



Dolphin StorExpress
DSE4XM1
DSE4XM2

User Guide for Linux

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Introduction

Congratulations on your purchase of a Dolphin StorExpress product. This guide provides user instructions for the following StorExpress models:

- DSE4XM1
- DSE4XM2

These products are part of the DSE4XM family of StorExpress products.

Dolphin's StorExpress is a PCI Express based solid state storage system designed to deliver superior response times and storage capacity. Providing large capacity and fast direct storage, StorExpress connects directly to any PCI Express system. It is the ideal solution for deploying fast solid state cache solutions to improve the performance of database or web-based applications. StorExpress systems integrate with Dolphin's PCI Express cluster technology enabling businesses to easily build fast distributed storage solutions. Capable of being connected to multiple servers, StorExpress provides a flexible and scalable storage solution which can be distributed within the enterprise to improve access to latency sensitive data. In a multi-server configuration, StorExpress is also capable of functioning as a clustering switch and can obviate the need for a dedicated clustering fabric for inter-server communication

Offering both superior power utilization and outstanding performance, this flash based solution significantly lowers annual power usage while delivering outstanding performance. StorExpress leverages the latest solid state SLC NAND technology to provide extremely fast storage solutions that outperform traditional disk based systems.

1.1 System Requirements

The DSE4XM requires an open x4 or x8 PCI Express slot for each DXH510 Host Adapter card.

Please refer to Chapter 3 for supported operating systems.

1.2 DSE4XM Components

Your DSE4XM product includes the following items:

- DSE4XM chassis

- DXH510 PCI Express host adapter card
- DXH510 half-height bracket
- 2 - 1m CX4 cables
- StorExpress USB Key, containing
 - DSE4XM User’s Guide for Windows
 - DSE4XM User’s Guide for Linux
 - ioManager User’s Guide
- Quick Start Instructions
- Configuration Sheet

1.3 Features and Performance

The DSE4XM product has the following features:

- 480 Gbyte or 960 Gbyte NAND Flash SLC using Fusion-IO ioDrive[®] technology
- Performance for x4, x8 and dual x8 server connection(s), respectively:
 - 800 MB/s, 1500 MB/s, and 2700 MB/s (read)
 - 600 MB/s, 1250 MB/s, and 2500 MB/s (write)
 - 80,000, 150,000, and 270,000 I/O operations per second (IOPS)¹
- < 50 microseconds read access latency²
- Server connection options
 - x4 PCI Express for up to four servers
 - x4 or x8 PCI Express for up to two servers
 - x4, x8, or dual x8 PCI Express for one server
 - Requires PCI Express slot in server (two slots for dual x8 connection)
 - Additional DXH510 host adapter required for each server connection or dual x8 connection
- Supports external 4-channel parallel fiber-optic transceivers
 - Extended distance up to 100 meters

1. Based on 4KB packet sizes

2. Based on 4KB packet sizes

1.4 Specifications

1.4.1 Mechanical

The following specifications are for the DSE4XM chassis:

- Standard 4U rackmount chassis
- Dimensions
 - Height: 6.96” (4U /176.8mm)
 - Depth: 18.9 (480mm)
 - Width: 19” (483mm)
- Weight approximately 32lbs (14.5kg)

1.4.2 Environmental

- Operating Temperature: 0°C to 50°C ambient
- Storage Temperature: -20°C to 70°C
- Relative Humidity: 15-85% non-condensing

1.4.3 Electrical

- Operating Voltage: 100-240 VAC at 50-60Hz
- Power Supply: 300 watt dual PSU

1.4.4 Agency Approvals

- FCC Part 15, Class A
- EMC Directive CE Mark, EN55022, EN55024, 61000-3-2, 61000-3-3, EN6950-1
- VCCI, Class A

1.5 Customer Support

If you continue to have issues with your system or need service, please contact Dolphin customer support at <http://www.dolphinics.com/support>

Hardware Installation

This chapter describes how to install your DSE4XM hardware.

Your DSE4XM includes a DXH510 PCI Express host adapter card and two 1-meter CX4 cables. These components support a x8 connection between the DSE4XM chassis and one server, which is the standard shipping configuration for the DSE4XM.

The DSE4XM supports additional configurations accommodating connections to up to four servers, with a fixed amount of storage allocated to each server. Each additional server requires a DXH510 adapter card and cable to connect to the DSE4XM chassis. Allocation of memory to each server is specified at the time the product is ordered and pre-configured at the factory. Dual x8 connection to a single server also requires an additional DXH510 and factory pre-configuration. Please contact Dolphin customer support at <http://www.dolphinics.com/support> to request a multi-server or dual x8 DSE4XM configuration.

2.1 DSE4XM Chassis Overview

Figure 2–1 shows the rear of the DSE4XM chassis. Table 2–1 lists the features noted by the labels in Figure 2–1. This figure will be referenced by the hardware installation instructions.

Figure 2–1 DSE4XM Chassis Rear

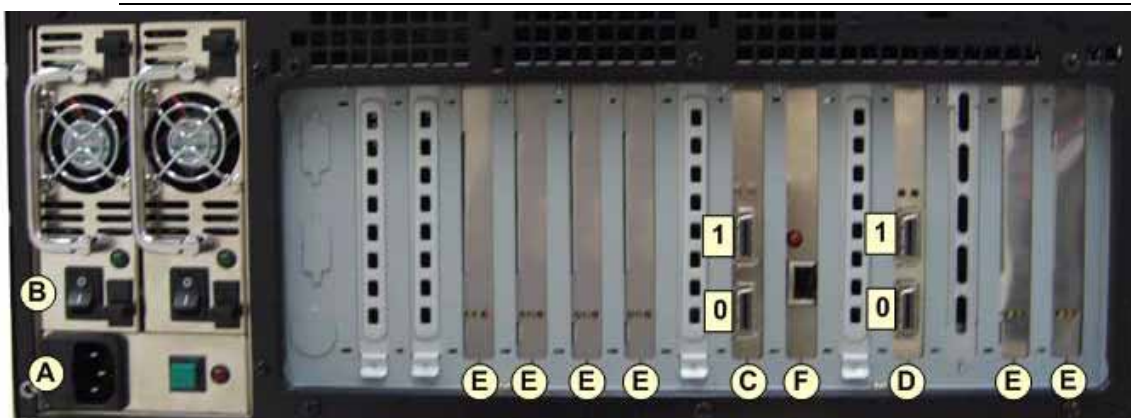


Table 2–1 DSE4XM Chassis Rear Features

Label	Name
A	AC Power Inlet
B	AC Power Switch
C	Uplink Slot 0
D	Uplink Slot 1
E	ioDrive SSD Slot
F	For Manufacturing Use Only
C/D - 0	Connector P0
C/D - 1	Connector P1

Figure 2–2 shows the front of the DSE4XM chassis with the front cover open.

Figure 2–2 DSE4XM Chassis Front

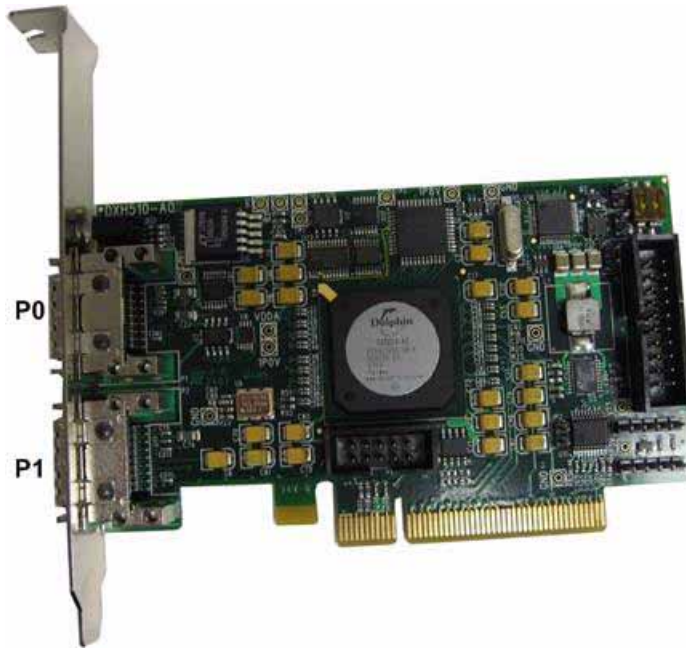


Caution: For protection of the StorExpress devices, we recommend that you do not attempt to service or remove the cover of your DSE4XM chassis. However, if you do, power should be disconnected from the chassis prior to servicing the chassis or removing the cover for any reason. In order to disconnect power remove the power cord from its receptacle in the back of the chassis as shown in Figure 2–1. The front power switch is not a disconnect switch for system power.

2.2 Installing DXH510 Card in Server

The DXH510 host adapter card is shown in Figure 2–3. The connector ports P0 and P1 are labeled in this figure.

Figure 2–3 DXH510 Adapter Card



Caution: *Electrostatic discharge (ESD) can damage electronic components. Be sure that you are properly grounded prior to any hardware installation procedure using an ESD protection device such as a wrist strap.*

If you are installing the DXH510 in a low-profile system and need to use the half-height bracket, please refer to the Section 2.2.1.

1. Locate the serial number on the back of your DXH510 and record it for future reference.
2. Power off the server and disconnect the power cable.
3. Remove the server's access panel. Locate an available PCIe slot.
 - Consult your server's documentation for details on removing the panel and identifying PCIe slots.

Note: *Your DXH510 is designed for use in a x8 PCIe slot. It will work in a x16 slot, but this does not improve performance. Your DXH510 can also work in a x2 or x4 slot but performance may be diminished in a x2 slot, or in a x4 slot if a x8 connection is intended.*

4. Follow server manufacturer's instructions for installing PCIe add-in cards.
5. Replace the server's access panel
6. Plug in the server's power cable

You have completed the hardware installation of the DXH510 into the server. If you are connecting multiple servers to the DSE4XM chassis, repeat this process for each server. Each server requires a DXH510 host adapter to connect to the DSE4XM chassis. If you are making a dual x8 connection to a single server, locate a second PCI Express slot and install the second DXH510 adapter.

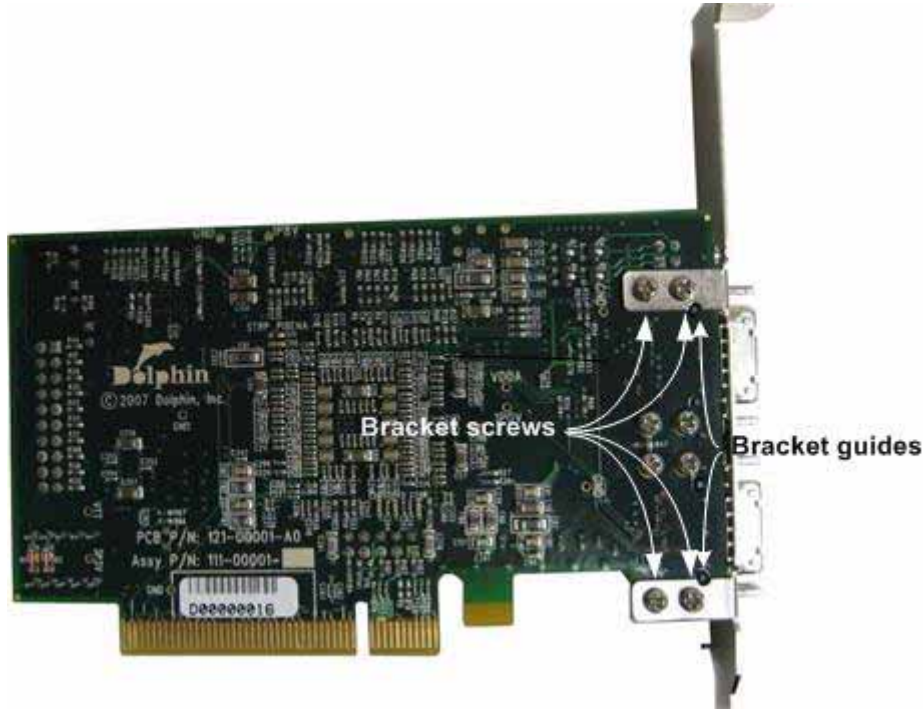
2.2.1 Half-height Bracket Installation

For installation in a low-profile server, the full-height bracket must be replaced with the half-height bracket.

Caution: *Electrostatic discharge (ESD) can damage electronic components. Be sure that you are properly grounded prior to any hardware installation procedure using an ESD protection device such as a wrist strap.*

1. Locate the half-height bracket in the DSE4XM package
2. Remove the four screws, indicated in Figure 2–4, that hold the full-height bracket to the DXH510. Do not attempt to remove the bracket until the screws have been fully removed.
3. Remove the bracket carefully from the device.
4. Align the connectors on the DXH510 with the openings in the half-height bracket: Be sure the bracket tabs are on the backside of the device.
5. Adjust the bracket so that the notches on the bracket tabs fit around the guides on the back of the card. The bracket guides are illustrated in Figure 2–4.
6. Attach the half-height bracket using a screwdriver to tighten the four screws. Do not overtighten the screws as this can damage the device.
7. Return to Step 2 of Section 2.2.

Figure 2–4 DXH510 Adapter Card Rear View



2.3 Connecting the DXH510 to Chassis

A server connects to the DSE4XM chassis using the DXH510 PCI Express host adapter card. One or two cables are used to connect the DXH510 to the DSE4XM chassis. One cable provides a x4 (8 Gbps) connection; two cables provide a x8 (16 Gbps) connection.

Two 1-meter cables (Model DXC1M-A) are provided as a part of the standard DSE4XM package. Additional compatible cables are available from Dolphin for connecting the DXH510 to the DSE4XM chassis, as listed in Table 2–2. See <http://www.dolphinics.com/support> for the most up to date compatible cable offerings.

Table 2–2 Dolphin DSE4XM Compatible Cables

Part Number	Description
DXC1M-A	1 Meter copper cable
DXC3M-A	3 Meter copper cable
FCDX10M-A	10 Meter fiber optic cable
FCDX50M-A	50 Meter fiber optic cable
FCDX100M-A	100 Meter fiber optic cable

The DSE4XM chassis has two pairs of connectors (four total), which are used to cable to the DXH510 host adapter. As shown in Figure 2–1 on Page 9, one set of connectors is located at Uplink Slot 0; the second set of connectors is located at Uplink Slot 1. The lower connector is P0 and the upper connector is P1.

One set of connectors can be used for a x8 connection when cabled to a single DXH510, or for two x4 connections when each connector in the set is cabled to a different DXH510 adapter card. Two sets of two connectors allow for connection to up to four DXH510 adapter cards in this manner.

Each DXH510 card has one pair of connectors, as shown in Figure 2–1 on Page 9. Both connectors are used for a x8 connection, or a single connector may be used for a x4 connection.

Table 2–3 shows how the DXH510 card(s) are cabled to the DSE4XM for configurations of one to four servers.

Table 2–3 DXH510 to DSE4XM Chassis Cable Connections

			One Server	Two Servers	Three Servers	Four Servers
DXH510: 1	P0	<i>cables to</i>	Uplink Slot 0: P0	Uplink Slot 0: P0	Uplink Slot 0: P0	Uplink Slot 0: P0
	P1	<i>cables to</i>	Uplink Slot 0: P1 [‡]	Uplink Slot 0: P1 [‡]	Uplink Slot 0: P1 [‡]	–
DXH510: 2	P0	<i>cables to</i>	–	Uplink Slot 1: P0	Uplink Slot 1: P0	Uplink Slot 0: P1
	P1	<i>cables to</i>	–	Uplink Slot 1: P1 [‡]	–	–
DXH510: 3	P0	<i>cables to</i>	–	–	Uplink Slot 1: P1	Uplink Slot 1: P0
	P1	<i>cables to</i>	–	–	–	–
DXH510: 4	P0	<i>cables to</i>	–	–	–	Uplink Slot 1: P1
	P1	<i>cables to</i>	–	–	–	–

[‡] Only required if a x8 connection is desired. May be left unconnected if a x4 connection only is needed.

The single server dual x8 configuration is similar to the two server configuration, however in this case both DXH510:1 and DXH510:2 adapters reside in the same server.

Attach the cable(s) to the required connectors for your configuration as specified by Table 2–3.

Figure 2-5 DSE4XM with One x8 Connection



Figure 2-6 DSE4XM with Four x4 Connections



Figure 2-7 DSE4XM with Two x8 Connections



Note: Cables should be strain relieved or strapped to a cabinet/rack to ensure additional reliability.

Note: Cables should be connected according to the configuration of your DSE4XM product. The configuration is documented on the configuration sheet included with your product. The standard StorExpress configuration is single server. Multiple server configurations require additional DXH510 adapter cards and cables, which may be purchased through <http://www.dolphinics.com>.

2.4 Powering up the DSE4XM

1. Connect main power (100-240VAC) to the DSE4XM chassis using the provided AC power cord or a regionally appropriate AC power cord to the DSE4XM chassis power connector, which is located on the back of the chassis, as shown in Figure 2–1. The AC power cord provided by Dolphin is a Northern American 3-prong plug. A different power cord, with the appropriate power prongs, is required for other geographies that don't support the North American standard. The chassis accepts any IEC 320 EN60320 C13 connector and the power supply provided with the DXE410 accepts any voltage from 100V to 240V at a frequency of 50-60Hz.

Auxiliary power is supplied to the DSE4XM when AC power is connected.

2. An AC power switch for each power supply unit is located on the back of the chassis near the power connector, as shown in Figure 2–1. These switches must be placed in the on position to provide full AC power to the chassis.
3. A DC power switch is provided in the front of the chassis, as shown in Figure 2–2. This switch can be used to manually fully power up the chassis.

The DSE4XM chassis provides automatic remote power-on capabilities. Toggling the front power button is not necessary to fully power to the chassis. As long as AC power is switch on, the DSE4XM will fully power up when the server (or first server) is powered on.

- When fully powered, the DSE4XM will go through a self test. You will observe that for 0.5 seconds the P0 and P1 LEDs on the Uplink slots will turn green. Then for 0.5 seconds, the P0 and P1 LEDs turn yellow. If the servers connected to the DSE4XM are powered down, or if the connectors are not cabled, then the LEDs will turn off.
4. Power-on the server that contains the DXH510. If not already powered, after server power is turned on, the DSE4XM will come on automatically. This is indicated by the following:
 - Chassis fans will turn on
 - The Uplink Slot P0 and P1 LEDs will transition from yellow to off and then green for connected ports, as described in the previous step.
 5. Check the P0 and P1 LEDs for both the DXH510 and the DSE4XM Uplink slot(s)
 - For a x8 or a single x4 connection, the P0 LED should be illuminated
 - For two x4 connections, both the P0 and P1 LEDs should be illuminated

6. Follow the procedure outlined in Chapter 3 for driver software installation. If you are prompted by the operating system for a driver, click Cancel.
7. Repeat the power-on procedure for any additional servers you may have connected to the DSE4XM.

Note: *If you are running a Windows operating system, Dolphin provides drivers to support the DXH510. These drivers are available on the Dolphin website at www.dolphinics.com/support*

2.5 Troubleshooting

Table 2–4 Troubleshooting Tips

Symptom	Tip
No Power to board	1) Check AC power cord for power. 2) Ensure rear power switch is turned on
Both Uplink slot LEDs are off when connected to server (both server and the DSE4XM must be powered)	1) Check cable connections
LED(s) are blinking when connected to server	Contact customer support
Memory cards do not appear in device manager or device list	Contact customer support
Host does not boot properly	Contact customer support
System hangs on boot	Contact customer support
Red Alarm LED is illuminated	TBD
Red Alarm LED is flashing	TBD

Software User Guide

The DSE4XM supports the following Linux distributions:

- Red Hat Enterprise Linux 4 & 5
- SuSe Linux Enterprise Server (SLES) 10
- Debian/Lenny, Etch, Sid
- Fedora Core 6, 8, and 9
- Ubuntu 8
- CentOS 4 & 5

Please visit <http://www.dolphinics.com/support> for the latest list.

3.1 Software Installation

You can install the ioDrive driver and utilities as:

- Install .deb packages (Debian/Ubuntu).
- Pre-compiled RPM packages (SUSE, RHEL, Fedora, CentOS).
- Source to build RPM packages.

Note: All commands require administrator privileges. Log in as "root" or use sudo to run the install.

3.1.1 Installing Using Pre-Compiled .deb Packages

To install the ioDrive Debian/Ubuntu driver and utilities:

1. Download appropriate install .deb packages from <http://www.dolphinics.com/support>:

```
iodrive-driver_1.2.4-2.6.26-1-amd64_amd64.deb  
iodrive-util_1.2.4-1_amd64.deb  
iodrive-firmware_1.2.4-1_all.deb  
iodrive-snmp_util_1.2.4-1_all.deb
```

2. Change to the directory where you downloaded the package.

3. Run the command:

```
$ dpkg -i iodrive*.deb
```

The drivers and utilities are installed to the following locations:

Drivers: /lib/modules/<kernel-version>/fusionio/

Utilities: /usr/bin

Firmware: /usr/share/fusionio/images

SNMP MIB: /usr/share/fusionio

If you need to upgrade your firmware before doing the installation, follow the steps in Section 3.5.3.3.

3.1.2 Installing using Pre-Compiled RPM Packages

To install the ioDrive Linux driver and utilities on SUSE, RHEL, Fedora, and CentOS:

1. Download appropriate iodrive-driver, iodrive-util, and iodrive-firmware RPMs from <http://www.dolphinics.com/support>.

Note: *Make sure you have the right download for your kernel. Run the command "uname -a" at a shell prompt to determine which kernel you are using. Compare your kernel version with the kernel version folders for the ioDrive drivers. If your kernel does not match any of the pre-compiled binaries, you must build the driver installation package. To do so, follow the guidelines in **the Building RPM Packages from Source** section of this guide.*

Example:

- iodrive-driver-1.2.4-1_kernel_2.6.18_53.1.14.el5.x86_64.rpm
Driver install package (driver and kernel versions may be different)
 - iodrive-util-1.2.4.-1.x86_64.rpm
Utilities package for the ioDrive (driver version may be different)
 - iodrive-firmware-1.2.4-1.noarch.rpm
Firmware package for the ioDrive (driver version may be different)
2. Change directory to where you downloaded the installation packages.
 3. Enter the following command: rpm -Uvh iodrive*.rpm

The drivers and utilities are installed to the following locations:

Drivers: /lib/modules/<kernel-version>/fusionio/

Utilities: /usr/bin

Firmware: /usr/share/fusionio/images

SNMP MIB: /usr/share/fusionio

Continue to the **Upgrade the Firmware** section below.

3.1.3 Building RPM Packages from Source

You will need to build a package from a source RPM only if the binary RPM's kernel version does not match the kernel version of your system.

Note: *Make sure you have the right download for your kernel by running the command "uname -a" at a shell prompt to determine which kernel you are using. Compare your kernel version with the kernel version folders for the ioDrive drivers. If your kernel does not match any of the pre-compiled binaries, you must build the driver installation package.*

1. Download current driver source and support packages from: <http://www.dolphinics.com/support>

2. Change directory to wherever you downloaded the source package.

3. Run the following command to build new RPMs tailored for your specific kernel:

```
$ rpmbuild --rebuild iodrive-driver-source-1.2.4-1.7.src.rpm
```

The exact file name will vary depending on the driver version.

4. If you want to build new RPMs for a non-running kernel, run:

```
$ rpmbuild --rebuild --define 'rpm_kernel_version 2.6.24.4-64.fc8-x86_64' iodrive-driver-source-1.2.4-1.7.src.rpm
```

Again, the exact names will vary depending on the software version.

Note: *A failure of this command may be due to required packages missing from the system. The output from the failed command informs you of which packages are missing.*

5. Change directory to: /usr/src/redhat/RPMS/x86_64/ for Redhat or /usr/src/packages/RPMS/x86_64/ for SUSE.

The exact directory will vary depending on the Linux version.

6. Run this command:

```
$ rpm -ivh iodrive*.rpm
```

to install the new binary RPMs. If there are problems with the new driver, copy the full system logs for assistance from Dolphin Customer Support.

3.2 Loading the ioDrive Driver

To load the ioDrive driver:

1. Run this command:

```
$ modprobe fio-driver
```

Note: *The driver will automatically load at system boot.*

The ioDrive is now available to the OS as /dev/fiox, where *x* is a letter.

2. To confirm the ioDrive is attached, use this command:

```
$ ls /dev/fio*
```

The output should include: /dev/fioa, /dev/fiob, /dev/fioc /dev/fiod /dev/fioe /dev/fiof. This shows that the block devices are attached.

3.3 Using the Logical Volume Manager

The Logical Volume Manager (LVM) volume group management application handles mass storage devices like the ioDrive if you add the ioDrive as a supported type:

1. Locate and edit the /etc/lvm/lvm.conf configuration file.
2. Add an entry similar to the following to that file:

```
types = [ "fio", 4 ]
```

The parameter "4" represents the maximum number of partitions supported by the drive. For the ioDrive, this can be any number from 1 upwards. Do NOT set this parameter to 0.

3.4 Configuring RAID

You can configure two or more ioDrives into a RAID array using standard Linux procedures.

Note: *If you are using RAID1/Mirrored and one device fails, be sure to run fio-format on the replacement device (not the existing good device) before rebuilding the RAID.*

3.4.1 RAID0/Striped

Enter the command:

```
$ mdadm --create /dev/md0 --chunk=4 --level=0 --raid-devices=6 /dev/fioa /dev/fiob /dev/fioc /dev/fiod /dev/fioe /dev/fiof
```

to create a striped set where fiox are the six ioDrives you want to stripe. Use fio-status to view your specific names. This is the suggested configuration for optimal storage and performance.

3.4.2 RAID1/Mirrored

Enter the command:

```
$ mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/fioa /dev/fiob
```

to create a mirrored set using the two ioDrives fioa and fiob. Again, use fio-status to view your specific names.

3.4.3 RAID10

Enter the command:

```
$ mdadm --create /dev/md0 -v --chunk=256 --level=raid10 --raid-devices=4 /dev/fioa /dev/fiob /dev/fioc /dev/fiod
```

to create a RAID10 array using four ioDrives: fioa, fiob, fioc, and fiod. (Use fio-status to view your specific names.)

3.5 ioDrive Maintenance

The ioDrive includes both software utilities for maintaining the device as well as external LED indicators to display its status.

3.5.1 ioDrive LED Indicators

The ioDrive includes three LEDs showing drive activity or error conditions.



Green	Yellow	Amber/ Red*	Indicates	Notes
OFF	OFF	OFF	Power off	
ON	OFF	ON	Power on (driver not loaded)	Load driver
ON	OFF	OFF	Power on (driver loaded)	
ON	FLASH	OFF	Writing (rate indicates volume of writes)	Can appear in combination with the Read LED

FLASH	OFF	OFF	Reading (rate indicates volume of reads)	Can appear in combination with the Write LED
ON	ON	ON	Location beacon	Also appears during a firmware update

* Later versions of the ioDrive use an amber-colored LED instead of a red LED.

3.5.2 The ioManager Console

Your ioDrive software includes the ioManager console application. This GUI performs the most common operations you need to do with the ioDrive. In addition, it provides a detailed information screen on each of your installed devices.

The ioManager can perform:

- Firmware upgrades
- Low-level formatting
- Attach and detach actions

The ioManager installs as an RPM or .deb. Details on how to use ioManager appear in the *ioManager User Guide* available at <http://www.dolphinics.com/support>.

3.5.3 Maintenance Tasks

The following are the most common tasks for maintaining your ioDrive using the command line utilities. You can also use the ioManager GUI console to do firmware upgrades as well.

Note: All commands require administrator privileges. Log in as "root" or use `sudo` to run the commands.

3.5.3.1 Upgrading Software RPMs

To upgrade the ioDrive RPMs:

1. If you have not done so, download the new driver RPM from the <http://www.dolphinics.com/support> site.
2. Remove the old RPMs (if installed):

```
$ rpm -e iodrive-driver iodrive-firmware iodrive-util
```

3. Install the new RPMs:

```
$ rpm -ivh iodrive-driver-1.2.4-1.x86_64.rpm iodrive-firmware-1.2.4-1.noarch.rpm iodrive-util-1.2.4-1.x86_64.rpm
```

Note: The actual names of the files may be different for each release.

3.5.3.2 Upgrading the ioDrive Driver

To upgrade the ioDrive driver:

1. If you have not done so, download the new driver (RPM or DEB) from <http://www.dolphinics.com/support>.
2. Run this command:

```
$ rpm -Uvh ioDrive-driver*.rpm OR  
$ dpkg -i iodrive-driver*.deb
```

to upgrade the driver.

Note: Read both the release notes and the errata files that come with each new release as well as these installation instructions to ensure no loss of data when performing upgrades.

3.5.3.3 Upgrading the ioDrive Firmware

Caution: You should upgrade the firmware only if there is a problem due to out-of-date firmware or if instructed to do so by Dolphin Customer Support.

Warning: It is extremely important that the power **not be turned off** during a firmware upgrade. Power loss during a firmware upgrade could cause device failure. Consider adding a UPS to the system prior to performing a firmware upgrade to prevent this from happening.

Caution: You should back up the data on the ioDrive prior to any upgrade as a precaution.

Caution: The default action of the `fio-update-iodrive` utility (without using the `-s` option) is to upgrade all ioDrive devices with the updated firmware in the `<iodrive_version>` file. Confirm that all devices need the upgrade prior to running the update. If in doubt, use the `-p` (Pretend) option with the `fio-update-iodrive` utility to view the possible results of the update..

To upgrade the firmware on the ioDrive:

1. If you have not done so, download the latest ioDrive firmware and drivers from <http://www.dolphinics.com/support>.
2. Unmount any mounted filesystems.
3. Detach the ioDrive with the command:

```
$ fio-detach <ioDrive-device>
```

where `<ioDrive-device>` is the name of the device you want to upgrade. Use the `fio-status` utility or the ioManager GUI to view this name.

4. Remove the old drivers:

```
$ modprobe -r fio-driver
```
5. If you are using RPMs, uninstall the old drivers:

```
$ rpm -e ioDrive-driver
```

6. Reboot the system. This ensures a clean firmware update.

7. Install the new driver and firmware:

```
$ rpm -ivh iodrive-driver-1.2.4-1.x86_64.rpm iodrive-firm-  
ware-1.2.4-1.noarch.rpm
```

OR

```
$ dpkg -i iodrive-driver*.deb iodrive-firmware*.deb
```

8. To update all your installed ioDrives, run the following command:

```
$ /usr/bin/fio-update-iodrive /usr/share/fusionio/  
images/iodrive_version.fff
```

where version is the numerical version of the driver)

9. To update only a specific ioDrive, use the `-s` parameter with the `fio-update-iodrive` utility:

```
$ /usr/bin/fio-update-iodrive /usr/share/fusionio/images/  
iodrive_version.fff -s fi0x
```

where `fi0x` is the name of your specific device.

Caution: Use the `-s` option with care, as updating the ioDrive in the wrong slot could damage your device.

Note: All three external LED indicators will light during the update process.

10. Power down and restart the computer.

Note: When upgrading from firmware for driver versions 1.1 or older, you must power the system all the way down and bring it all the way back up. The upgrade process requires a shutdown and restart for the firmware load to complete on the ioDrive.

Note: When upgrading to a new major version (ex: 1.0 to 2.0), it may require a low-level format to bring the ioDrive back online. Please see the release notes for details to ensure data integrity.

3.5.3.4 Unloading the ioDrive Driver

To unload the ioDrive driver, run the command:

```
$ modprobe -r fio-driver
```

3.5.3.5 Uninstalling the ioDrive Driver Package

To uninstall the ioDrive driver package, run the command:

```
$ rpm -e iodrive-driver
```

OR

```
$ dpkg -r iodrive-driver
```

3.5.3.6 Uninstalling the ioDrive Utilities

To uninstall the ioDrive utilities, run the command:

```
$ rpm -e iodrive-util iodrive-snmpp
```

OR

```
$ dpkg -r iodrive-util iodrive-snmpp
```

3.5.4 Unmanaged Shutdown Issues

Unmanaged shutdowns due to power loss or other circumstances will force the ioDrive to perform a consistency check during the reboot. This may take several minutes or more to complete and is shown by a progress percentage during startup.

Although data written to the ioDrive will not be lost due to unmanaged shutdowns, important data structures may not have been properly committed to the drive. This consistency check repairs these data structures.

3.5.5 Disabling Auto-Attach

The ioDrive driver automatically loads and attaches all installed ioDrives to the operating system by default. (If the ioDrive does not attach, it will not be available to applications or users.) You can disable auto-attach to assist in troubleshooting or diagnostics.

To disable auto-attach:

1. Append the following parameter at the kernel command line of your boot loader:
`iodrive=0`
2. Reboot Linux. The ioDrive driver won't load, so the device won't be available to users, but all other services and applications will now be available. Use either the `fio-attach` utility or the ioManager GUI to attach the drive to the operating system.

Proceed with troubleshooting to correct the problem. If the problem is outdated firmware, use `iodrive=1` to place the driver in minimal mode. You can then use `fio-update-iodrive` to update the firmware. To restore the auto-attach, remove the `iodrive=0` parameter.

3.6 Command Line Utilities Reference

The ioDrive packages include various command line utilities. These provide a number of useful ways to access, test, and manipulate your device. They include:

Utility	Purpose
<code>fio-attach</code>	Makes an ioDrive available to the OS
<code>fio-detach</code>	Temporarily removes an ioDrive from OSaccess

Utility	Purpose
fiio-format	Used to perform a low-level format on an ioDrive
fiio-status	Displays information about the device
fiio-update-iodrives	Updates the ioDrive's firmware

Note: Each utility has *-h* (for Help) and *-v* (for Version) options.

fiio-attach

Description

Attaches the ioDrive and makes it available to the operating system. This creates a block device in /dev named *fiiox* (where *x* is a, b, c, etc.). You can then partition, format, or set up the ioDrive as part of a RAID array. The command displays a progress bar and percentage as it operates.

Note: In most cases, the ioDrive driver automatically attaches the device on load. You only need to run *fiio-attach* if you ran *fiio-detach* or if you create and set the ioDrive's *AutoAttach* parameter in the Module Parameters section to 0.

Syntax

```
fiio-attach <iodrives-device> [-q, -h, -v]
```

where *<iodrives-device>* is the name of the device node (/dev/*fiio**x*), where *x* indicates the board number: 0, 1, 2, etc. For example, /dev/*fiio*0 indicates the first ioDrive installed on the system.

Option

-q Quiet: disables the display of the progress bar and percentage.

fiio-detach

Description

Detaches and removes the corresponding /dev/*fiio**x* ioDrive block device. The *fiio-detach* command will wait until the device completes all read/write activity before executing the detach process. The command displays a progress bar and percentage as it completes the process.

Caution: Before using this utility, ensure that the device you want to detach is not currently mounted and in use.

Syntax

```
fiio-detach <device-node> [-i, -q, -h, -v]
```

where <device-node> is the name of the device node such as /dev/fctx where *x* indicates the device number: 0, 1, 2, etc. For example: /dev/fct0. You can also reference the same device as fct0.

Options

- i** Immediate: Causes a forced immediate detach (does not save metadata)
- q** Quiet: Runs the Detach process without displaying the progress bar or percentage.

fio-format

Description

Performs a low-level format of the ioDrive. (This format is distinct from a format performed by the operating system.) The fio-format utility displays a progress bar and percentage as it completes the format.

Note: *The ioDrive ships pre-formatted and does not require the use of fio-format except to change the logical size of the device.*

Caution: *Use this utility with care, as it deletes all user information on the ioDrive.*

Syntax

```
fio-format <ioDrive-device> [-q, -s <device-size>, -f, -u, -h, -v]
```

where <ioDrive-device> is the block device name (fctx) where *x* indicates the device number (0, 1, 2, etc). For example: fct0..

Options

- q** Quit on erase error.
- s** <device-size> Sets the storage size by a number and one of the following units as a suffix:
- % Percentage of drive for user data
 - t/T Number of terabytes to format
 - g/G Number of gigabytes to format
 - m/M Number of megabytes to format
- For example, setting the size as either 90% or 72GB on an 80GB ioDrive both result in the same capacity for user data—72GB.
- u** Quiet: Disables the display of the progress bar or percentage.

fio-status

Description

Provides detailed information about the specified or all installed ioDrive(s) – either `fctx` or `fiox` devices. The `fio-status` command must run with root privileges and requires that the driver be loaded. If it finds no device, it displays an index number instead.

Syntax

```
fio-status </dev> [-c, -a, -h, -v]
```

where <dev> is name of the device. If you don't specify a name, `fio-status` displays information on all installed ioDrives.

Options

- c Count: Report only the number of ioDrives installed.
- a All: Print all available information for each device. The fio-status command displays the following information:
 - Serial number
 - Part number
 - Manufacturer's name
 - Manufacturing date
 - Firmware version at manufacturing time
 - Size of the device, out of total capacity
 - NAND manufacturer
 - NAND cell type (SLC, MLC, or unknown)
 - Size of the device in blocks
 - Size of a block in pages
 - Size of a page in bytes (including ECC overhead)
 - Number of pads, planes and banks
 - Size of an ECC-protected unit (including check-bit overhead)
 - FPGA ID
 - Hardware UID
 - Bus ID
 - Vendor ID
 - Subsystem vendor and device IDs
 - Device ID
 - PCI slot number
 - Internal temperature (avg. and max., since driver load) in degrees Centigrade
 - Ambient temperature, in degrees Centigrade
 - Internal voltage: avg. and max.
 - Auxiliary voltage: avg. and max.
 - Health status: *Healthy*, *Marginal*, or *Degraded*, based on the percentage of good erase blocks on the device
 - Percentage of good data
 - Percentage of good blocks
 - Percentage of good metadata
 - Subsystem Vendor and Device IDs

Sample Output

The fio-status command alone displays abbreviated information on all installed ioDrives:

```
fio-status
Found 2 ioDrives in this system.
Fusion-io driver version: 1.2.4.3

fct0 Attached to /dev/fioa (block device)
      ioDimm3 SN:0719 Firmware v11791
      92 GBytes unformatted capacity.

fct1 Not attached
      ioDimm3 SN:0299 Firmware v11791
      154 GBytes unformatted capacity.
```

The fio-status command with the -a parameter and no device name displays all the information available on every installed ioDrive.

```
fio-status -a

Found 2 ioDrives in this system.
Fusion-io driver version: 1.2.4.3
```

```

fct0    Attached to /dev/fioa (block device)
        ioDimm3 SN:0719 PN:001195011, Mfr:000 Date:20080709
        Firmware v11791
        92 GBytes, 8192 blocks, 256 pages, 47264 bytes/page (25
pads, 1 plane, 4 banks)
        Nand: Samsung (ec) SLC
        Error correction: 11 bits per 240 bytes, retire above 4
bits
        FPGA ID:000 UID:0000000002cf01326845000048f00c00
        PCI: 02:00.0, Slot Number:2 Vendor ID: laed Device ID:
1003
        Ambient temperature: 40 degC
        Internal temperature: avg 44.3 degC, max 50.7 degC
        Media status: healthy. 99.78% blocks good. data:99.77%
good, md:100%

fct12   Not attached
        ioDimm3 SN:0299 PN:001160002, Mfr:AEMS Date:20080724
        Firmware v11791
        154 GBytes, 8192 blocks, 256 pages, 78848 bytes/page (20
pads, 1 plane, 4 banks)
        Nand: Samsung (ec) SLC
        Error correction: 11 bits per 240 bytes, retire above 4
bits
        FPGA ID:xc5vlx110t-ff1136-1
        UID:00000000012b01326854000046cd0801
        PCI: 03:00.0, Slot Number:3 Vendor ID: laed Device ID:
1001
        Ambient temperature: 34 degC
        Internal temperature: avg 37.9 degC, max 42.8 degC
        Media status: healthy. 99.87% blocks good. data:99.82%
good, md:100%

```

fio-update-iodrive

Description

Updates the ioDrive's firmware. This utility scans the PCIe bus for all attached ioDrives and updates them. Each ioDrive displays a progress bar and percentage as the update completes. To update one or more specific devices, use the -d option along with the device number (shown in fio-status) if the driver is loaded or the -s option along with the PCI bus address (viewed using lspci) if the driver is unloaded, to identify which device to update.

Caution: *The default action (without using the “-d” option) is to upgrade all ioDrive devices with the updated firmware contained in the <iodrive_version>. Confirm that all devices need the upgrade prior to running the update. If in doubt, use the -p Pretend option to view the possible results of the update.*

Syntax

```
fio-update-iodrive <iodrive_version> [-d, -f, -l, -p, -q, -h, -v]
```

where `<iodrive_version>` is the path and firmware archive file provided by Dolphin. The default path is `/usr/share/fusionio/images`.

Options

- d** Updates the specified device. Use `/fctx` where `x` is the number of the device shown in `fio-status`.
- f** Force Upgrade (Also used to perform a rollback to an earlier firmware version.)
- l** List firmware available in the archive.
- p** Pretend: Show what updates would be done (the firmware is not modified).
- q** Runs the update process without displaying the progress bar or percent completed.
- s** Updates the devices in the specified slots using '*' as a wildcard for devices. The slots are identified in the following PCIe format (as shown in `lspci`):

```
[[[<domain>]:]<bus>:][<slot>][.[<func>]]
```

Caution: Use the `-d` or `-s` option with care, as updating the wrong ioDrive could damage your device.

Caution: Use the `-f` option with care, as forcing an upgrade could damage your device.

Note: All three external LED indicators will light during the update process.

3.7 Setting up SNMP

The `fio-snmp-agentx` SNMP agent is an RFC 2741-compliant AgentX sub-agent. (Optionally, you can use any RFC-compliant SNMP agent.) The master SNMP agent will defer queries to `fio-snmp-agentx` for supported MIBs.

3.7.1 SNMP Master Agent

The `fio-snmp-agentx`, provided in the `iodrive-util` package, requires an already-installed SNMP master agent. The SNMP master agent must support and be configured for AgentX connections (see <http://www.irtf.org/rfc/rfc2741.txt>). The `fio-snmp-agentx` is tested and verified with `net-snmp`, which is the typical SNMP agent provided with most Linux distributions.

There are many agents available that support this functionality. If you choose to use `net-snmp`, then use the instructions in the following sections to configure and launch it.

3.7.1.1 Launching the SNMP Master Agent

Install the net-snmp package using the package manager for your version of Linux.

Red Hat/Fedora/CentOS

Use the following command to install Net-SNMP on Red Hat/Fedora/CentOS:

```
yum install net-snmp
```

Debian/Ubuntu

Use the following command to install Net-SNMP on Debian/Ubuntu:

```
apt-get install snmpd
```

Other Linux Versions

Use the standard system package manager to install the Net-SNMP package on your Linux distribution. The Linux ioDrive installer places three MIB files in `/usr/share/fusionio`: the default `fioIoDrv.MIB`, `cpqIODrv.mib` for HP systems, and `HPNSASCSI-MIB.txt`.

3.7.1.2 Configuring the Master Agent

Configure the Net-SNMP master agent daemon to set the network communications parameters, security, and other options using the `snmpd.conf` text file. The location of this file is system-dependent; often it is in `/etc/snmp` or `/usr/share/snmp`.

A simple `snmpd` configuration file might include the following:

```
# set standard SNMP variables
syslocation "Data room, third rack"
syscontact itguy@example.com

# required to enable the AgentX protocol
master agentx
agentxsocket tcp:localhost:705

#set the port that the agent listens on (defaults to 161)
agentaddress 161

# simple access control (some form of access control is required)
rocommunity public
```

3.7.1.3 Running the Master Agent

Once you install and configure the master agent, you must start or restart the `snmpd` daemon for the new parameters to take effect. You can simply run `snmpd` from its installed location (often `/usr/sbin` - see the `snmpd` man page for options). It will typically need root privileges to run properly. You can also use the `snmpd` startup script

in `/etc/init.d` or `/etc/rc.d/init.d`. If you are concerned about security, use the more advanced SNMPv3 access control instead of the `rocommunity` and `rwcommunity` access control directives as outlined in the relevant man page.

3.7.2 Running and Configuring the Fusion-io SNMP Subagent

Configure the subagent by creating a `fio-snmpp-agentx.conf` file. Store this conf file in the directory where the `snmpd.conf` file is located for the master agent. At a minimum, set the agent network parameters in this file similar to the following:

```
# required to enable the AgentX protocol
agentxsocket tcp:localhost:705
```

This must match the AgentX network parameters in the `snmpd.conf` file for the master agent. For further AgentX configuration information, please consult the man pages or visit <http://www.net-snmp.org>.

Once the SNMP master agent is started, you can start the subagent by running the command:

```
/usr/bin/fio-snmpp-agentx.exe -c <Path to Net-SNMP config file>
```

where the `-c Path` parameter includes the name and location of the subagent's `.conf` file. For example, the command:

```
/usr/bin/fio-snmpp-agentx.exe -c /usr/snmp/fio-snmpp-agentx.conf
```

would launch the ioDrive subagent using the Net-SNMP configuration file "`fio-snmpp-agentx.conf`" found in the `/usr/snmp` directory. Once you launch the subagent, you can now view your ioDrive management information using an SNMP MIB browser or by using a network management system accessing `cpqIODrv.mib` or `HPNSASCSI-MIB`.

3.7.2.1 Subagent Log File

The ioDrive SNMP subagent can maintain a log file regarding its own activities. This file is separate from the MIB as it includes entries on the subagent's communications with the master agent including any errors or intermittent issues.

To have the subagent maintain this log file, include the `-l` parameter and a path to the log file as part of the command in running the subagent. For example, the command:

```
fio-snmpp-agentx.exe /usr/snmp/fio-snmpp-agentx.conf -l /usr/snmp/subagent.log
```

would keep the subagent log file in the file `subagent.log` in the directory `/usr/snmp`.

Your ioDrive's SNMP subagent is now ready to monitor your device.