



User Guide

Seagate[®] Nytro[®] WarpDrive[®] and Nytro XP6000 Flash Accelerator Cards

NWD-WLP4-200
NWD-WLP4-400
NWD-BLP4-400
NWD-BLP4-800
NWD-BLP4-1600
XP6209-4A1024
XP6209-4B2048
XP6210-4A2048
XP6210-4B2048
NWD-BFH6-1200
NWD-BFH8-1600
NWD-BFH8-3200

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December 2017

Revision History

Version and Date	Description of Changes
Version 1.12, December 2017	Added Section 3.6, Safety, Standards, and Compliance . For a comprehensive list of changes to this document, see Revision History on page 34.

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Seagate Technology Support Services

For information regarding online support and services, visit: <http://www.seagate.com/support/by-product/ssd-and-pcie-flash/>

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Chapter 1: Introduction

1.1 Overview

The Seagate® Nytro® WarpDrive® Acceleration Application cards are block storage devices. The cards present themselves to the operating system through a Fusion-MPT™ interface as single or multiple drives that require minimal user configuration. You can use these cards for either nonpersistent (for example, cache) or persistent (for example, database files) data.

The Nytro WarpDrive cards have Flash ROM for storing the BIOS and firmware, and NVRAM for storing nonvolatile user data. The cards have three LEDs on the PCI bracket to indicate activity, drive life, and status. The Nytro WarpDrive cards have a PCI Express® (PCIe®) interface that complies with the *PCI Express Specification 2.0* or *PCI Express Specification 3.0*.

The functionality of the Nytro WarpDrive cards comes from a SAS2008 or SAS2308 I/O controller with Nytro WarpDrive firmware that runs on the internal processor..

1.2 Related Documents

Refer to the following documents for more information on the Nytro WarpDrive card and related tools.

- *Seagate® Nytro® WarpDrive® and Nytro XP6000 Application Acceleration Card r112.00.51.00 Release Notes*
- *Seagate® Nytro® WarpDrive® Application Acceleration Card Management Utility User Guide*
- *Seagate® Nytro® WarpDrive® 6203 Application Acceleration Card Quick Installation Guide*
- *Seagate® Nytro® XP6209 Application Acceleration Card User Guide*
- *Seagate® Nytro® XP6209 Application Acceleration Card Quick Installation Guide*
- *Seagate® Nytro® XP6210 Application Acceleration Card Quick Installation Guide*
- *Seagate® Nytro® WarpDrive® 6301 Application Acceleration Card Quick Installation Guide*

1.3 Features

This section lists the features of the Nytro WarpDrive and Nytro XP6000 cards.

- Proven enterprise firmware stack
- Best-in-class read and write performance
- Average latency of less than 50 ms
- Low host burden – No static CPU and memory overhead
- Support for Windows®, Linux® VMware®, and FreeBSD® operating systems
- Bootable
- PCIe 2.0, x8 (for the Nytro WarpDrive 6203, Nytro XP6209, and Nytro XP6210 cards)
- PCIe 3.0 x 8 (for the Nytro WarpDrive 6301 card)
- Profile and form factor varies
- PCIe standard or low-profile bracket
- LEDs for data activity, drive life, and drive status
- High reliability with block-level, page-level, and die-level failure protection

1.4 Nytro WarpDrive and Nytro XP6000 Card Characteristics Summary

The Nytro WarpDrive and Nytro XP6000 cards contain Flash ROM for storing the BIOS and firmware. Three LEDs are located on the PCI bracket to indicate activity, drive life, and status.

The following table shows the characteristics of each Nytro WarpDrive and Nytro XP6000 card model.

Table 1 Nytro WarpDrive Card and Nytro XP6000 Characteristics Summary

Device Name	Model Name	Capacity	Connector	Flash Controller	NAND Type	Card Style	Controller
Nytro WarpDrive 6203	NWD-WLP4-200	200 GB	X8 PCIe 2.0	SF2582	SLC (single-level cell)	HHHL (Half-Height Half-Length)	SAS2008
Nytro WarpDrive 6203	NWD-WLP4-400	400 GB	X8 PCIe 2.0	SF2582	SLC	HHHL	SAS2008
Nytro WarpDrive 6203	NWD-BLP4-400	400 GB	X8 PCIe 2.0	SF2582	MLC (multi-level cell)	HHHL	SAS2008
Nytro WarpDrive 6203	NWD-BLP4-800	800 GB	X8 PCIe 2.0	SF2582	MLC	HHHL	SAS2008
Nytro WarpDrive 6203	NWD-BLP4-1600	1600 GB	X8 PCIe 2.0	SF2582	MLC	HHHL	SAS2008
Nytro XP6209	XP6209-4A1024	930 GB	X8 PCIe 2.0	SF2582	MLC	HHHL	SAS2008
Nytro XP6209	XP6209-4B2048	1796 GB	X8 PCIe 2.0	SF2582	MLC	HHHL	SAS2008
Nytro XP6210	XP6210-4A2048	1860 GB	X8 PCIe 2.0	SF 2582	MLC	Full Height Half Length (FHHL)	SAS2008
Nytro XP6210	XP6210-4B2048	1860 GB	X8 PCIe 2.0	SF 2582	MLC	FHHL	SAS2008
Nytro WarpDrive 6301	NWD-BFH6-1200	1200 GB	X8 PCIe 3.0	SF2582	MLC	FHHL	SAS2308
Nytro WarpDrive 6301	NWD-BFH8-1600	1600 GB	X8 PCIe 3.0	SF2582	MLC	FHHL	SAS2308
Nytro WarpDrive 6301	NWD-BFH8-3200	3200 GB	X8 PCIe 3.0	SF2582	MLC	FHHL	SAS2308

Chapter 2: Installation

2.1 Quick Installation Instructions

You can use the quick installation instructions to install your Nytro WarpDrive card, or you can see the next section if you need more detailed installation instructions.

To quickly install your Nytro WarpDrive card, follow these instructions.

1. Unpack the Nytro WarpDrive card and inspect it for damage.
2. Turn off the server, and remove the power cord.
3. Remove the cover from the server.
4. Insert the card in an available PCIe slot.
5. Secure the bracket to the system's chassis.
6. Replace the cover and the power cord, then turn on the server.

The Nytro WarpDrive card hardware installation is complete.

2.2 Hardware Installation Instructions

2.2.1 Card Retention, Shipping, and the PCIe Specification

The PCIe specification requires that add-in cards with a mass of greater than 350 grams must have additional card retention at the server level. Neither the connector nor the optional *hockey stick* feature described in the PCIe specification provides the required retention.

Server OEMs and ODMs are solely responsible for choosing and qualifying their own server and rack shipping solution. Seagate does not qualify the server and rack shipping solution and is not responsible for such solution or any impact to Seagate products.

Seagate will make available mechanical design collateral for its products, which may be used by server OEMs and ODMs to design retention features for their server products. Seagate information is provided AS IS only and Seagate does not certify any design retention features used by OEMs and ODMs.

Seagate does not perform server and rack shock and vibration testing of OEM and ODM products. OEMs and ODMs are solely responsible for any server and rack shock and vibration testing.

2.2.2 Hardware Installation for the Nytro WarpDrive 6203, Nytro XP6209, Nytro XP6210 Cards

1. **Unpack the Nytro WarpDrive card and inspect it for damage.** Unpack the card in a static-free environment and follow good antistatic grounding procedures. Remove the Nytro WarpDrive card from the antistatic bag, and carefully inspect it for damage. If you notice any damage, contact Seagate, or your reseller support representative.

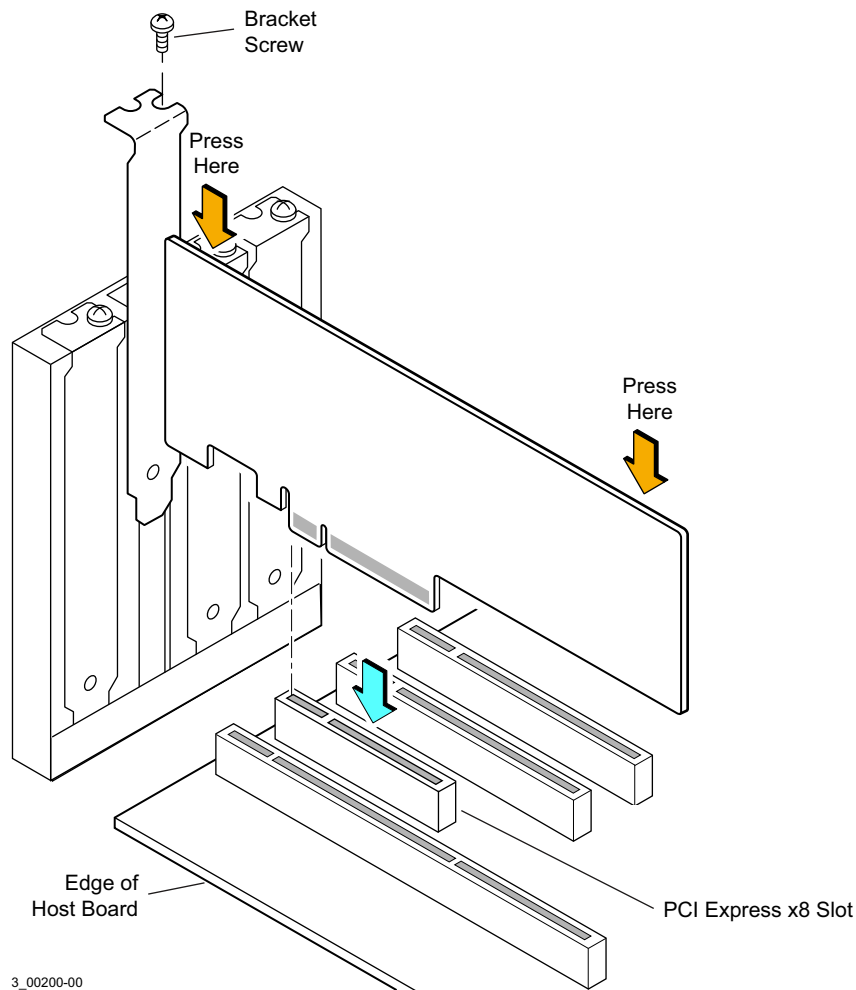
NOTE Back up your data before changing your system configuration.

2. **Prepare the computer.** Turn off the server, and disconnect the power cords from the power supply. Remove the cover from the chassis.

WARNING To avoid electrical shock, disconnect the server from the main power and from any networks before you install the card.

3. **Replace the PCI mounting bracket (system dependent).** If required for your system, replace the shorter PCI mounting bracket that ships on the Nytro WarpDrive card with the full-height bracket supplied. Save the two screws from the short bracket and use the screws to attach the full-height bracket.
4. **Insert the Nytro WarpDrive card in an available PCIe slot.** Locate an empty PCIe slot. Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot. Save the bracket screw, if applicable. Align the card to the PCIe slot. Press down gently, but firmly, to properly seat the card in the slot. The following figure shows how to insert the card in a PCIe slot.

Figure 1 Card Installation for the Nytro WarpDrive 6203, Nytro XP6209, and the Nytro XP6210 Cards



NOTE

The shape, size, and locations of components on your Nytro WarpDrive card might vary from this illustration.

5. For highest performance, make sure that the PCIe slot is PCIe 2.0 and make sure that it has an active width of dedicated eight lanes. The Nytro WarpDrive card functions with an active width of four lanes or two lanes, but with reduced performance.

CAUTION

The location must meet the 300 LFM (linear feet/minute) minimum airflow requirement.

6. **Secure the bracket to the system's chassis.** Install the bracket screw, if applicable, or engage the system retention mechanism to secure the card to the system's chassis.

7. **Replace the cover, reconnect the power cords, and power up the system.** Replace the server's cover, reconnect the power cords, and reconnect any network cables. Turn on the power.

The Nytro WarpDrive card hardware installation is complete.

2.2.3 Hardware Installation for the Nytro WarpDrive 6301 Card

1. **Unpack the Nytro WarpDrive card and inspect it for damage.** Unpack the card in a static-free environment and follow good antistatic grounding procedures. Remove the Nytro WarpDrive card from the antistatic bag, and carefully inspect it for damage. If you notice any damage, contact Seagate, or your reseller support representative.

NOTE Back up your data before changing your system configuration.

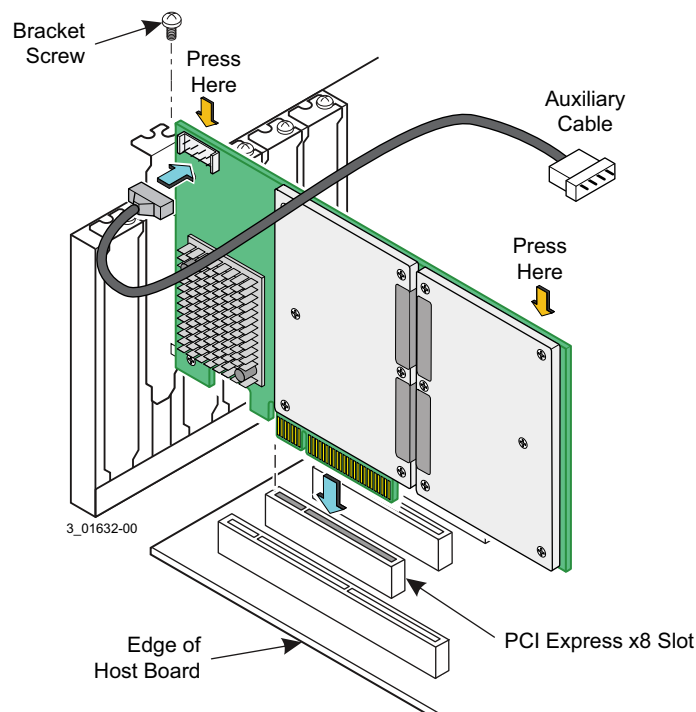
2. **Prepare the computer.** Turn off the server, and disconnect the power cords from the power supply. Remove the cover from the chassis.

WARNING To avoid electrical shock, disconnect the server from the main power and from any networks before you install the card.

3. **Insert the Nytro WarpDrive card in an available PCIe slot.** Locate an empty PCIe slot. Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot. Save the bracket screw, if applicable. Align the card to the PCIe slot. Press down gently, but firmly, to properly seat the card in the slot. The following figure shows how to insert the card in a PCIe slot.

NOTE Make sure that the PCIe slot is capable of providing 75 W of power. Otherwise, install the auxiliary power cable shown in the following figure. The auxiliary power cable connects to an auxiliary power supply.

Figure 2 Card Installation for the Nytro WarpDrive 6301 Card



NOTE The shape, size, and locations of components on your Nytro WarpDrive card might vary from this illustration.

4. For highest performance, make sure that the PCIe slot is PCIe 3.0 and make sure that it has an active width of eight lanes or sixteen lanes. The Nytro WarpDrive card functions with an active width of four lanes or two lanes, but with reduced performance.

CAUTION The location must meet the 300 LFM (linear feet/minute) minimum airflow requirement.

5. **Secure the bracket to the system's chassis.** Install the bracket screw, if applicable, or engage the system retention mechanism to secure the card to the system's chassis.
6. **Replace the cover, reconnect the power cords, and power up the system.** Replace the server's cover, reconnect the power cords, and reconnect any network cables. Turn on the power.

The Nytro WarpDrive card hardware installation is complete.

NOTE For all server types, do not ship the 6301 card installed or mounted inside a server. Ship the card separately and install the card into the server at its final destination. This prevents potential damage during shipment. If the card is shipped installed in a server and is damaged during shipment, the applicable warranty is void.

2.3 Software Installation Instructions

2.3.1 Windows Driver Installation

Download the latest Windows Server® 2012 R2 drivers from the Seagate website. To install the appropriate device driver, follow these steps:

1. Go to this website:
<https://www.seagate.com/support/solid-state-flash-storage/accelerator-cards/nytro-warpdrive-accelerator-card/downloads/>
2. Click the driver you need.
3. Open the Windows Driver Configuration Utility file and follow the instructions to install the driver.

2.3.2 Linux Driver Installation

Seagate provides open source drivers in the following ways:

- Precompiled binaries to add to an existing installation using driver update disks or RPMs for selected distributions.
- Fusion-MPT™ source to add or update any distribution.

Download the latest Linux® drivers from the Seagate website. To install the appropriate device driver, follow these steps:

1. Go to this website:
<https://www.seagate.com/support/solid-state-flash-storage/accelerator-cards/nytro-warpdrive-accelerator-card/downloads/>
2. Click the driver you need.
3. Download the driver files and install the RPM files.

2.3.3 FreeBSD Driver Installation

Download the latest FreeBSD® drivers from the Seagate website. To install the appropriate device driver, follow these steps:

1. Go to this website:
<https://www.seagate.com/support/solid-state-flash-storage/accelerator-cards/nytro-warpdrive-accelerator-card/downloads/>
2. Click the driver you need.
3. Download the driver files and install the drivers.

2.3.4 VMware Driver Installation

2.3.4.1 VMware ESXi5.0, ESXi5.1, ESXi5.5

Download the VMware drivers from the Seagate website. To install the appropriate device driver, follow these steps:

1. Go to this website:
<https://www.seagate.com/support/solid-state-flash-storage/accelerator-cards/nytro-warpdrive-accelerator-card/downloads/>
2. Click the driver you need.
3. Download the driver files and install the drivers.

2.4 BIOS Boot Support Settings

The Nytro WarpDrive BIOS permits you to change the card properties. You can specify that the card is eligible for Seagate software control or that the card is reserved for control by software that does not belong to Seagate. You can select from the following settings in the Boot Support feature of the BIOS:

Enabled BIOS and OS permits the BIOS and the operating system driver to control the card.

Enabled BIOS Only permits the BIOS to control the card. The operating system driver does not control the card. Some operating system drivers (such as Windows drivers) do not support this option.

Enabled OS Only permits the operating system to control the card. The BIOS does not control the card with this setting.

Disabled prevents the motherboard from considering the card as a boot device. Therefore you cannot boot from the card. However, you can still see the card when you use the configuration protocol, and in all other respects, the card performs as usual. You can use this option when you have multiple cards in your system and you do not plan to boot from this card.

Changes to these settings display in the Status field on the main Adapter List menu. The new setting takes effect when the BIOS reloads when you reboot the system.

Selecting Disabled prevents the user from booting the WarpDrive, but in all other respects the WarpDrive will work the same.

2.4.1 Changing the BIOS Settings

To change the BIOS settings, follow these instructions:

1. At power-on, press Ctrl-C to log on to the BIOS screen.

NOTE The model number, date, and firmware number for your Nytro WarpDrive card will vary from the illustrations below.

Figure 3 The BIOS Screen



2. Press **Enter** to go to **Adapter Properties**.

Figure 4 The Adapter Properties Screen

```
Config Utility          v110.00.00.00 (2013.05.20)
Adapter Properties -- WarpDrive

Adapter                NWD-BLP4-1600
PCI Slot               06
PCI Address(Bus/Dev)  05:00
Firmware Revision     110.00.00.00
Package Version       0.00.00.00
SAS Address            500605B0:12341234
MUDATA Version        0D.43
Status                 Enabled
Boot Order             0
Status LED             Green
Life LED               Green
Boot Support           [Disabled]

Esc = Exit Menu      F1/Shift+1 = Help
Enter = Select Item  -/+ / Enter = Change Item
```

3. To toggle between the **Boot Support** settings, use the **-/+ / Enter** keys.

Figure 5 The Disabled Boot Support Setting

```

Config Utility                               v110.00.00.00 (2013.05.20)
Adapter Properties -- WarpDrive

Adapter                                     NWD-BLP4-1600
PCI Slot                                    06
PCI Address(Bus/Dev)                        05:00
Firmware Revision                          110.00.00.00
Package Version                             0.00.00.00
SAS Address                                 500605B0:12341234
NUDATA Version                             00.43
Status                                      Enabled
Boot Order                                  0
Status LED                                  Green
Life LED                                    Green
Boot Support                                [Disabled]

Esc = Exit Menu      F1/Shift+1 = Help
Enter = Select Item  -/+ /Enter = Change Item

```

4. Press **Esc** to exit the BIOS menu.

2.5 Managing the Nytro WarpDrive Card

You can use the following tools to manage your Nytro WarpDrive card:

BIOS This tool is available only during boot. Use this tool to view information about the card and to configure the boot support options. See [BIOS Boot Support Settings](#).

DDCLI This menu-driven, command line interface tool permits you to view information, view the status, and flash upgrade the firmware for the Nytro WarpDrive card. Refer to the *Seagate® Nytro® WarpDrive® Application Acceleration Card Management Utility User Guide*.

Chapter 3: Characteristics

This chapter presents characteristics for each Nytro WarpDrive card.

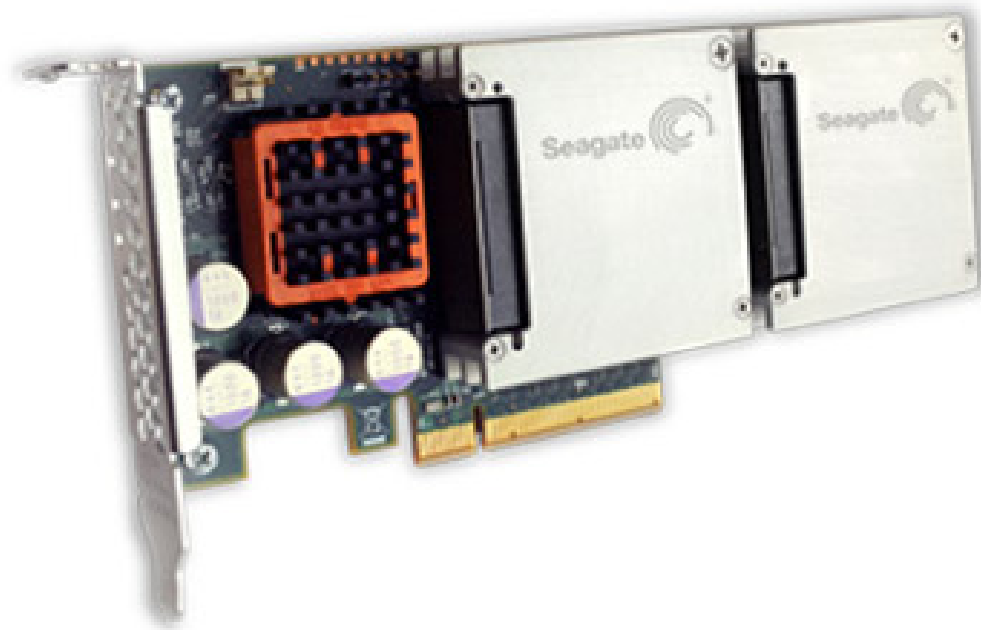
3.1 Nytro WarpDrive 6203 Card Characteristics

The Nytro WarpDrive 6203 card uses a low-profile, half-height, and half-length PCIe board.

The Nytro WarpDrive 6203 card uses a SAS2008 controller with drive firmware that runs on its internal processor. The controller connects to up to four embedded nonvolatile memory modules. The Nytro WarpDrive 6203 card can be used for either persistent or nonpersistent data and offers high-performance with low latency and a low CPU burden.

The following figure shows the Nytro WarpDrive 6203 card.

Figure 6 Nytro WarpDrive 6203 Card

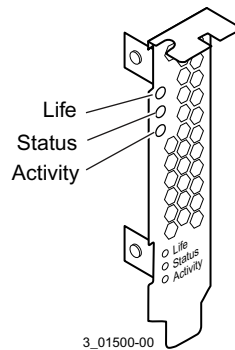


3.1.1 LEDs

Three board-mounted, right-angle LEDs shine through holes in the PCI bracket: one is for data activity, one is for drive life, and one is for drive status. The LEDs are labeled on the bracket.

3.1.2 Troubleshooting the Nytro WarpDrive Card

The LEDs provide key status information to diagnose any problem with the Nytro WarpDrive card. You can also contact [Seagate Technology Support Services](#). The following figure shows the LED layout.

Figure 7 Nytro WarpDrive 6203 Card LED Diagram**Table 2 Status Indicators on a Running System**

Name	Color	LED Description
Activity	Green	On, blinking – Indicates data activity on the card. No action required.
Life	Green	On, steady – Card has sufficient life remaining for programming and erasing the Flash memory. No action required.
	Yellow	On, steady – Card has approximately 10% or less of life remaining for programming and erasing the Flash memory. Plan for replacements.
	Red	On, steady – Card has no program or erase cycles left. Data can be read, but writes are at risk. Back up data and copy to a new Nytro WarpDrive card.
Status	Green	On, steady – Normal.
		On, blinking – Lets the user locate a specific Nytro WarpDrive card in a rack of servers.
	Yellow	On, steady – Warning. One of the following conditions applies: <ul style="list-style-type: none"> Temperature warning. If this condition persists, you might damage your Nytro WarpDrive card. Increase cooling for the card or shut down your system to prevent damage. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue.
	Red	On, blinking – Firmware fault code: <ul style="list-style-type: none"> Run the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry. If no information appears, contact Seagate Technology Support Services.
On, steady – One of the following conditions applies: <ul style="list-style-type: none"> One or more SSDs failed (IT mode). At least one SSD has exceeded its temperature. Failed RAID volume (DD mode). No RAID volume is configured (DD mode). Backup power store failed. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry the utility (DD mode).		

If you experience a problem with your Nytro WarpDrive 6203 card that you cannot resolve, report it to your FAE or, if you obtained the product from an OEM, report it to the OEM. Keep these tips in mind when reporting a problem:

- Clearly identify and report the revision level of the Nytro WarpDrive 6203 card. To view this information, use the `ddcli` command, Option 1.
- Report the part number (for example, L3-25475-xxx) listed on the label, and clearly identify the board revision.
- Describe the steps leading up to the error.
- Report the operating system version and the host driver version.

3.1.3 Power Consumption for the Nytro WarpDrive 6203 Card

The Nytro WarpDrive 6203 card receives power from the PCIe 12-V and 3.3-V power rails.

Use the following data for power consumption measured with the 16-KB I/O size:

- 12.0-V DC at 1.18 Amps (14.16 W)
- 3.3-V DC at 1.82 Amps (6.01 W)
- 3.3-V aux DC at 0.03 A (0.1 W)

3.2 Nytro XP6209 Card Characteristics

The Nytro XP6209 card uses a low-profile, half-height, and half-length PCIe board.

The Nytro XP6209 card uses a SAS2008 controller with the DirectDrive firmware that runs on its internal processor. The controller connects to up to four embedded flash modules. You can use the Nytro WarpDrive card for either persistent or nonpersistent data and the card offers high-performance with consistent low latency with a low host CPU and DRAM burden.

The following figure shows the Nytro XP6209 card.

Figure 8 Nytro XP6209 Card



3.2.1 LEDs

Three board-mounted, right-angle LEDs shine through holes in the PCI bracket: one is for data activity, one is for drive life, and one is for drive status. The LEDs are labeled on the bracket.

3.2.2 Troubleshooting the Nytro WarpDrive 6209 Card

The LEDs provide status information to diagnose problems with the Nytro XP6209 card. The following figure shows the LED layout. You can also contact [Seagate Technology Support Services](#).

Figure 9 Nytro XP6209 LED Diagram

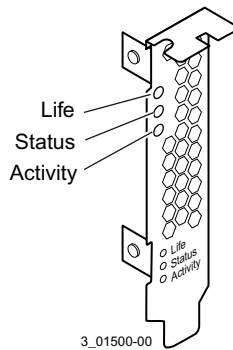


Table 3 Status Indicators on a Running System

Name	Color	LED Description
Activity	Green	On, blinking - Indicates data activity on the card. No action required.
Life	Green	On, steady - Card has sufficient life remaining for programming and erasing the Flash memory. No action required.
	Yellow	On, steady - Card has approximately 10% or less of life remaining for programming and erasing the Flash memory. Plan for replacements.
	Red	On, steady - Card has no program or erase cycles left. Data can be read, but writes are at risk. Back up data and copy to a new Nytro WarpDrive card.

Table 3 Status Indicators on a Running System (Continued)

Name	Color	LED Description
Status	Green	On, steady - Normal. On, blinking - Lets the user locate a specific Nytro WarpDrive6209 card in a rack of servers.
	Yellow	On, steady - Warning. One of the following conditions applies: <ul style="list-style-type: none"> Temperature warning. If this condition persists, you might damage your Nytro XP6209 card. Increase cooling for the card or shut down your system to prevent damage. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue.
	Red	On, blinking - Firmware fault code: <ul style="list-style-type: none"> Run the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry. If no information appears, call your field application engineer. On, steady - One of the following conditions applies: <ul style="list-style-type: none"> One or more SSDs failed. Failed RAID volume (DD mode). No RAID volume is configured (DD mode). At least one SSD has exceeded its temperature. Backup power store failed. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry the utility (DD mode).

If you experience a problem with your Nytro XP6209 card that you cannot resolve, report it to your FAE. Or if you obtained the product from an OEM, report it to the OEM. Keep these tips in mind when reporting a problem:

- Clearly identify and report the revision level of the Nytro XP6209 card. To view this information, use the `ddcli` command, Option 1.
- Report the part number (for example, L3-25256-00C) listed on the label, and clearly identify the board revision.
- Describe the steps leading up to the error.
- Report the operating system version and the host driver version.

3.2.3 Power Consumption for the Nytro XP6209 Card

The Nytro XP6209 card receives power from the PCIe 12-V and 3.3-V power rails.

Use the following data for power consumption.

Table 4 Power Consumption

Model	Idle	Typical Power I/O	Maximum Power I/O
XP6209-4A1024	11.3 W	16.5 W	17.5 W

NOTE

For the XP6209-4A1024, typical power I/O was measured at 8-KB, random access, 30% write, 70% read, Queue Depth (QD)=32/SSD. Maximum power I/O was measured at 4-KB, random access, 0% write, 100% read, QD=32/SSD.

3.2.4 Thermal Considerations

The Nytro XP6209 card is designed to operate in an environment defined by the following parameters:

- Temperature range: 0 °C to 50 °C
- Relative humidity range: 5% to 90% noncondensing
- Maximum wet bulb temperature: 28 °C
- Minimum airflow: 250 LFM

The board is designed for the following storage and transit environmental parameters:

- Temperature range: -20 °C to 75 °C
- Relative humidity range: 5% to 95% noncondensing

3.2.4.1 Maximum Sensor Temperature

System design and cooling capacity variations can affect the actual airflow delivered to the Nytro WarpDrive cards. System-level fan speeds might require adjustment to make sure that the Nytro WarpDrive sensor temperature does not exceed the maximums. The maximum sensor temperature for the XP6209 card is 70 °C.

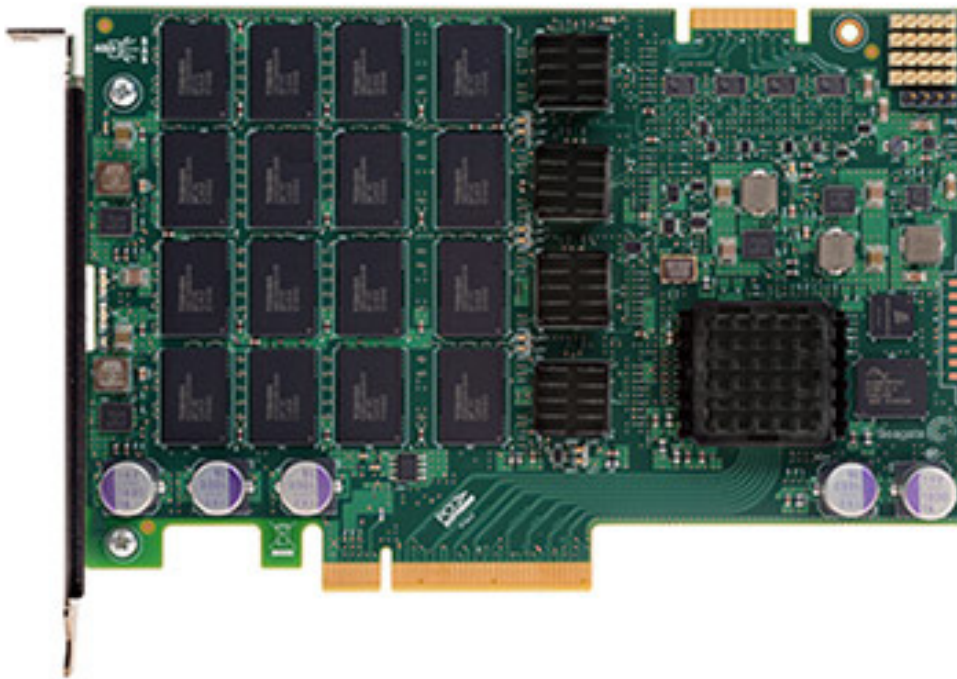
3.3 Nytro XP6210 Card Characteristics

The Nytro XP6210 card uses a full-height, and half-length PCIe board.

The Nytro XP6210 card uses a SAS2008 controller with drive firmware that runs on its internal processor. The controller connects to four embedded nonvolatile memory modules. The Nytro XP6210 card can be used for either persistent or nonpersistent data and offers high-performance with low latency and a low CPU burden.

The following figure shows the Nytro XP6210 card.

Figure 10 Nytro XP6210 Card



3.3.1 Bracket LEDs

Three board-mounted, right-angle LEDs shine through holes in the PCI bracket: one is for data activity, one is for life, and one is for status. The LEDs are labeled on the bracket.

3.3.2 Troubleshooting the Nytro XP6210 Card

The LEDs provide key status information to diagnose any problem with the Nytro XP6210 card. You can also contact [Seagate Technology Support Services](#). The following figure shows the LED layout.

Figure 11 Nytro WarpDrive 6210 Card LED Diagram

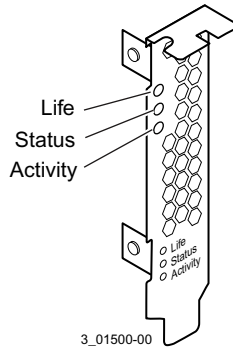


Table 5 Status Indicators on a Running System

Name	Color	LED Description
Activity	Green	On, blinking – Indicates data activity on the card. No action required.
Life	Green	On, steady – Card has sufficient life remaining for programming and erasing the Flash memory. No action required.
	Yellow	On, steady – Card has approximately 10% or less of life remaining for programming and erasing the Flash memory. Plan for replacements.
	Red	On, steady – Card has no program or erase cycles left. Data can be read, but writes are at risk. Back up data and copy to a new Nytro WarpDrive card.
Status	Green	On, steady – Normal.
		On, blinking – Lets the user locate a specific card in a rack of servers.
	Yellow	On, steady – Warning. One of the following conditions applies: <ul style="list-style-type: none"> Temperature warning. If this condition persists, you might damage your card. Increase cooling for the card or shut down your system to prevent damage. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue.
	Red	On, blinking – Firmware fault code: <ul style="list-style-type: none"> Run the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry. If no information appears, call Seagate Technology Support Services.
On, steady – One of the following conditions applies: <ul style="list-style-type: none"> One or more embedded drives failed (IT mode). At least one embedded drive has exceeded its temperature. Failed RAID volume (DD mode). No RAID volume is configured (DD mode). Backup power store failed. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry the utility (DD mode).		

If you experience a problem with your Nytro XP6210 card that you cannot resolve, report it to your FAE or, if you obtained the product from an OEM, report it to the OEM. Keep these tips in mind when reporting a problem:

- Clearly identify and report the revision level of the Nytro XP6210 card. To view this information, use the `ddcli` command, Option 1.
- Report the part number (for example, L3-25475-xxx) listed on the label, and clearly identify the board revision.
- Describe the steps leading up to the error.
- Report the operating system version and the host driver version.

3.3.3 Power Consumption for the Nytro XP6210 Card

The Nytro XP6210 cards receives power from the PCIe 12-V and 3.3-V power rails.

Use the following data for power consumption measured with the 16-KB I/O size:

- 12.0-V DC at 1.35 Amps (16.2 W)
- 3.3-V DC at 1.57 Amps (5.18 W)
- 3.3-V aux DC at 0.03 A (0.1 W)

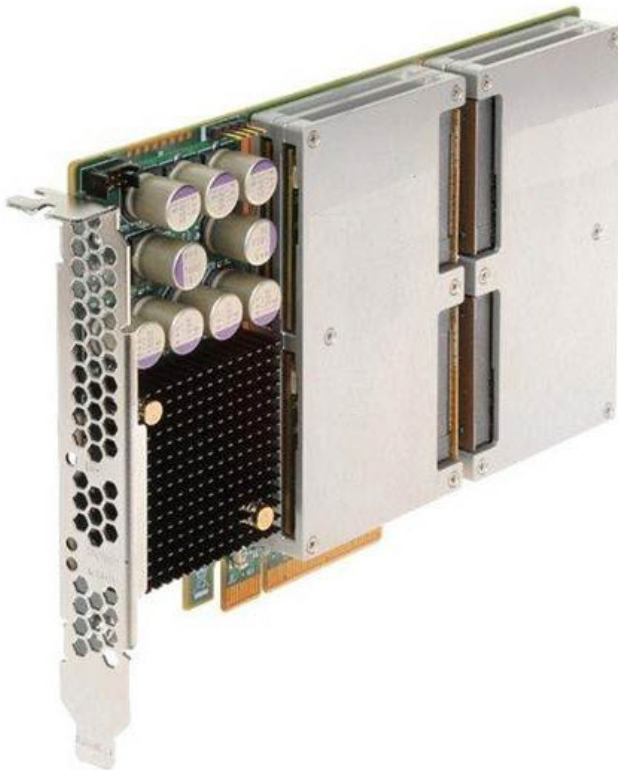
3.4 Nytro WarpDrive 6301 Card Characteristics

The Nytro WarpDrive 6301 card uses a full-height PCIe board.

The Nytro WarpDrive 6301 card uses a SAS2308 controller with drive firmware that runs on its internal processor. The controller connects to up to eight embedded nonvolatile memory modules. The Nytro WarpDrive 6301 card can be used for either persistent or nonpersistent data and offers high-performance with low latency and a low CPU burden.

The following figure shows the Nytro WarpDrive 6301 card.

Figure 12 Nytro WarpDrive 6301 Card



3.4.1 Shipping

You must always ship the Nytro WarpDrive 6301 card separately from its intended target servers. Do not ship a server with the Nytro WarpDrive 6301 card installed.

3.4.2 LEDs

Three board-mounted, right-angle LEDs shine through holes in the PCI bracket: one is for data activity, one is for drive life, and one is for drive status. The LEDs are labeled on the bracket.

3.4.3 Troubleshooting the Nytro WarpDrive 6301 Card

The LEDs provide key status information to diagnose any problem with the Nytro WarpDrive card. You can also contact [Seagate Technology Support Services](#). The following figure shows the LED layout.

Figure 13 Nytro WarpDrive Card LED Diagram

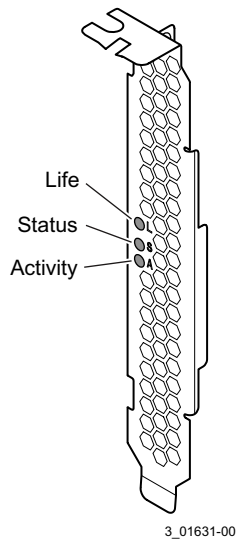


Table 6 Status Indicators on a Running System

Name	Color	LED Description
Activity	Green	On, blinking – Indicates data activity on the card. No action required.
Life	Green	On, steady – Card has sufficient life remaining for programming and erasing the Flash memory. No action required.
	Yellow	On, steady – Card has approximately 10% or less of life remaining for programming and erasing the Flash memory. Plan for replacements.
	Red	On, steady – Card has no program or erase cycles left. Data can be read, but writes are at risk. Back up data and copy to a new Nytro WarpDrive card.

Table 6 Status Indicators on a Running System (Continued)

Name	Color	LED Description
Status	Green	On, steady – Normal.
		On, blinking – Lets the user locate a specific Nytro WarpDrive card in a rack of servers.
	Yellow	On, steady – Warning. One of the following conditions applies: <ul style="list-style-type: none"> Temperature warning. If this condition persists, you might damage your Nytro WarpDrive card. Increase cooling for the card or shut down your system to prevent damage. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue.
		Red
		On, steady – One of the following conditions applies: <ul style="list-style-type: none"> One or more SSDs failed (IT mode). At least one SSD has exceeded its temperature. Failed RAID volume (DD mode). No RAID volume is configured (DD mode). Backup power store failed. Other component issues: Run the list and health commands in the <code>ddcli</code> utility to determine which component has an issue. If no information appears, reboot the system and retry the utility (DD mode).

If you experience a problem with your Nytro WarpDrive 6301 card that you cannot resolve, report it to your FAE or, if you obtained the product from an OEM, report it to the OEM. Keep these tips in mind when reporting a problem:

- Clearly identify and report the revision level of the Nytro WarpDrive 6301 card. To view this information, use the `ddcli` command, Option 1.
- Report the part number (for example, H3-25455-xxx) listed on the label, and clearly identify the board revision.
- Describe the steps leading up to the error.
- Report the operating system version and the host driver version.

3.4.4 Power Consumption for the Nytro WarpDrive 6301 Card

The Nytro WarpDrive 6301 card draws its main power for operation from either the 12-V PCIe power rail, or from an external 12-V power supply through the auxiliary power cable. Power comes from only one of these sources, not both. Attaching the power cable causes the board to select the cable as the source of power.

The Nytro WarpDrive 6301 card monitors the PCIe 3.3V rail to determine if the host server has lost power on this rail, but the power consumed from this rail is negligible.

The PCIe 3.3V auxiliary rail powers a small nonvolatile memory on the Nytro WarpDrive 6301 card so that this memory can update through the system management bus on the PCIe connector. Compared to the power consumed during Nytro WarpDrive 6301 card normal operation, the power consumed by the PCIe 3.3V auxiliary rail is negligible.

For the Nytro WarpDrive 6301 card, sequential writes of 100 percent with an I/O size of 64 KB consumed the most power. Seagate measured power consumption from the 12-V rail and the 3.3-V rails under a number of I/O loading conditions to find this result.

Seagate tested an eight drive module configuration using 256-GB drive modules. The maximum power consumption was 46.3 W during 64 thousand sequential writes.

Use the following data for power consumption measured with an I/O size of 64 KB:

- 12.0-V DC at 3.86 Amps (46.3 W)
- 3.3-V DC at 0.0 Amps (0.0 W)
- 3.3-V aux DC at 0.006 Amps (0.02 W)

3.4.5 Qualified Servers for the Nytro WarpDrive 6301 Card

ATTENTION Seagate has qualified servers that support the card and that provide the correct thermal conditions to deliver the full operating performance.

Due to unique weight, power consumption, and thermal dissipation requirements, the Nytro WarpDrive 6301 cards are recommended for operation in servers that Seagate has qualified. Servers on the Seagate qualified server list are tested in Seagate labs and confirmed to offer sufficient power and thermal support. Some adjustment to factory servers settings might be necessary to achieve correct power and thermal settings. Contact your sales representative for additional details. The following list provides information and requirements for the Nytro WarpDrive 6301 card. If you do not meet these requirements, you void the applicable card warranty.

- **Weight:** For all server types, do not ship the card installed or mounted inside a server. Ship the card separately, and install the cards into the server at the final destination. This action prevents potential damage during shipment. If the card is shipped installed in a server and is damaged during shipment, the applicable warranty is void.
- **Power Consumption:** The card consumes a maximum of 46.3 W of power to operate at full performance. If a target PCIe® slot does not supply this amount of power, you must use the auxiliary power cable that ships with each card. Insufficient power availability does constrain the performance capabilities of the card.
- **Thermals:** You must install and operate the card with the correct thermal envelope with sufficient airflow. Fan setting and placement of the card are critical to maintaining optimal performance and endurance. Because of thermal constraints, you must provide a minimum of 300 LFM to the card.

When the card operates in another server type, you might not achieve maximum I/O performance. To find a list of qualified servers, go here:

<http://www.seagate.com/files/www-content/support-content/solid-state-flash-storage/accelerator-cards/nytro-warpdrive/en-us/documents/seagate-nytro-compatibility-servers-v1.pdf>

3.4.6 Drivers for the Nytro WarpDrive 6301 Card

For improved I/O performance, the card requires the following operating system drivers. To find these drivers, go here: <http://www.seagate.com/products/solid-state-flash-storage/accelerator-cards/>

- Windows® Driver Version 2.10.66.00
- Linux® Driver Version 17.00.02.00-1
- VMware® ESX4.1
- VMware ESX5.0/VMware ESXi 5.1

3.5 Thermal and Atmospheric Characteristics

The Nytro WarpDrive 6301 card design operates in an environment defined by the following parameters.

- Temperature range: 5 °C to 45 °C (dry bulb)
- Relative humidity range: 8 percent to 80 percent noncondensing
- Maximum wet bulb temperature: 28 °C
- Airflow requirement: more than 300 LFM

The Nytro WarpDrive 6301 card is designed for a storage and transit environment defined by the following parameters.

- Temperature range: –20 °C to +75 °C (dry bulb)
- Relative humidity range: 5 % to 95 % noncondensing

NOTE Because of system design and cooling capacity variations that affect the actual airflow delivered to the Nytro WarpDrive card, the system-level fan speeds might require adjustments to make sure the Nytro WarpDrive card sensor temperature does not exceed 74 °C.

3.6 Safety, Standards, and Compliance

3.6.1 Regulatory and Model Numbers

The following Regulatory and Model Numbers represent all features and configurations in this series:

Table 7 Regulatory and Model Numbers

Device Name	Regulatory Number	Model Number
Nytro Warpdrive 6203	25499	ST25499
Nytro Warpdrive 6209	25927	ST25927
Nytro XP6210	26410	ST26410
Nytro Warpdrive 6301	25455	ST25455

3.6.2 Agency and Safety Certifications

Each Solid State Drive ("drives") has a product label that includes certifications that are applicable to that specific drive. The following information provides an overview of requirements that may be applicable to the drive.

3.6.2.1 Safety certification

This drive is recognized in accordance with UL 60950-1, CSA 60950-1 and IEC/EN60950- 1 as tested by UL.

3.6.2.2 European Union (EU) CE Marking Requirements

Drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2014/30/EU) put into force on 20 April 2016. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55032:2012, Class B and the immunity levels are defined by EN 55024:2010.

The drives also meet the requirements of The Low Voltage Directive (LVD) 2014/35/EU.

Seagate drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with all relevant regulatory requirements and standards for the drives, Seagate cannot guarantee that all system-level products into which the drives are installed comply with all regulatory requirements and standards applicable to the system-level products. The drive is designed for operation inside a properly designed system (e.g., enclosure designed for the drive), with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for the system-level products.

For compliance with the RoHS "Recast" Directive 2011/65/EU (RoHS 2), [Section 3.6.3.1.1, Restriction of Hazardous Substances in Electrical and Electronic Equipment](#).

3.6.2.3 Australian RCM Compliance Mark

If these models have the RCM marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR32 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication and Media Authority (ACMA).

3.6.2.4 Canada ICES-003

If this model has the ICES-003:2016 marking it complies with requirements of ICES tested per ANSI C63.4-2014.

3.6.2.5 South Korean KC Certification Mark

The South Korean KC Certification Mark means the drives comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Agency (RRA) Communications Commission, Republic of Korea. These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

기종별	사용자안내문
B급 기기 (가정용 방송통신기자재)	이 기기는 가정용(B급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

3.6.2.6 Morocco Commodity Mark

Seagate drives are tested for compliance and complies with the European Union (EU) Electromagnetic Compatibility (EMC) Directive 2014/30/EU and the Low Voltage Directive (LVD) 2014/35/EU. Accordingly, the drives also meets the requirements of Morocco's Order of the Minister of Industry, Trade, Investment and Digital Economy No. 2574-14 of 29 Ramadan 1436 (16 July 2015) on electromagnetic compatibility of equipment.

For drives with the Morocco Mark, Seagate has added the Moroccan Commodity Mark to the drives provided to the OEM for the sale of Customer Kits produced by our OEM customers that are intended to be incorporated into the OEM's finished system-level product by an end user. The Customer Kits are considered 'devices' under Morocco's Order of the Minister of Industry, Trade, Investment and Digital Economy No. 2574-14 of 29 Ramadan 1436 (16 July 2015) on electromagnetic compatibility of equipment.

3.6.2.7 Taiwanese BSMI

Drives with the Taiwanese certification mark comply with Chinese National Standard, CNS13438.

For compliance with the Taiwan Bureau of Standards, Metrology and Inspection's (BSMI) requirements, [Section 3.6.3.3, Taiwan Requirements—Taiwan RoHS](#).

3.6.2.8 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult a dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

3.6.2.9 Japan VCCI

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラス B 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction guide.

3.6.3 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

3.6.3.1 European Union Restriction of Hazardous Substance Law

3.6.3.1.1 Restriction of Hazardous Substances in Electrical and Electronic Equipment

Seagate drives are designed to be compliant with the European Union RoHS "Recast" Directive 2011/65/EU (RoHS 2) as amended by Directive (EU) 2015/863. The RoHS2 restricts the use of certain hazardous substances such as Lead, Cadmium, Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ether (PBDE), BisBis(2-Ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP), and Diisobutyl phthalate (DIBP) in electrical and electronic equipment (EEE).

3.6.3.1.2 Substances of Very High Concern (SVHC)

The European Union REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) Regulation (EC) 1907/2006 regulates chemicals shipped into and used in Europe. A number of parts and materials in Seagate products are procured from external suppliers. We rely on the representations of our suppliers regarding the presence of REACH substances in these articles and materials. Our supplier contracts require compliance with our chemical substance restrictions, and our suppliers document their compliance with our requirements by providing full-disclosure material content declarations that disclose inclusion of any REACH-regulated substance in such articles or materials. Product-specific REACH declarations are available upon request through your Seagate Sales Representative.

3.6.3.2 China Requirements—China RoHS 2



China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2016, titled Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. To comply with China RoHS 2, Seagate determines this product's Environmental Protection Use Period (EPUP) to be 20 years in accordance with the *Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products*, SJT 11364-2014.

Table 8 China - Hazardous Substances

部件名称 Part Name	有害物质 Hazardous Substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁺⁶)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板组装 PCBA	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制。

This table is prepared in accordance with the provisions of SJ/T 11364-2014

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

3.6.3.3 Taiwan Requirements—Taiwan RoHS

Taiwan RoHS refers to the Taiwan Bureau of Standards, Metrology and Inspection's (BSMI) requirements in standard CNS 15663, Guidance to reduction of the restricted chemical substances in electrical and electronic equipment. Seagate products must comply with the "Marking of presence" requirements in Section 5 of CNS 15663, effective January 1, 2018. This product is Taiwan RoHS compliant.

The following table meets the Section 5 "Marking of presence" requirements.

Table 9 Taiwan - Restricted Substances

設備名稱：硬盤設備 /SSD，型號：僅適用於內部使用 Equipment Name: Hard Disk Device/SSD, Type Designation: Internal Use Only						
單元 Unit	限用物質及其化學符號 Restricted Substance and its chemical symbol					
	鉛 (Pb)	汞 (Hg)	鎘 (Cd)	六價鉻 (Cr ⁺⁶)	多溴聯苯 (PBB)	多溴二苯醚 (PBDE)
印刷電路板組裝 PCBA	—	○	○	○	○	○
備考 1. "○" 係指該項限用物質之百分比含量未超出百分比含量基準值。 Note 1. "○" indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence. 備考 2. "—" 係指該項限用物質為排除項目。 Note 2. "—" indicates that the restricted substance corresponds to the exemption.						

Revision History

Version and Date	Description of Changes
Version 1.11, January 2014	Added Section 2.2.1, Card Retention, Shipping, and the PCIe Specification . Updated Table 1 and moved it to Chapter 1. Added information for the Nytro XP6209, Nytro XP6210, and Nytro WarpDrive 6301 products to Chapter 3: Characteristics .
Version 1.10, September 2013	Updated Table 1 . Updated product information throughout the document.
Version 1.9, June 2013	Updated Table 1 . Updated product information throughout the document.
Version 1.8, May 2013	Updated Table 1 .
Version 1.7, January 2013.	Added notes in Section 2.2.3 .
Version 1.6, September 2012	Added information for the Nytro WarpDrive 6301 product. Added Sections 2.2.3 and 3.4 . Updated Table 1 .
Version 1.5, May 2012	Updated the product name from WarpDrive Solid State Storage Acceleration card to Nytro WarpDrive Application Acceleration card. Updated Table 2 .
Version 1.4, January 2012	Revised the product information throughout the document.
Version 1.3, September 2011	Changed the installation information.
Version 1.2, August 2011	Added new information for the Nytro WarpDrive 6203 product and reorganized the document by product.
Version 1.1, May 2011	Added new product information.
Version 1.0, September 2010	Initial release of this Nytro WarpDrive User Guide.



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