripheral device only has the Thunderbolt icon (⚡) next to its port(s), or on the connector of an attached cable, it will not work with the Sonnet card.

Support Information

Known Limitations and Advice—All Users (continued)

• Many peripherals require additional drivers and application software to operate or have full functionality. Software should be included with the device, or available to download from the manufacturer's Web site. Check the peripheral's user's manual for information about necessary software.

• If you have connected a card reader to the Fusion card's USB-C port, always "eject" any memory card from the operating system before removing it from the card reader, or disconnecting the reader (with the card inserted in it) from its cable or the Sonnet card.

• While your computer is on, always "eject", "stop", "unplug", or "put away" any drive (hard drive, SSD, etc.) before disconnecting it from its cable or the Sonnet card's USB-C port.

• Disconnecting storage devices while they are transferring or receiving data, may result in damage to the file(s) being transferred or cause your system to hang.

• Although many peripherals may draw power directly from the Sonnet card, other devices require an external power source. Remember to use external power supplies when necessary.

• 1-meter or longer Thunderbolt 3 (40Gbps) cables DO NOT support USB 3.2 Gen 1 (formerly USB 3.0 & 3.1 Gen 1) by design, only Thunderbolt 3 & USB 2.0.

Contacting Customer Service

The Sonnet Web site located at www.sonnettech.com has the most current support information and technical updates. Before contacting Customer Service, please check our Web site for the latest updates and online support files, and check this Quick Start Guide for helpful information.

Email support requests generally receive the fastest responses, and are usually processed within a 24-hour period during normal business hours, excluding holidays. When you contact Customer Service, have the following information available so the customer service staff can better assist you:

• Product name
• SSD model(s)
• Computer model
• OS version
• A System Report (macOS), or a Microsoft System Information MSINFO32 (Windows) report (Windows), along with a description of the issue(s) you are encountering with your device

If further assistance is needed, please contact **Sonnet Customer Service** at:
E-mail: support@sonnettech.com
Tel: 1-949-472-2772
(Monday–Friday, 9 a.m.–5 p.m. Pacific Time, excluding holidays)

Japan Customers
Contact Sonnet Customer Service Japan at:
E-mail: jp.support@sonnettech.com