



PCIe Flash Drive FlashMAX2&3

User's Guide

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Preface

This document describes how to use the PCIe Flash Drive.

This preface includes the following information:

- ☐ [Intended Audience](#)
- ☐ [Product Version](#)
- ☐ [Release Notes](#)
- ☐ [Document Organization](#)
- ☐ [Referenced Documents](#)
- ☐ [Document Conventions](#)
- ☐ [Convention for storage capacity values](#)
- ☐ [Getting Help](#)
- ☐ [Comments](#)

Notice: The use of PCIe Flash Drive and all other Hitachi Data Systems products is governed by the terms of your agreement(s) with Hitachi Data Systems.

Intended Audience

This document is intended for the personnel who are involved in planning, managing, and performing the tasks to prepare your site for PCIe Flash Drive installation and to install the same.

This document assumes the following:

- The reader has a background in hardware installation of computer systems.
- The reader is familiar with the location where the PCIe Flash Drive will be installed, including knowledge of physical characteristics, power systems and specifications, and environmental specifications.

Product Version

This document revision applies to PCIe Flash Drive Series.

Release Notes

Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document.

Document Organization

The table below provides an overview of the contents and organization of this document. Click the chapter title in the left column to go to that chapter. The first page of each chapter provides links to the sections in that chapter.

Chapter	Description
Chapter 1. Product Overview	Describes the PCIe Flash Drive overview.
Chapter 2. Installing Flash Drive	Describes how to install the Flash Drive.
Chapter 3. Driver and Utility	Describes how to install the driver and utility for the Flash Drive on Windows Server, Red Hat Enterprise Linux, or ESXi.
Chapter 4. Specifications	Describes the various specifications of the Flash Drive.

Referenced Documents

There are no referenced documents.

Document Conventions

This document uses the following typographic conventions:

Convention	Description
Regular text bold	In text: keyboard key, parameter name, property name, hardware labels, hardware button, hardware switch. In a procedure: user interface item
<i>Italic</i>	Variable, emphasis, reference to document title, called-out term
Screen text	Command name and option, drive name, file name, folder name, directory name, code, file content, system and application output, user input
< > (angled brackets)	Variable (used when italic is not enough to identify variable).
[] (square bracket)	Optional values
{ } braces	Required or expected value
vertical bar	Choice between two or more options or arguments
_(underline)	Default value, for example, [<u>a</u>] b]

This document uses the following icons to draw attention to information:

Icon	Meaning	Description
	WARNING	This indicates the presence of a potential risk that might cause death or severe injury.
	CAUTION	This indicates the presence of a potential risk that might cause relatively mild or moderate injury.
NOTICE	NOTICE	This indicates the presence of a potential risk that might cause severe damage to the equipment and/or damage to surrounding properties.
	Note	This indicates notes not directly related to injury or severe damage to equipment.
	Tip	This indicates advice on how to make the best use of the equipment.

Convention for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 kilobyte (KB)	1,000 (10^3) bytes
1 megabyte (MB)	1,000 KB or $1,000^2$ bytes
1 gigabyte (GB)	1,000 MB or $1,000^3$ bytes
1 terabyte (TB)	1,000 GB or $1,000^4$ bytes
1 petabyte (PB)	1,000 TB or $1,000^5$ bytes
1 exabyte (EB)	1,000 PB or $1,000^6$ bytes

Logical storage capacity values (for example, logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 KB	1,024 (2^{10}) bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes

Getting Help

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: <https://portal.hds.com>

Comments

Please send us your comments on this document: doc.comments@hds.com. Include the document title and number including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Data Systems Corporation.

Thank you!

Product Overview

This chapter gives an overview of the Flash Drive (abbreviated hereafter to Flash Drive).

- ☐ [Features](#)
- ☐ [Supported OSs](#)
- ☐ [Restrictions](#)
- ☐ [Checking Package](#)

Features

This product can be installed to the PCI Express (abbreviated hereafter to PCIe) slot of a system unit. It comes with the following features.

- SSD (Solid State Drive) with high performance equal to DRAM
- Storage capacity comparable to HDD (1.1 TB, 2.2 TB, 4.8 TB)

Supported OSs

The Flash Drive supports the following 64-bit OSs.

- Windows Server 2012 R2
- Red Hat Enterprise Linux
- VMware vSphere ESXi™

Restrictions

1. Endurance (maximum rewrite capacity) specifications

Some restrictions on rewrite capacity apply to the Flash Drive. Although the Flash Drive uses non-volatile memory, there is a possibility of data loss due to the natural electric discharge if it is not powered on for an extended period of time. Refer the retention period with the below table.

Specification		HGST 1.1TB PCIe Flash Drive	HGST 2.2TB PCIe Flash Drive	HGST 4.8TB PCIe Flash Drive
Maximum rewrite capacity		4PB	8PB	30PB
Rewrite frequency	2TB/day	5.5 years	11 years	41 years
	5TB/day	2.2 years	4.4 years	16 years

When the Flash Drive reaches its maximum rewrite capacity, a paid-for replacement is required even if the product is still within its warranty period. Because the rewrite frequency depends on your usage, choose a capacity that suits your usage needs. Also, check the remaining rewrite capacity regularly and determine the time for replacement (data migration).

- Flash Drive endurance (maximum rewrite capacity) monitoring:

When the maximum rewrite capacity is reached, the Flash Drive enters the rewrite suppression mode (Read Only mode). So, it is necessary to monitor the remaining rewrite capacity regularly and perform data migration and replacement before the drive enters the Read Only mode.

Using the utility command vgc-monitor of the Flash Drive:

You can use the utility command vgc-monitor on RHEL or Windows to check the current remaining rewrite capacity. The vgc-monitor command outputs "Remaining Life: xx.xx%" which indicates in percentage the remaining rewrite capacity divided by the maximum rewrite capacity (xx.xx PB). (The factory default is 96% to 100%).

For how to use the vgc-monitor command on RHEL, Windows, or ESXi, see the following.

RHEL: vgc-monitor -d /dev/vgcx
Windows: vgc-monitor -d vgcx
ESXi: /opt/vgc/bin/vgc-monitor -d vgcx

To find **x** in vgcx above, use the following command.

RHEL, Windows: vgc-monitor
ESXi: /opt/vgc/bin/vgc-monitor



For PCI slots with Flash Drives installed, their buses are assigned letters in the following order: vgca, vgcb, vgcc, ...

vgc-monitor -d output example

```
[root@spa05]# vgc-monitor -d /dev/vgca
vgc-monitor x.x(xxxxx.xx)
Driver Uptime:xx:xx
Card Name      Num Partitions  Card Type      Status
vgca           1                HIT-MX-LP-XXXX-XX  Good

    Serial Number      :xxxxxxxx
    Card Info          :Part:SJTxxxxxx
                      Rev:FlashMAX xxxxx,x8 Gen2

Temperature      :xxC(Safe)
Temp Throttle     :Inactive
Card State Details :Normal
Action Required   :None

    Partition  Usable Capacity  RAID
    vgca0     xxxxxGB      enabled
    Mode      :maxcapacity
    Total Flash Bytes :xxxxxxxxxxxxxxxx (xx.xxTB) (reads)
                  xxxxxxxxxxxxxxxxxxx (xx.xxTB) (writes)

    Remaining Life    :xx.xx%
    Partition State   :READY
    Flash Reserves Left :xx.xx%
```

2. Retention (maximum power-off duration) specification

Although the Flash Drive uses non-volatile memory, there is possibility of data loss due to the natural electric discharge if it is not powered on for an extended period of time. Refer the retention period with the below table.

Remaining write capacity	90%	67%	50%	0%
Retention (maximum power-off duration)	5 years	18 months	9 months	3 months

As the remaining write capacity decreases, the duration that data can be kept without power becomes shorter. So, even when the device is stored, turn on the server once every 3 months.

3. System memory requirement

Even though the driver of the Flash Drive manages NAND-type flash, it uses system memory (RAM). Apart from the memory required for the OS and applications, the driver requires 3 GB for each 1 TB of Flash Drive memory.

#	HGST 1.1TB PCIe Flash Drive	HGST 2.2TB PCIe Flash Drive	HGST 4.8TB PCIe Flash Drive
Required memory	3 GB or more	6 GB or more	12 GB

4. Regular backup

To protect against data loss, regularly back up data on the Flash Drive to an auxiliary storage device. All data on the Flash Drive may be lost if the drive is damaged.

5. Booting

The Flash Drive cannot function as a boot device.

6. Unanticipated shutdown

If an unanticipated shutdown occurs because of external factors such as power cut, when the device restarts, data integrity is checked mandatorily. The integrity check may take anywhere from a few minutes up to 10 minutes. (When the OS starts, the progress information appears, as an increasing percentage.) Note that while no data written to the Flash Drive will be lost as a result of this unanticipated shutdown, data access is not possible while the integrity check is still in progress.



When an unexpected shutdown occurs, a loading.lock file may be created for security by Red Hat Enterprise Linux Server or ESXi, for which the Flash Drive driver cannot be temporarily downloaded. If so, remove the loading.lock file to load the driver.

7. Brackets

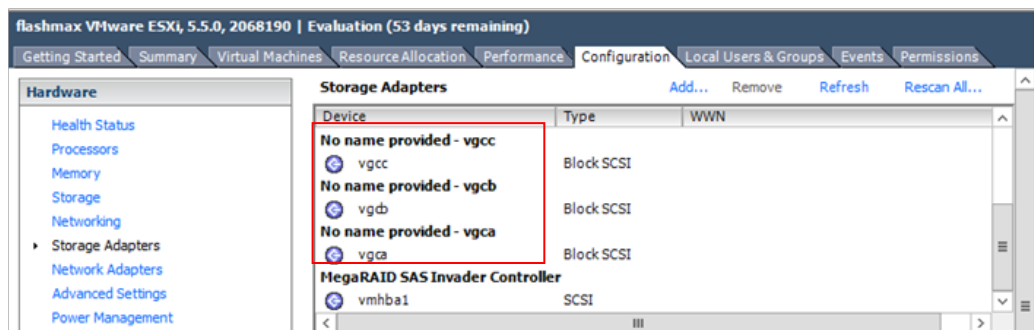
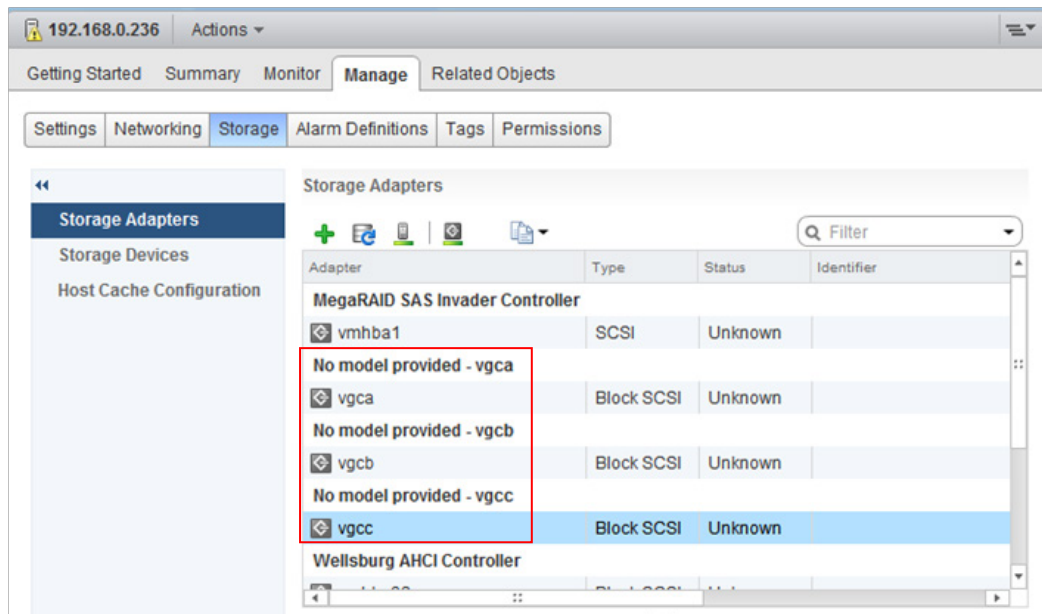
Two types of support brackets are available: standard or low profile. Either one of them can be used.

8. Restrictions in the rescue mode of Red Hat Enterprise Linux Server

When the Red Hat Enterprise Linux Server enters rescue mode, the Flash Drive cannot be recognized. If you want to operate the Flash Drive during system maintenance, wait until system recovery in rescue mode is finished. Then, move to the single user mode and operate the drive.

9. Restrictions on VMware vSphere ESXi5.5

On VMware vSphere ESXi5.5 Web Client, the Flash Drive is shown as "No model provided - vgcx"; on VMware vSphere ESXi5.5 Client, it is shown as "No name provided - vgcx." It is just because of the view on ESXi5.5. Since "vgcx" is a unique name for this card, you can identify the Flash Drive.



10. Changing OS

If you want to change the OS of the device where the Flash Drive is installed, first use the utility for the Flash Drive to format it at a low level, and then change the OS (such as changing from Windows to RHEL).

Checking Package

Before using the Flash Drive, read the accessory list that comes with the drive. Make sure all items on the list are included. If there are any items missing, contact your local dealer.

Installing Flash Drive

This chapter describes how to install the Flash Drive.

- [Adding, Removing, or Replacing Flash Drive](#)
- [External View](#)

Adding, Removing, or Replacing Flash Drive

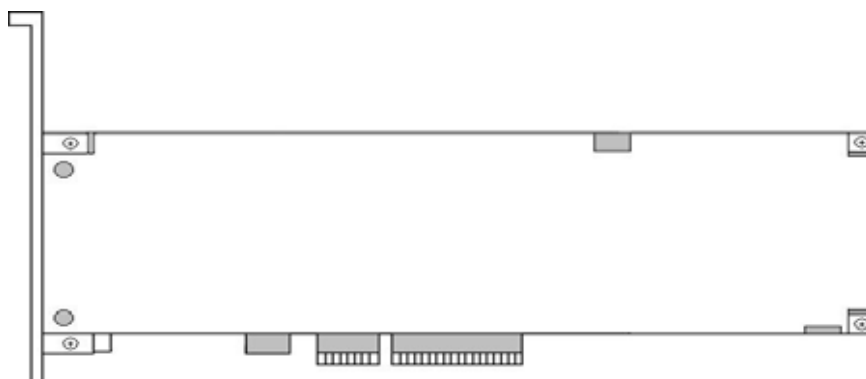


Do not remove the device's cover. Also, do not install or remove any internal option. Because the system device contains components of high density, if you are not familiar with the operation, you may be injured or the device may become faulty.

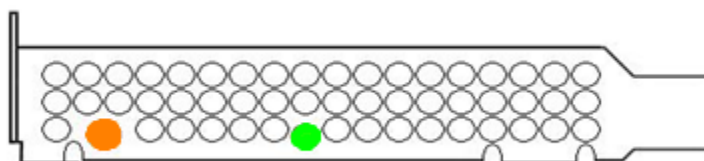
Maintenance personnel must be employed to add, remove, or replace a Flash Drive. If you need to add, remove, or replace an option, contact your local dealer or maintenance personnel.

External View

- Front view



- Face plate



Driver and Utility

This chapter describes how to install the driver and utility for the Flash Drive on Windows Server, Red Hat Enterprise Linux, and ESXi.

- ☐ [Installing Flash Drive Driver and Utility \(Windows 2012 R2\)](#)
- ☐ [Installing Flash Drive Driver and Utility \(RHEL\)](#)
- ☐ [Installing Flash Drive Driver and Utility \(ESXi\)](#)
- ☐ [RAID Configuration](#)
- ☐ [Flash Drive Utility \(Windows 2012 R2\)](#)
- ☐ [Flash Drive Utility \(RHEL\)](#)
- ☐ [Flash Drive Utility \(ESXi\)](#)

Installing Flash Drive Driver and Utility (Windows 2012 R2)

This section describes how to install the driver and utility for the Flash Drive on Windows 2012.

Installing driver and utility



If older driver and utility are installed, see [Uninstalling driver and utility](#) on page 3-10 to uninstall them.



If you have used the “Driver & Utility DVD” to install an OS with the Flash Drive installed, then the driver and utility for the Flash Drive have also been installed. In this case, skip to [Format the drive \(Use FlashMAX III Manager\)](#) on page 3-5.

1. Copy the driver and utility package

(1) Insert the “PCIe Flash Drive FlashMax2&3 Driver and Utility Install Kit” CD in the DVD or CD drive. From the Windows2012R2 directory, copy the following file to any directory you like.

Virident_FlashMAX_ III -x.x.x.xxxxx.msi

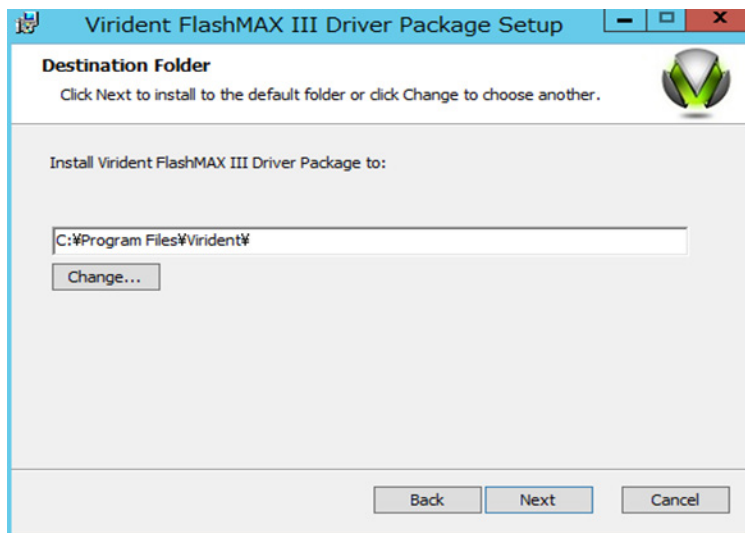
2. Install the driver and utility

(1) From the current directory of the copied file, double-click **Virident_FlashMAX_ III -x.x.x.xxxxx.msi**.

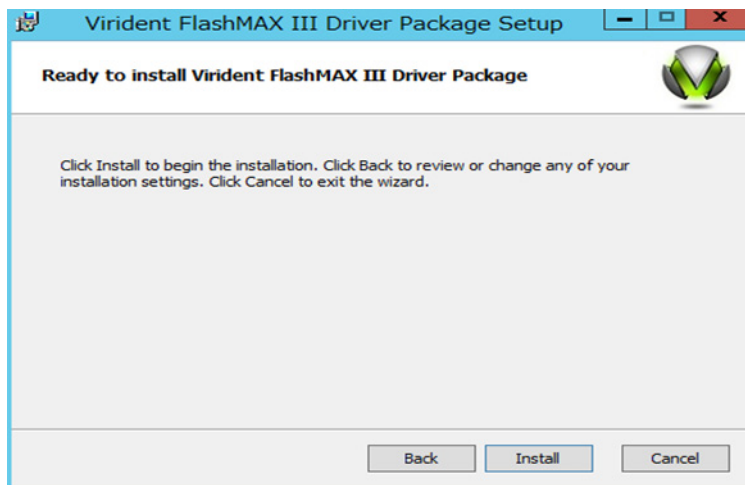
(2) When Virident FlashMAX III Driver Package Setup dialog box appears, click **Next**.



(3) When Destination Folder dialog box appears, click **Next**.



(4) When Ready to install Virident FlashMAX III Driver Package dialog box appears, click **Install**.



(5) When Completed the Virident FlashMAX III Driver Package Setup Wizard dialog box appears, click **Finish**.



(6) Restart the system.

3. Format the drive (Use FlashMAX III Manager)

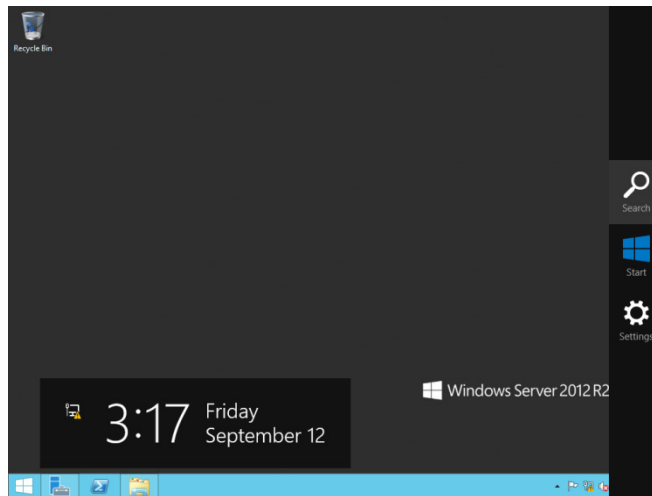
If this is a new Flash Drive or if you want to clear the user data, always use the following procedure to format the drive. Formatting is done at a low level on the Flash Drive and is different from the formatting performed by the OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write requirements, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

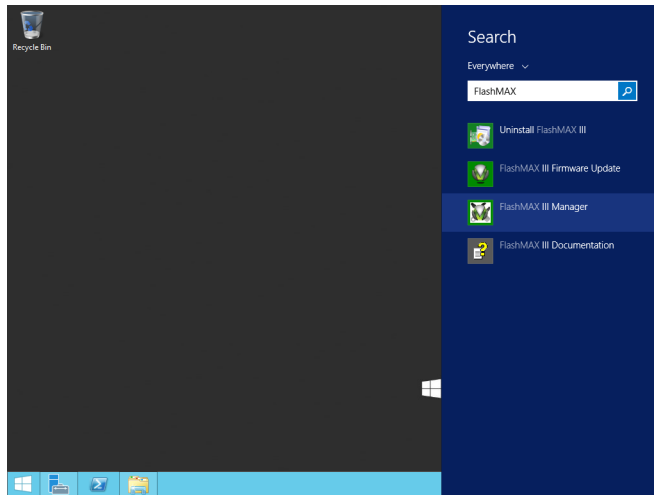


To format a Flash Drive, the Flash Drive needs to be online. Click **Start > Administrative Tools > Computer Management > Storage > Disk Management** to open the window, set the Flash Drive online.

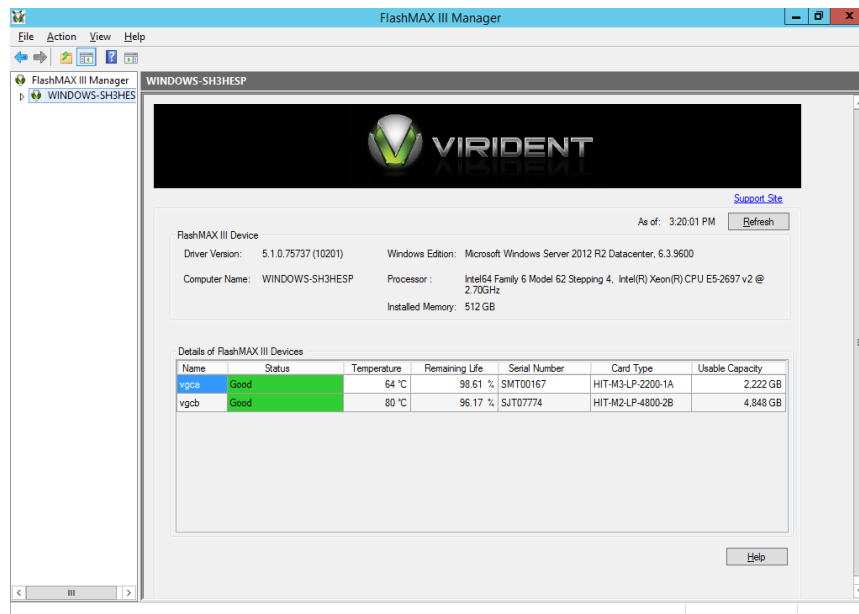
(1) Click the **Search** icon which may be located at the top or bottom right of the screen.



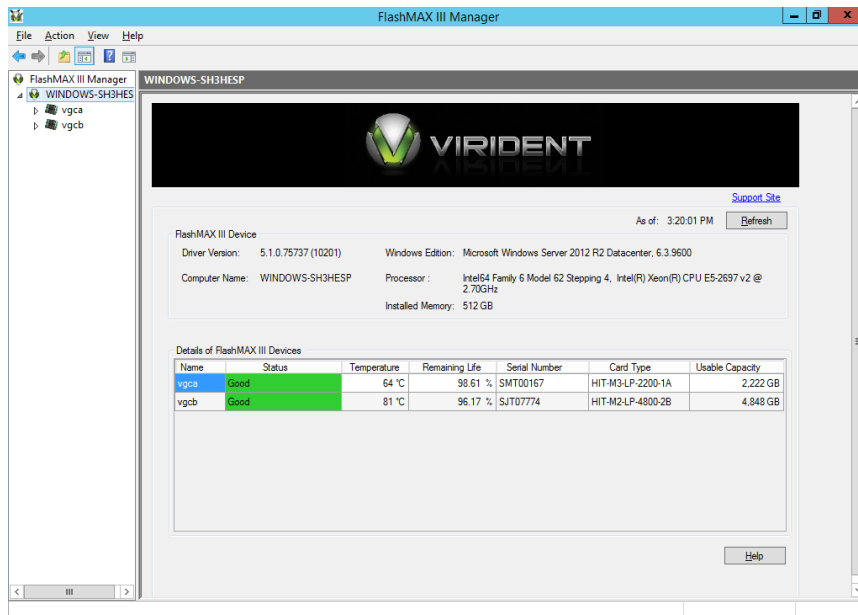
(2) Enter **FlashMAX** to search and then click **FlashMAX III Manager**.



(3) FlashMAX III Manager starts. From the console tree in the left pane, double-click **FlashMAX III Manager** to display the computer name.

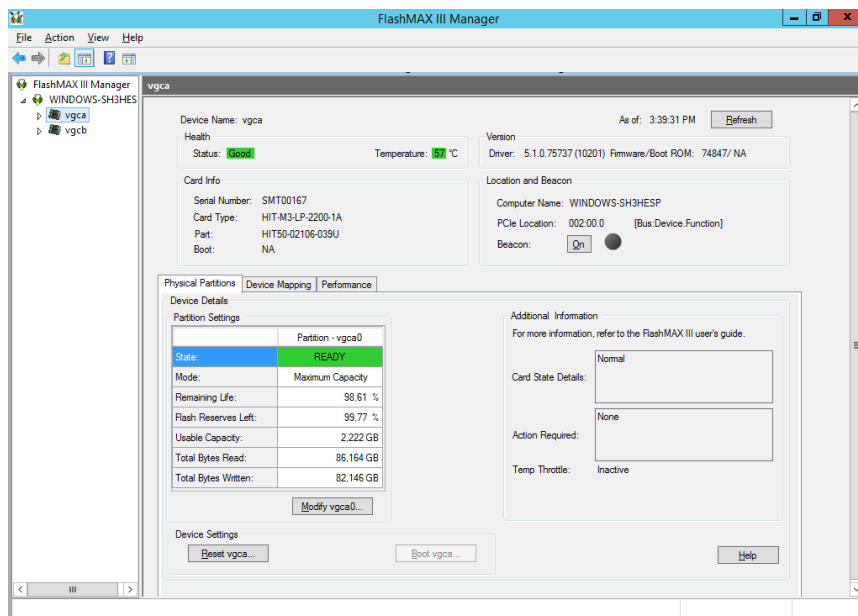


(4) Double-click the computer name to display the Flash Drives as indicated by vgcx.



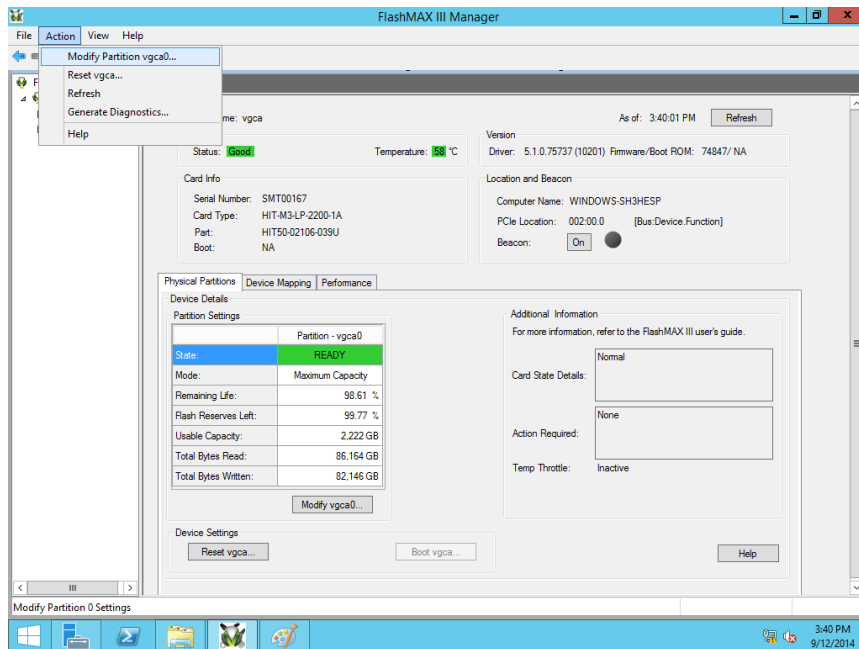
(5) Select the Flash Drive you want to format.

The following example shows two Flash Drives represented by drive letters from vgcx to vgcx. Select one at a time.

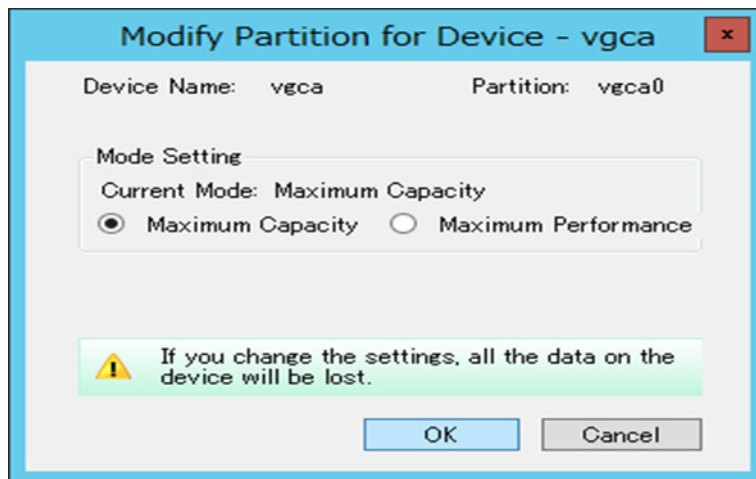


For PCI slots with Flash Drives installed, their buses are assigned letters in the following order: vgcx, vgcx, ...

(6) From the Action menu, select **Modify Partition vgcx0**.

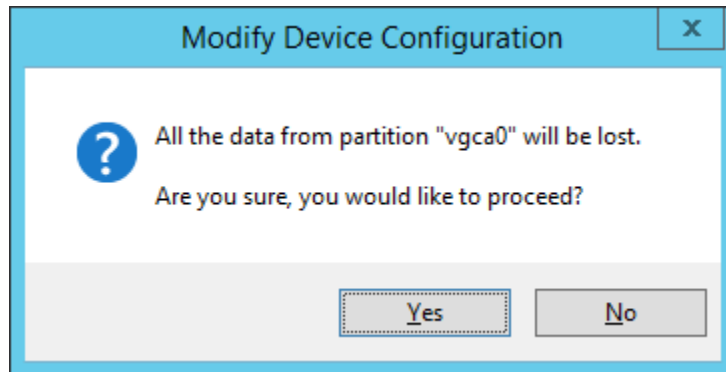


(7) When the Modify Partition for Device - vgcx dialog box appears, select a formatting mode in the **Mode Setting** section.

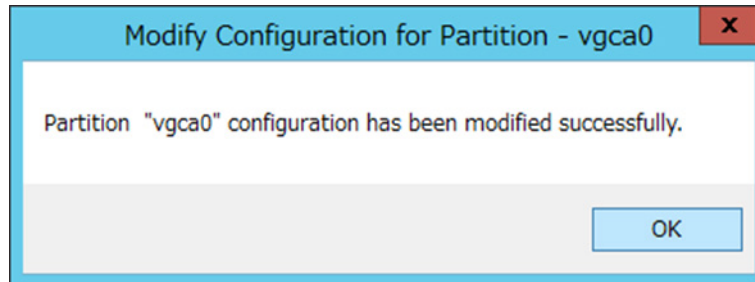


Formatting is not possible if the Flash Drive has volume specified in Disk Management. In this case, remove the volume and then start formatting again.

(8) When the Modify Device Configuration dialog box appears, make sure formatting will be applied to partition "vgcx0". Then, click **Yes**.



(9) When the Modify Configuration for Partition - vgca0 dialog box appears, click **OK**.



(10) Return to (5) and then format all vgcx of the Flash Drives.



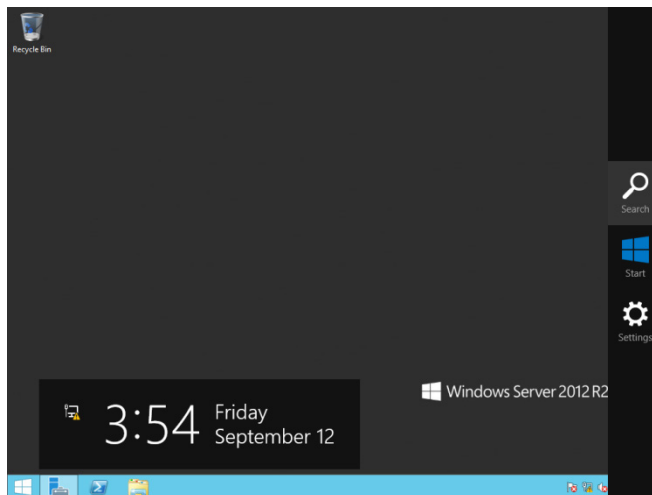
After the message indicated above appears, formatting still goes on internally. During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 20 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

Uninstalling driver and utility

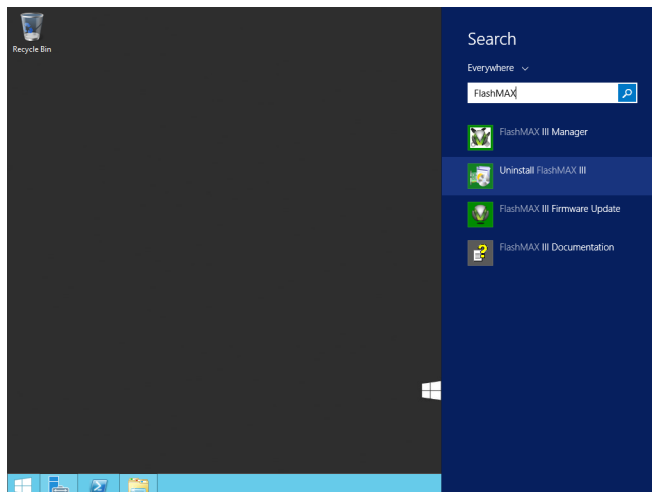


- To format a Flash Drive, the Flash Drive needs to be online. Click **Start > Administrative Tools > Computer Management > Storage > Disk Management** to open the window, set the Flash Drive online.
- Exit the FlashMAX III Manager, if it has been started, before installing the driver.

1. Click the search icon which may be located at the top or bottom right of the screen.



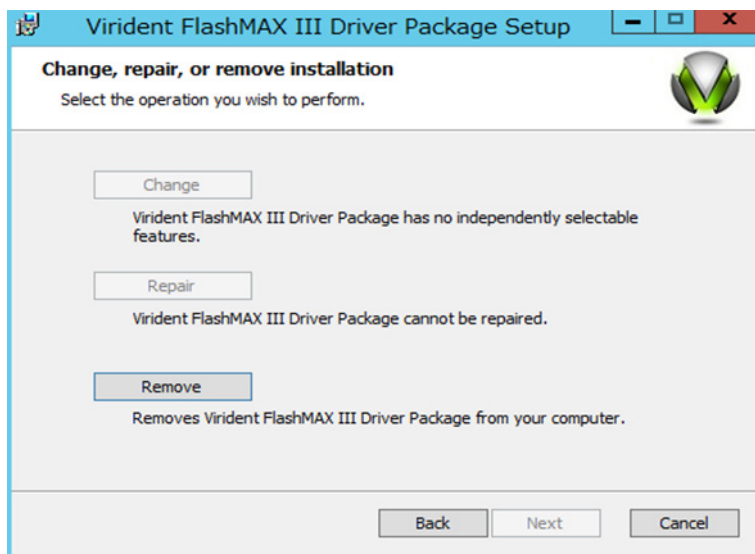
2. Enter "FlashMAX" to search and then click Uninstall FlashMAX III.



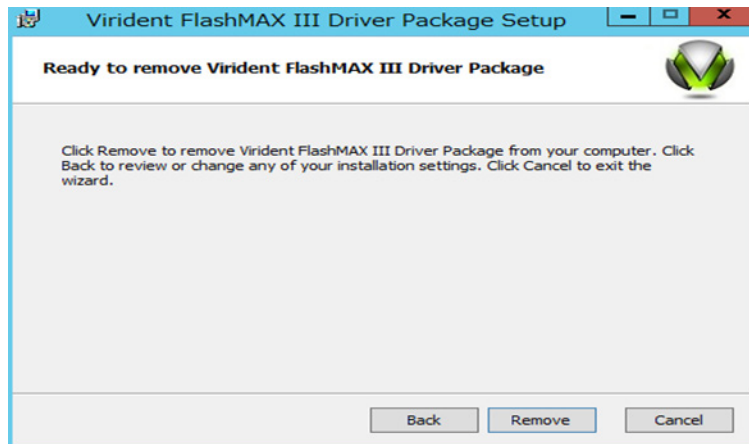
3. When the Virident FlashMAX III Driver Package Setup dialog box appears, click Next.



4. When Change, repair, or remove installation dialog box appears, click Remove.



5. When Ready to remove Virident FlashMAX III Driver Package dialog box appears, click Remove.



6. When Completed the Virident FlashMAX III Driver Package Setup Wizard dialog box appears, click Finish.



7. Restart the system.

Installing Flash Drive Driver and Utility (RHEL)

This section describes how to install the driver and utility for the Flash Drive on RHEL.

Installing driver and utility



If an older version of the driver and utility are installed, see [Uninstalling driver and utility](#) on page 3-18 to uninstall them.



If you have used the "Driver & Utility CD" to install an OS with the Flash Drive installed, then the driver and utility for the Flash Drive have also been installed. In this case, skip to [Format the drive](#) on page 3-14.

To install the driver and utility for the Flash Drive on RHEL, perform the following procedure as a root user.

1. Copy the driver and utility package

Insert the PCIe Flash Drive FlashMax2&3 Driver and Utility Install Kit CD in the DVD or CD drive. From the RHELx directory, copy the following files to any directory you like.

- (1) kmod-vgc-*****.x86_64.rpm
- (2) vgc-utils-*****.x86_64.rpm

2. Install the driver

From the directory of the copied files, enter "rpm -ivh <DriverName.rpm>".

The driver is installed in the /lib/modules/*****.x86_64/weak-updates/vgc-*****/ directory.

Example: rpm -ivh kmod-vgc-*****.x86_64.rpm

3. Install the utility

- (1) From the directory of the copied files, enter "rpm -ivh <UtilityName.rpm>". The utility is installed.

Example: rpm -ivh vgc-utils-*****.x86_64.rpm

- (2) When you enter "service vgcd start", the service of the Flash Drive starts.

4. Format the drive

If this is a new Flash Drive or if you want to clear the user data, always use the following procedure to format the drive. Formatting is done at a low level on the Flash Drive, and is different from formatting performed by the OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

(1) Perform a low level formatting of the Flash Drive.

Below is an example of formatting in the Maximum Capacity mode.

```
vgc-config -d /dev/vgcx -m maxcapacity -n 1
```

* Use the vgc-monitor command to find out the **x** in "vgcx".

Example of formatting in the Maximum Performance mode:

```
vgc-config -d /dev/vgcx -m maxperformance -n 1
```

* Use the vgc-monitor command to find out the **x** in "vgcx".



For PCI slots with Flash Drives installed, their buses are assigned letters in the following order: vgca, vgcb, vgcc, ...

(2) When the following message appears, enter **yes** and then press the Enter key.

```
***WARNING:this operation will erase ALL data on the drive, type <yes> to continue:
```

(3) The following message appears.

```
***Formatting drive. Please wait...***
```

(4) After the message disappears, it takes about 15 minutes for formatting to finish at which time you can proceed to the next step.

(5) Create a file system.

Use the mkfs command to create a file system.

Example: `mkfs -t ext4 -J size=400 /dev/vgcx0`

* Use the vgc-monitor command to find out the **x** in "vgcx0".



Formatting cannot be performed if the Flash Drive is still mounted.



During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 15 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

Setting up Flash Drive automatic mounting

Use the following procedure to set up Flash Drive automatic mounting.

[If the SoftRAID function of the OS is not used]

1. Modify the fstab file

Add the "/etc/fstab" entry to the file.

Add "noauto" to the mount options, and set dump and fsck to 0.

Example: /dev/vgcx0 /mnt/flash_drive0 ext4 defaults,noauto 0 0
(device) (mount location (any)) (file system)

* Place a comma (,) not a dot (.) before noauto.

* Use the vgc-monitor command to find out the **x** in "vgcx0".
(vgcx0 of all Flash Drives must be added.)

* Before modifying the fstab file, make sure a file system has been created on the Flash Drive and the drive can be mounted manually.

2. Edit the vgcd.conf file

Edit "/etc/sysconfig/vgcd.conf" and specify the mount point.

By specifying the mount point defined in [/etc/fstab] in [MOUNT_POINTS=""], automatic mounting is possible.



(1) "/etc/fstab" is defined as follows:

```
/dev/vgcx0 /mnt/flash_drive0 ext4 defaults,noauto 0 0
MOUNT_POINTS="/mnt/flash_drive0"
```

(2) To mount multiple Flash Drives, place a space between the mount points.
The following example shows how to mount two Flash Drives.

```
mount /dev/vgca0 /mnt/flash_drive0
mount /dev/vgcb0 /mnt/flash_drive1
MOUNT_POINTS="mnt/flash_drive0 /mnt/flash_drive1"
```

[If the SoftRAID function of the OS is used]



RAID must be configured in advance as described in For RHEL on page [3-31](#).

1. Modify the fstab file

Add the “/etc/fstab” entry to the file.

Add “noauto” to the mount options, and set dump and fsck to 0.

Example: /dev/md0 /mnt/flash_drive0 ext4 defaults,noauto 0 0
(device) (mount location (any)) (file system)

* Place a comma (,) not a dot (.) before noauto.

* Before modifying the fstab file, make sure a file system has been created on the Flash Drive and the drive can be mounted manually.

2. Edit the vgcd.conf file

(1) Edit “/etc/sysconfig/vgcd.conf” and specify the mount point.
Specify the mount point defined in [/etc/fstab] in [MOUNT_POINTS=””].

(2) Edit “/etc/sysconfig/vgcd.conf” and change “RESCAN_MD=1” to
“RESCAN_MD=0”



(1) “/etc/fstab” is defined as follows:

```
/dev/md0 /mnt/flash_drive0 ext4 defaults,noauto 0 0
MOUNT_POINTS="/mnt/flash_drive0"
```

(2) To mount multiple Flash Drives, place a space between the mount points. The following example shows how to mount two Flash Drives.

```
mount /dev/md0 /mnt/flash_drive0
mount /dev/md1 /mnt/flash_drive1
MOUNT_POINTS="/mnt/flash_drive0 /mnt/flash_drive1"
```

Setting up autoloader for RAID configuration

If the SoftRAID function of the OS is used to configure RAID, set up autoloader in the following way.



RAID must be configured in advance as described in For RHEL on page 3-31.

1. Create a new mdadm.conf file

Execute the following command to create the "/etc/mdadm.conf" file.

```
echo DEVICE partitions > /etc/mdadm.conf
echo DEVICE /dev/vgc*0* >>/etc/mdadm.conf
mdadm --detail --scan >> /etc/mdadm.conf
```

Changing security context

When setting "Kernel Dump Configuration" with Kernel crash dumps (GUI), change the security context to the Flash Drives



Install the **polycoreutils-python** package beforehand.

1. Change the security context

The following is an example that two Flash Drives are installed.

(1) Use "ls -lZ" to check the current security context.

Example: ls -lZ /dev/vgc*0*

```
brw-rw----. root disk system_u:object_r:device_t:s0 /dev/vgca0
brw-rw----. root disk system_u:object_r:device_t:s0 /dev/vgcb0
```

(2) Use "semanage" to change "device_t" to "fixed_disk_device_t".

```
Example: semanage fcontext -a -f -b -t fixed_disk_device_t "/dev/vgca0"
         semanage fcontext -a -f -b -t fixed_disk_device_t "/dev/vgcb0"
```

(3) Use "restorecon" to restore the new security context.

Example: restorecon -v /dev/vgc*0*

```
restorecon reset /dev/vgca0 context
system_u:object_r:device_t:s0-
>system_u:object_r:fixed_disk_device_t:s0
restorecon reset /dev/vgcb0 context
system_u:object_r:device_t:s0-
>system_u:object_r:fixed_disk_device_t:s0
```

(4) Use "ls -lZ" to check that "device_t" in the security context has changed to "fixed_disk_device_t".

Example: ls -lZ /dev/vgc*0*

```
brw-rw----. root disk system_u:object_r:fixed_disk_device_t:s0
/dev/vgca0
brw-rw----. root disk system_u:object_r:fixed_disk_device_t:s0
/dev/vgcb0
```

(5) Reboot the system.

Uninstalling driver and utility

1. Uninstall the utility

(1) Unmount all Flash Drives.

(2) If the SWRAID of the OS is running, stop the SWRAID service.

Example: mdadm --misc --stop /dev/mdx
mdx is a RAID number (x=0, 1, 2, etc.)

(3) Stop the service of the Flash Drive.

Example: service vgcd stop

(4) Use "rpm -qa | grep vgc-utils" to look for old utility.

(5) Use "rpm -e <UtilityName>" to uninstall the utility indicated in (4).

Example: rpm -e vgc-utils-*****.x86_64

(6) Use "rpm -qa | grep vgc-utils" to make sure the old utility no longer appears.

2. Uninstall the driver

(1) Use "rpm -qa | grep kmod-vgc" to look for old driver.

(2) Use "rpm -e < DriverName>" to uninstall it.

Example: rpm -e kmod-vgc-*****.x86_64

(3) Use "rpm -qa | grep kmod-vgc" to make sure the old driver no longer appears.



In (3), if an old driver is not uninstalled and so is still displayed, then you cannot install a new driver.

3. Restart the system

After restarting the system, install the new driver and utility as described in [Installing driver and utility](#) on page 3-13

Installing Flash Drive Driver and Utility (ESXi)

This section describes how to install the driver and utility for the Flash Drive.

Installing driver and utility



If an older version of the driver and utility are installed, see [Uninstalling driver and utility](#) on page 3-23 to uninstall them.

1. Download the installation package

Download the following installation package from VMware Website shown below on a remote machine to execute vCLI.

VMware Website :

http://www.vmware.com/resources/compatibility/detail.php?deviceCategory=io&productid=37314&deviceCategory=io&details=1&partner=535&releases=172&page=1&display_interval=10&sortColumn=Partner&sortOrder=Asc

Device Driver:vgcccommon version x.x.xxx.xxx

Firmware:74847

Model : FlashMAX III

Device Type : HGST

Number of Ports : 0

VID : 1a78

DID : 0050

Retrieve the following installation package from the downloaded file.

VSI-x.x.x.xxxxx.xxx-ESXi-xx-offline_bundle-xxxxxxx.zip

2. Transfer the installation package to Hypervisor host

Create a folder “flashmax” in the directory under the hypervisor host before transferring the downloaded installation package.

(Example of destination: /vmfs/volumes/datastore1)

3. Set to the maintenance mode.

Stop all virtual machines before installing the installation package, and set the hypervisor host to the maintenance mode.

4. Enable ESXi Shell.

Enable ESXi Shell using DCUI (Direct Console User Interface) on the hypervisor host. Executing commands in ESXi Shell is required to use utility commands of the Flash Drive.

5. Install the installation package using ESXi Shell

Install the package using `esxcli software vib install -d`

Example:

```
esxcli software vib install -d /vmfs/volumes/datastore1/flashmax/VSI-  
x.x.xxxxx.xxx-ESXi-xx-offline_bundle-xxxxxxx.zip
```

6. Reboot the system.

7. Format the drive

When you have newly purchased a Flash Drive or need to delete the user data, make sure to format the drive following the procedure below, low level formatting of the Flash Drive, which is different from format on OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

Set the hypervisor host to the maintenance mode, and execute the following Flash Drive utility command in ESXi Shell.

1. Perform a low level formatting of the Flash Drive.

Example of formatting in the Maximum Capacity mode:

```
/opt/vgc/bin/vgc-config -d vgcx -m maxcapacity -n 1
```

- Use the `/opt/vgc/bin/vgc-monitor` command to find out **x** in **vgcx**.
- Enter all paths to `vgc-config`.

Example of formatting in the Maximum Performance mode:

```
/opt/vgc/bin/vgc-config -d vgcx -m maxperformance -n 1
```

- Use the `/opt/vgc/bin/vgc-monitor` command to find out **x** in "vgcx".
- Enter all paths to `vgc-config`.



For PCI slots with Flash Drives installed, their buses are assigned letters in the following order: vgca, vgcb, vgcc, ...

2. When the following message appears, enter **yes** and then press **Enter**.
***WARNING: this operation will erase ALL data on the drive, type <yes> to continue:
When key input is available about 15 minutes later, the format is complete.



During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 15 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

3. Check status of each Flash Drive
Check that each Flash Drive has **Good** for Status by using the vgc monitor command.
Example:

```
/opt/vgc/bin/vgc-monitor -d vgcx
```

 - Use the /opt/vgc/bin/vgc-monitor command to find out the **x** in **vgcx**.
4. Assign each Flash Drive to a storage device.
Example:

```
esxcli storage core adapter rescan --all
```
5. Return ESXi Shell to the original setting.
Log out of ESXi Shell using the **exit** command, and then disable ESXi Shell if the original setting of ESXi Shell is Disable.
6. Leave the maintenance mode
End the maintenance mode of the hypervisor host.

Setting Limit to ESXi resource pool

When many VDI images are allocated under the VMware View environment in a short period of time, the system RAM available for the Flash Drive may be temporarily exhausted. The Flash Drive may stop running due to insufficient RAM supplied by the system. You need to set Limit for Resource Allocation to ESXi in the vSphere Client. See [System memory requirement](#) on page 1-4 to find required memory for the Flash Drive.

- How to calculate Limit for Resource Allocation

Conditions:

4.8-TB Flash Drive: One card is installed;

System memory: 256 GB;

Memory for Flash Drive: 12 GB

Limit for Resource Allocation:

System memory (256 GB) – Memory for Flash Drive (12 GB) = 244 GB

Driver and utility for Flash Drive have been completely installed.

Uninstalling driver and utility

1. Set to the maintenance mode.

Stop all virtual machines, and set the hypervisor host to the maintenance mode.

2. Uninstall the installation package using ESXi Shell

Uninstall with `esxcli software vib remove -n sas-vgc`

Example: `esxcli software vib remove -n sas-vgc`

3. Reboot the system.

4. Leave the maintenance mode.

End the maintenance mode of the hypervisor host.

RAID Configuration

This section describes how to use the SoftRAID function of the OS to configure RAID and perform replacement when a fault occurs



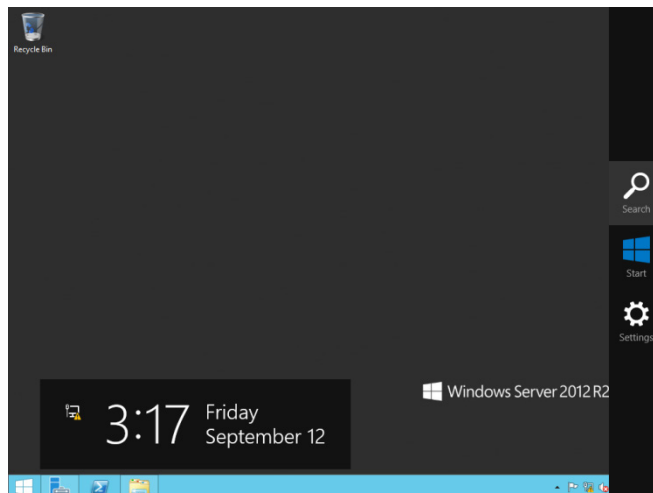
SoftRAID supports RAID0 (striping), but not RAID1 (mirror) and RAID5.

For Windows Server 2012 R2

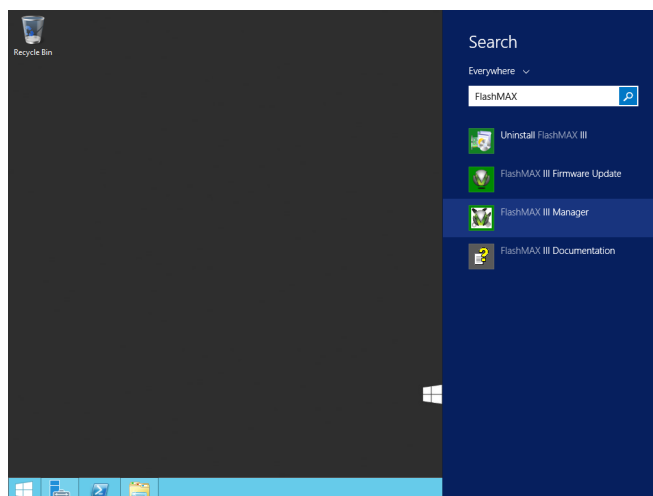
[RAID0 (striping) configuration procedure]

1. Check the vgcx of the Flash Drive assigned to a striped volume

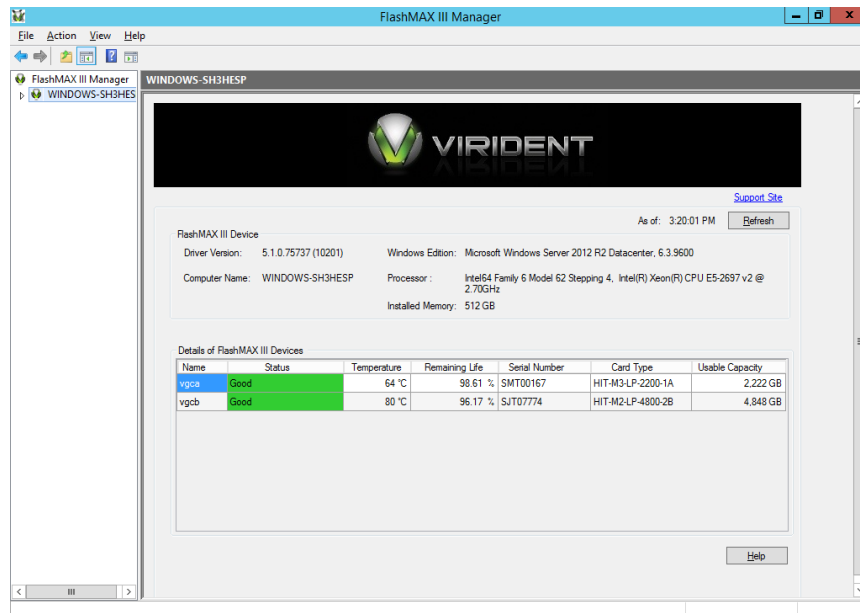
(1) Click the **Search** icon which may be located at the top or bottom right of the screen.



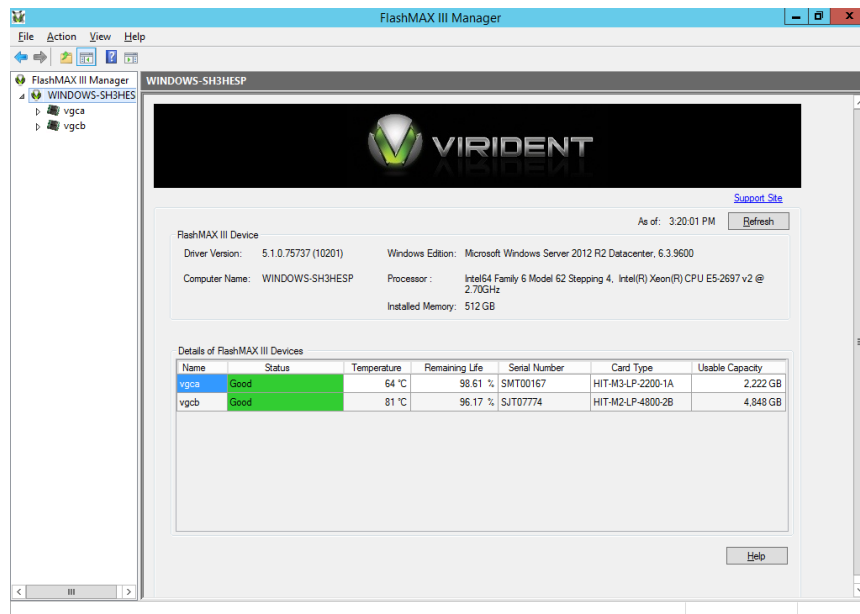
(2) Enter **FlashMAX** to search and then click **FlashMAX III Manager**.



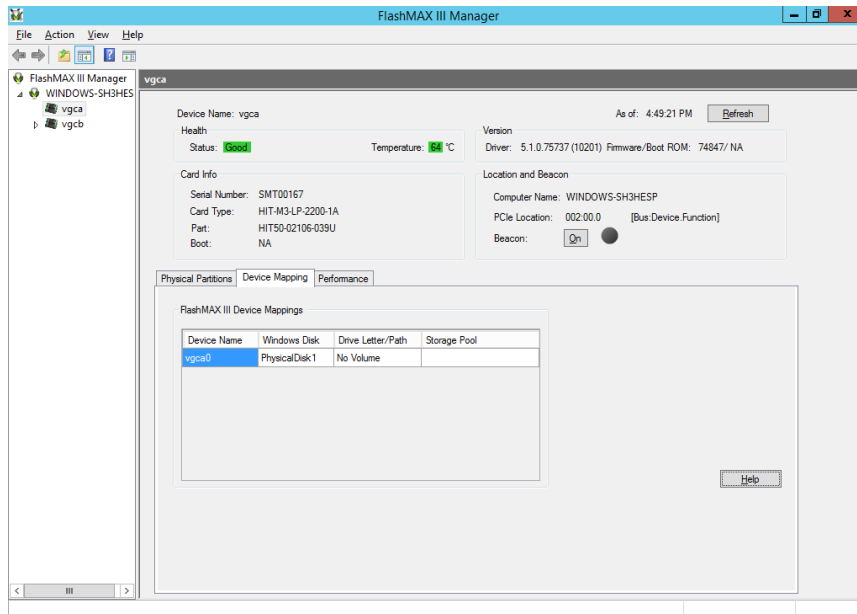
(3) FlashMAX III Manager starts. From the console tree in the left pane, double-click **FlashMAX III Manager** to display the computer name.



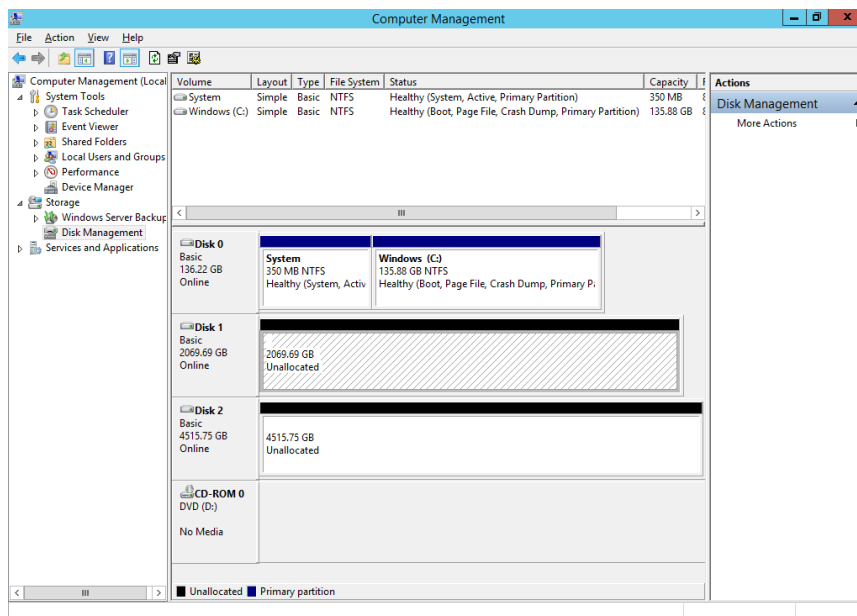
(4) Double-click the computer name to display the Flash Drives as indicated by vgca, vgcb, etc.



(5) Select the **vgcx** of the Flash Drive and then click the **Device Mapping** tab in the right pane. Make sure PhysicalDiskx appears in the Windows Disk column in the FlashMAX III Device Mappings section.



(6) The **x** in PhysicalDiskx refers to Disk x which appears when you select **Computer Management - Storage - Disk Management**.



(7) Check the vgcx and PhysicalDiskx combination of each Flash Drive assigned to the striped volume.

2. Format the drive (Use FlashMAX III Manager)

Format the Flash Drive with the striped volume assigned using the following procedure. Formatting is done at a low level on the Flash Drive, and is different from formatting performed by the OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

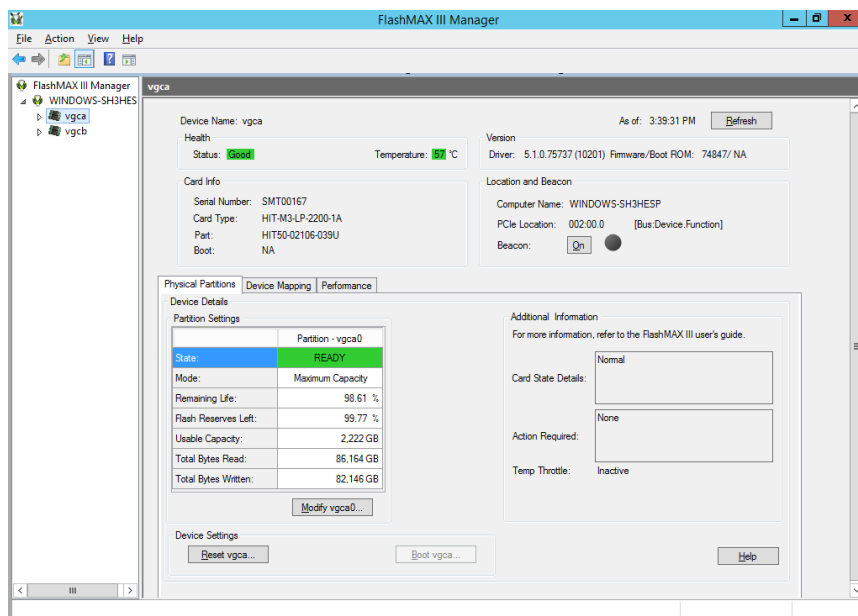


To format a Flash Drive, the Flash Drive needs to be online. Click **Start > Administrative Tools > Computer Management > Storage > Disk Management** to open the window, set the Flash Drive online.

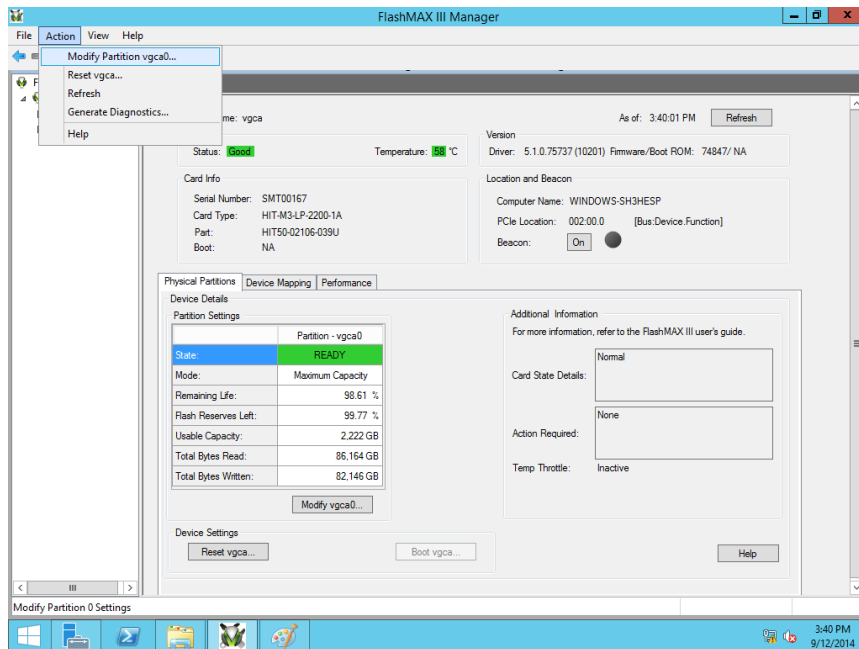


For a Flash Drive with a striped volume assigned, do not mix the Maximum Capacity mode with the Maximum Performance mode. Because of differences between these two modes, mixing them causes the performance of the drive with a striped volume assigned to drop.

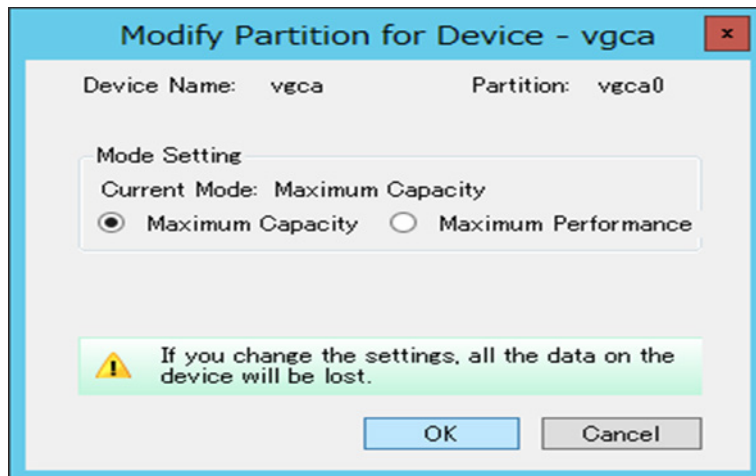
(1) Select the **vgcx** of the Flash Drive you want to format.



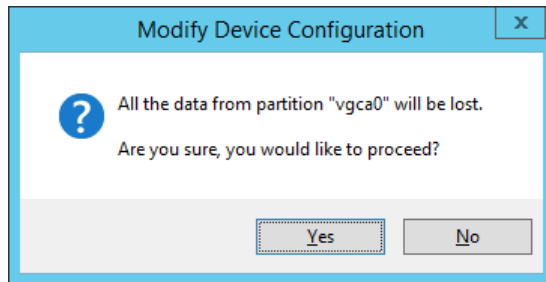
(2) From the Action menu, select **Modify Partition vgcx0**.



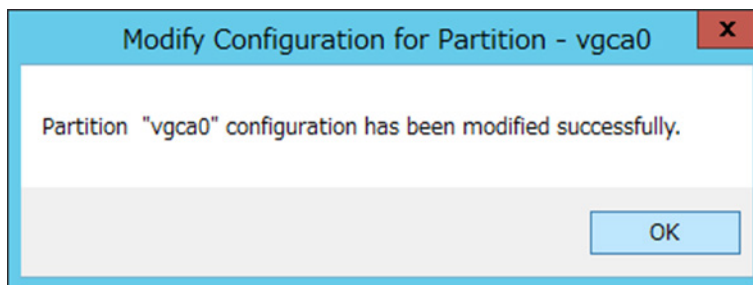
(3) When the Modify Partition for Device - vgcx dialog box appears, select a formatting mode in the **Mode Setting** section and then click **OK**.



(4) When the Modify Device Configuration dialog box appears, make sure formatting will be applied to partition "vgcx0". Then, click **Yes**.



(5) When the Modify Configuration for Partition - vgcx0 dialog box appears, click **OK**.



(6) Return to (1) and then format all vgcx of the Flash Drives.



After the message indicated above appears, formatting still goes on internally. During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 20 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

3. From the Start menu, select Administrative Tools, Computer, Memory, and Disk Management, then select a disk. Right-click and then select New Striped Volume.

4. When the New Striped Volume Wizard starts, click Next.

5. From Disk Selection, select a disk you want to use and then click Add. Then, select any disk area (MB). Click Next.

6. From Assign Drive Letter or Path, select a drive name and then click Next.

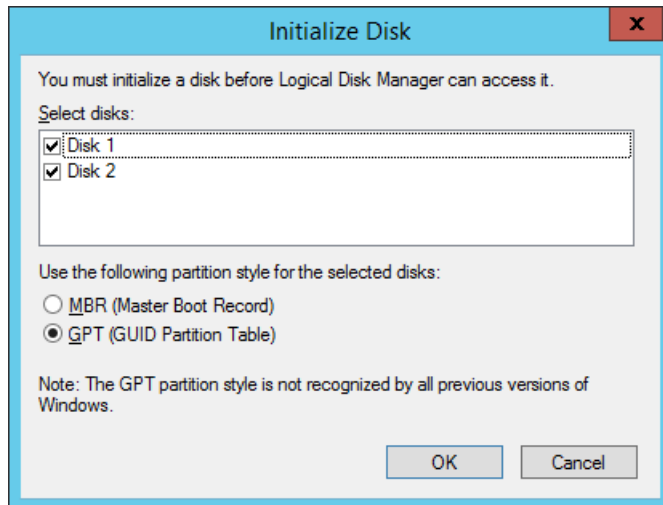
7. From Format Volume, select a setting and then click Next.

8. When the New Striped Volume Wizard ends, click Finish.

9. When a message appears to indicate the disk will change from basic to dynamic mode, click Yes.



After Disk Management is selected, the Initialize Disk dialog box may appear. In this case, select **MBR (Master Boot Record)** or **GPT (GUID Partition Table)** and then click **OK**. If you want to create a memory of 2 TB or more, you need to select GPT. If you are using a Flash Drive with memory more than 2 TB (2.2 TB or 4.8 TB), select **GPT**.



[RAID0 (striping) Replacing a faulty drive]

1. Turn off the system.
2. Replace the faulty Flash Drive with a new one.
3. Turn on the system.
4. From the Start menu, select **Administrative Tools, Computer, Memory,** and **Disk Management**. Right-click the “failed” area to the right of the faulty disk, and then select **Delete Volume**.
5. When the Delete Striped Volume dialog box appears, click **Yes**.
6. Restart the system.
7. Configure the RAID again as described in [For Windows Server 2012 R2](#) on page 3-24.

For RHEL

[RAID0 (striping) configuration procedure]

1. Perform a low level formatting of the Flash Drive

Do this to the vgcx of all Flash Drives in the RAID.

Formatting example using Maximum Capacity mode:

```
vgc-config -d /dev/vgcx -m maxcapacity -n 1
```

* Use the vgc-monitor command to find out the **x** in "vgcx".

Formatting example using Maximum Performance mode:

```
vgc-config -d /dev/vgcx -m maxperformance -n 1
```

* Use the vgc-monitor command to find out the **x** in "vgcx".



Formatting cannot be performed if the Flash Drive is still mounted.

2. Use the Flash Drives to construct the RAID

<When x number of Flash Drives are installed>

```
mdadm --create /dev/md0 --chunk=256 --level=x --raid-devices=x /dev/  
vgca0 /dev/vgcb0/ . . /dev/vgcx0
```

* Type in the above on one line.

* raid-devices=x where x is the number of Flash Drives

* level=x indicates the level of RAID (x=0 RAID0 (striping))

3. Create a file system

Use the mkfs command to create a file system.

Example: `mkfs -t ext4 -J size=400 /dev/mdx`

* mdx refers to a RAID number (x=0, 1, 2, etc.)

[RAID0 (striping) Replacing a faulty drive]

1. Turn off the system.
2. Replace the faulty Flash Drive with a new one.
3. Turn on the system.
4. Stop the RAID service.

```
mdadm --misc --stop /dev/mdx
```

* mdx refers to a RAID number (x=0, 1, 2, etc.)

5. Delete the super block information.

```
mdadm --misc --zero-superblock /dev/vgcx0
```

* Use the `vgc-monitor` command to find out the **x** in "vgcx0".

6. Restart the system.

7. Configure the RAID again.

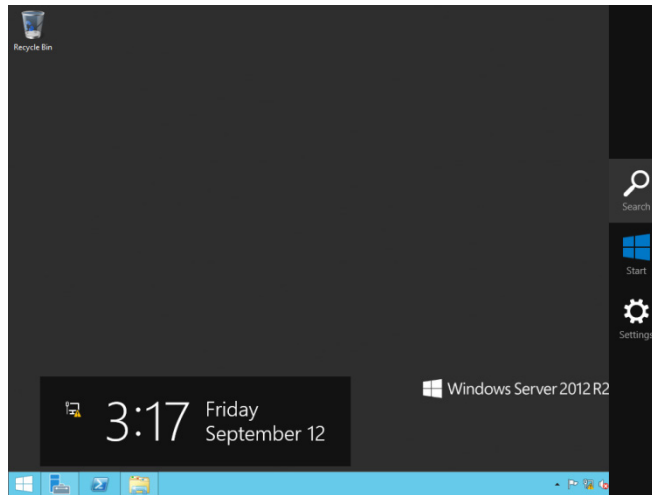
Follow [For RHEL 6](#) on page 3-31 to configure the RAID again, and then perform [Setting up autoload for RAID configuration](#) on page 3-17.

Flash Drive Utility (Windows 2012 R2)

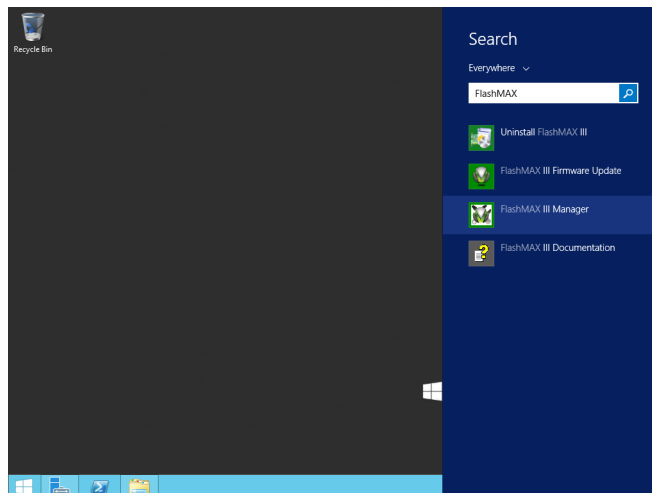
This section describes the FlashMAX III Manager utility for the Flash Drive.

Starting FlashMAX Manager

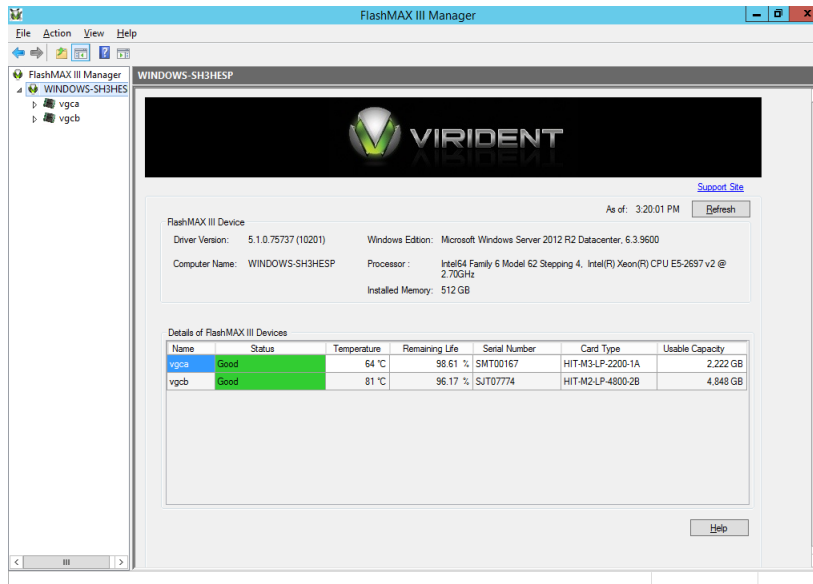
(1) Click the **Search** icon which may be located at the top or bottom right of the screen.



(2) Enter **FlashMAX** to search and then click **FlashMAX III Manager**.



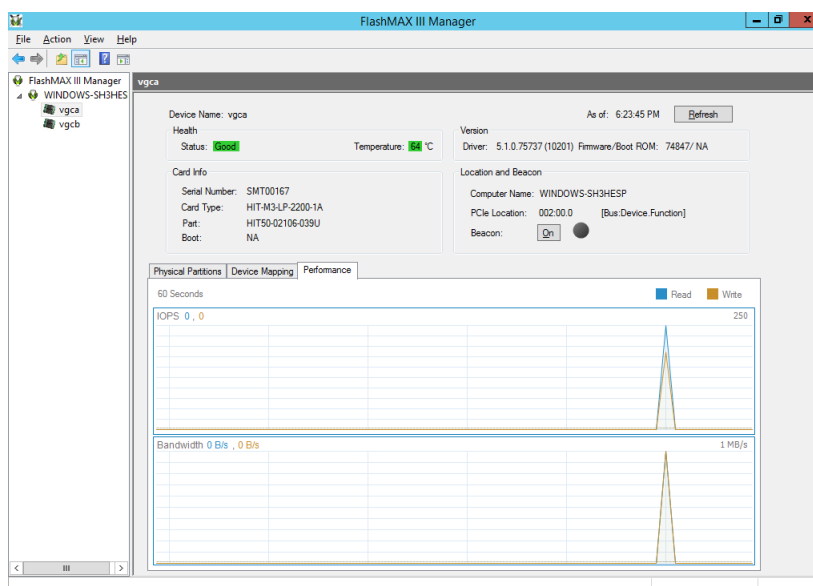
(3) FlashMAX III Manager starts. From the console tree in the left pane, double-click **FlashMAX III Manager** to display the computer name. You can check the vgcx for each Flash Drive displayed in the right pane. Also, you can use the Remaining Life column to check the remaining rewrite capacity of each drive.



Performance

You can check the performance (IOPS, Bandwidth) for each vgcx of the Flash Drives in the following way.

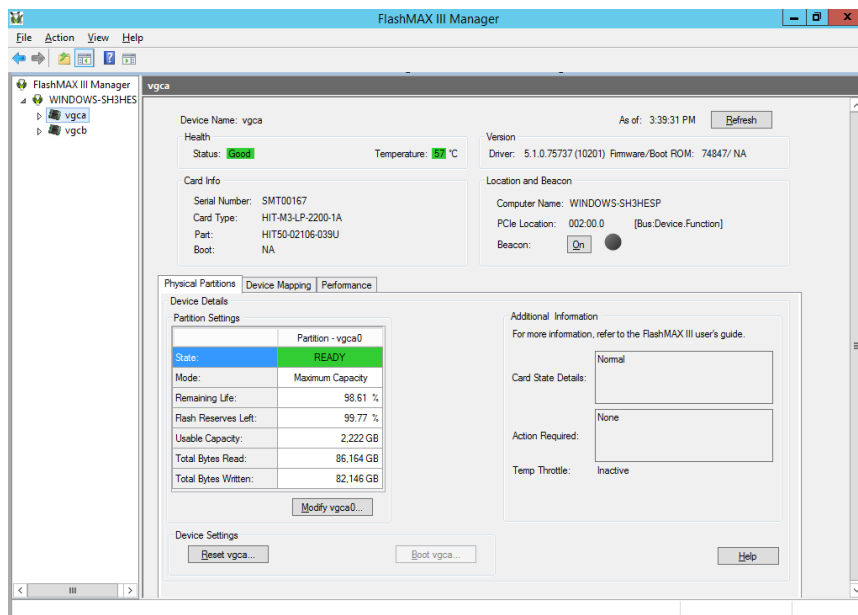
Start **FlashMAX III Manager**, select the **vgcx** of a Flash Drive, and then click the **Performance** tab in the right pane. The performance information of the selected Flash Drive appears.



Beacon

When multiple Flash Drives are connected to one server, to make it easy to link vgcx (can be checked from the OS) and disk x (PhysicalDiskx) with this device, turn on all LEDs on the PCI bracket; this makes it possible to pinpoint a card.

Start **FlashMAX III Manager**, select the **vgcx** of a Flash Drive. In the Location and Beacon section of the right pane, clicking ON of Beacon turns on the LEDs of all Flash Drives. To turn off the LEDs, click **OFF**.



Modifying Partition vgcx

If this is a new Flash Drive or if you want to clear the user data, always use the following procedure to format the drive. Formatting is done at a low level of the Flash Drive, and is different from formatting performed by the OS.

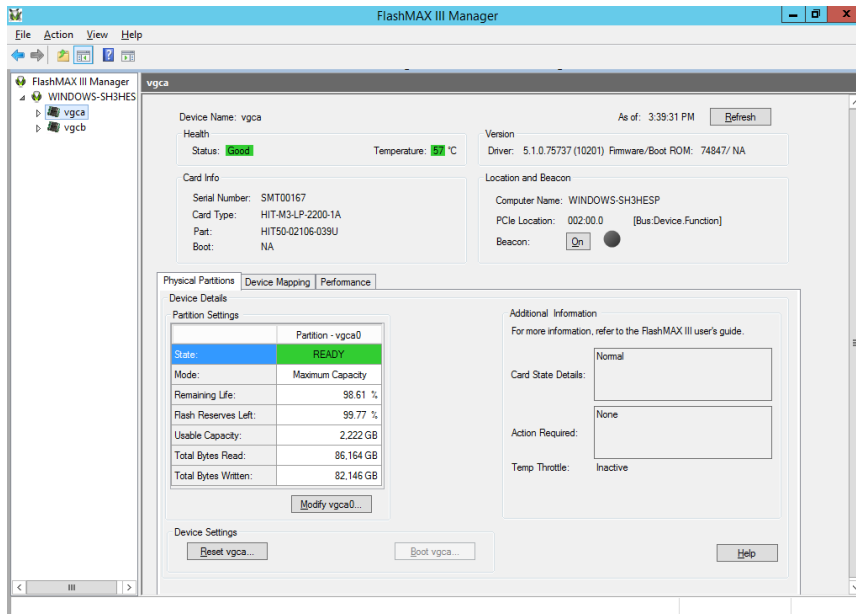
Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.



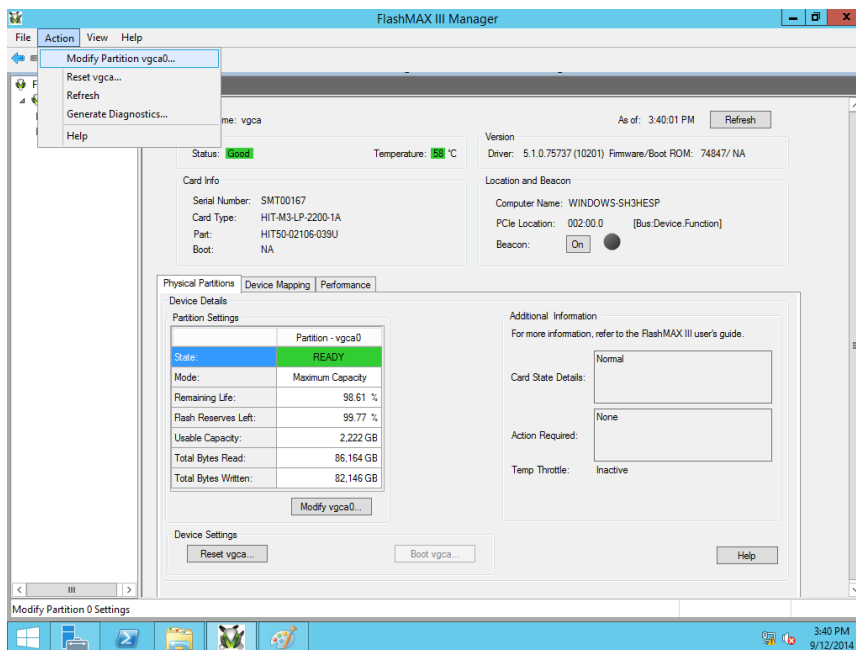
To format a Flash Drive, the Flash Drive needs to be online. Click **Start > Administrative Tools > Computer Management > Storage > Disk Management** to open the window, set the Flash Drive online.

(1) Select the **vgcx** of the Flash Drive you want to format.

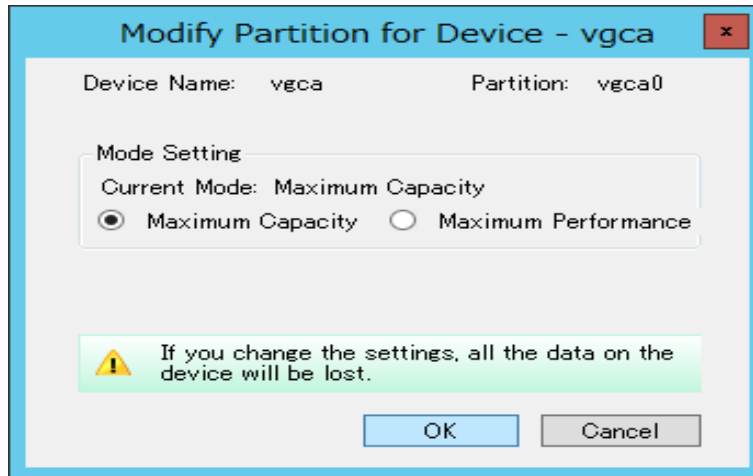
The following example shows two Flash Drives represented by drive letters from vgca to vgcb.



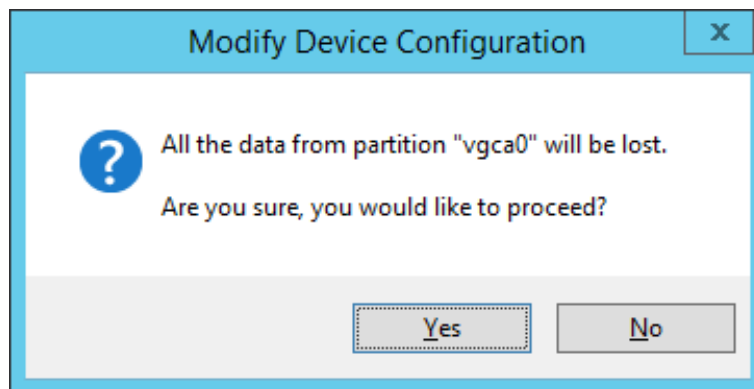
(2) From the Action menu, select **Modify Partition vgcx0**.



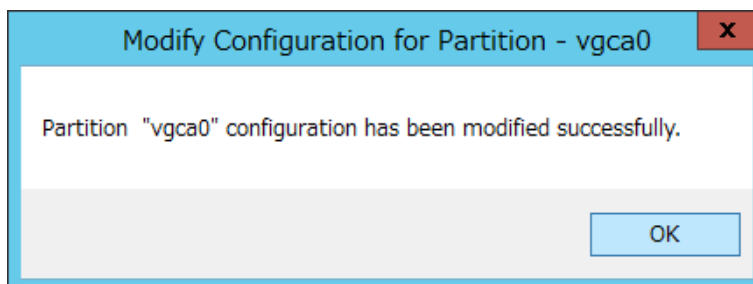
(3) When the Modify Partition for Device - vgcx dialog box appears, select a formatting mode in the **Mode Setting** section.



(4) When the Modify Device Configuration dialog box appears, make sure formatting will be applied to partition "vgcx0". Then, click **Yes**.



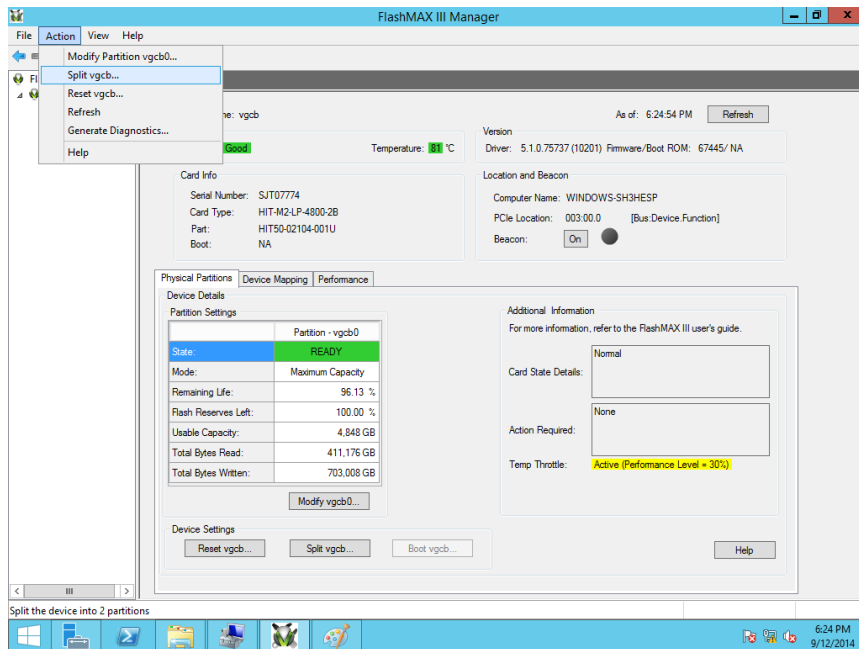
(5) When the Modify Configuration for Partition - vgcx0 dialog box appears, click **OK**.



After the message indicated above appears, formatting still goes on internally. During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 20 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

Splitting vgcx

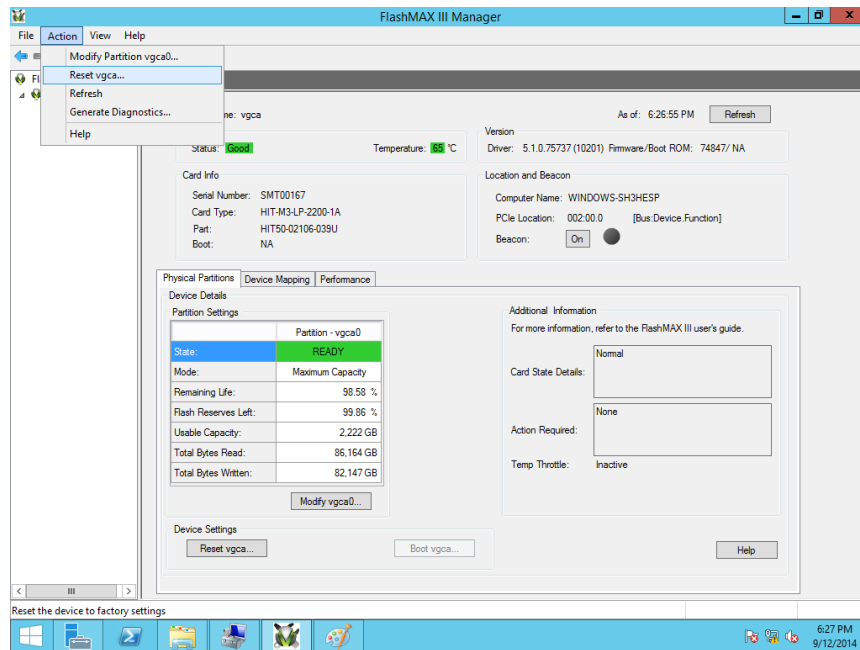
You can split a Flash Drive into two physical partitions. However, the total rewrite capacity is also halved. If the total write capacity of one partition is used up, you cannot use the other partition either. Therefore, if you want to create partitions, use splitting software or the logical volume manager (LVM).



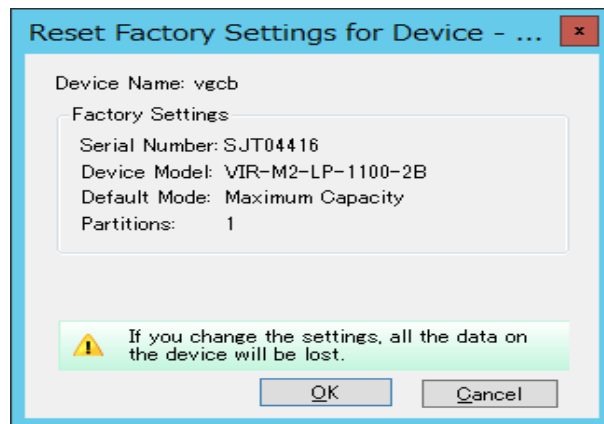
Resetting vgcx

Use this function to restore a Flash Drive to its factory defaults. Because this is performed at a low level in the Maximum Capacity mode, it is different from the formatting performed by the OS.

- (1) From the Action menu, select **Reset vgcx**.



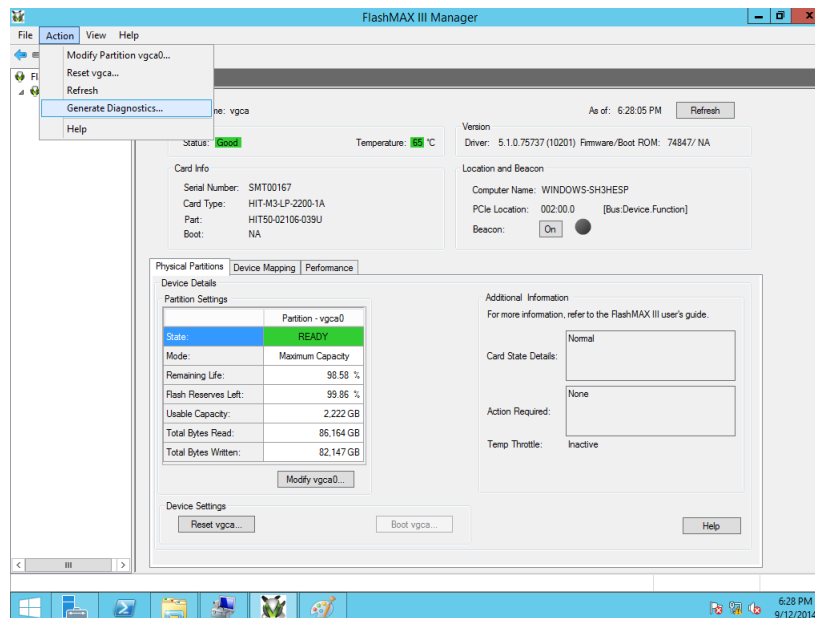
- (2) Click **OK**. Formatting starts.



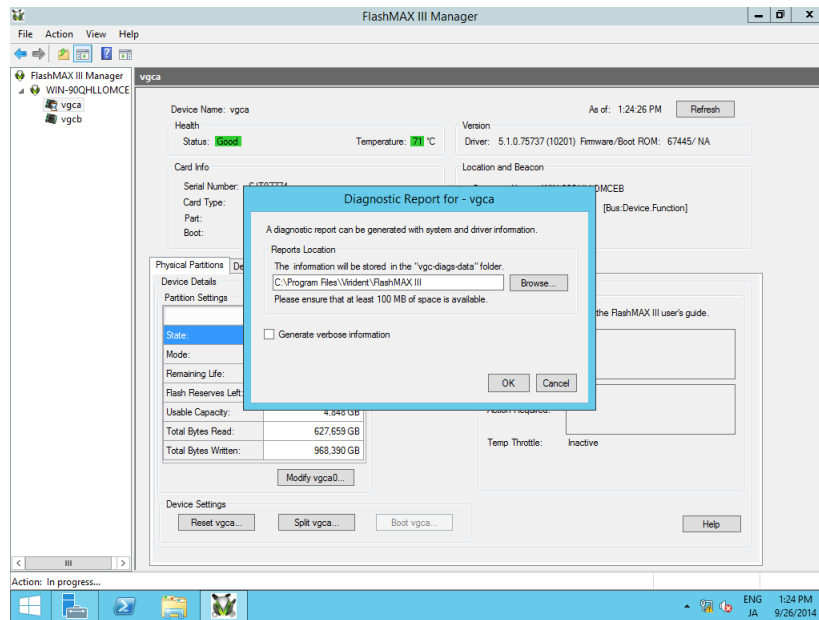
Generating Diagnostics

You can use this function to save support information (log file, system configuration, drive configuration, drive metadata) necessary for analysis when a fault occurs. The information is saved to a file named vgc.diaqs-xxx-xx-xx.zip. It is recommended that you perform this task immediately after a Flash Drive error occurs and send this vgc.diaqs.tar.gz file to the maintenance personnel.

- (1) Start **FlashMAX III Manager**. From the Action menu, select **Generate Diagnostics**.



- (2) Specify a location to save the file, and then click **OK**.



Flash Drive Utility (RHEL)

This section describes the utility for the Flash Drive.

vgc-monitor

This is the main command you use to check the status of a Flash Drive. Executing this command without any parameters, outputs a list of all Flash Drives installed on the server.

Command:

```
# vgc-monitor -d < Driver name >
```

* Use the vgc-monitor command to find out the "x" in "vgcx".

Example: To check the status of the Flash Drive in /dev/vgca

```
# vgc-monitor -d /dev/vgca
```

vgc-monitor -d output example

```
[root@spa05]# vgc-monitor -d /dev/vgca
```

```
vgc-monitor x.x(xxxxx.xx)
```

```
Driver Uptime:xx:xx
```

Card Name	Num Partitions	Card Type	Status
vgca	1	HIT-MX-LP-XXXX-XX	Good

```
Serial Number      : xxxxxxxx
```

```
Card Info           :Part: SJTxxxxx
```

```
Rev: FlashMAX xxxxx,x8 Gen2
```

```

Temperature          :xxC(Safe)
Temp Throttle        :Inactive
Card State Details   :Normal
Action Required      :None

Partition    Usable Capacity  RAID
vgca0        xxxxxGB          enabled
Mode          :maxcapacity
Total Flash Bytes :xxxxxxxxxxxxxx (xx.xxTB) (reads)
                  xxxxxxxxxxxxxxx (xx.xxTB) (writes)

Remaining Life       :xx.xx%
Partition State      :READY
Flash Reserves Left  :xx.xx%

```

vgc-diags

When multiple Flash Drive You can use this command to save support information (log file, system configuration, drive configuration, drive metadata) necessary for analysis when a fault occurs. The information is saved to a file named vgc.diags.tar.gz. It is recommended that you execute this command immediately after a Flash Drive error occurs. Send this vgc.diags.tar.gz file to the maintenance personnel.

Command:

```
# vgc-diags < drive-name >
```

Example: To get log information of all Flash Drives

```
# vgc-diags
```

Example: To get log information of only /dev/vgcb

```
# vgc-diags /dev/vgcb
```

vgc-beacon

When multiple Flash Drives are connected to one server, to make it easy to link device name (dev/vgcx)vgcx (can be checked from the OS) with this device, turn on all LEDs on the PCI bracket; this makes it possible to pinpoint a card.

Command:

```
# vgc-beacon -d < domain:bus:dev.fn > -b < 1 or 0 >
```

```
# vgc-beacon -d < drive name > -b < 1 or 0 >
```

Example: To turn on LED in /dev/vgca

```
# vgc-beacon -d /dev/vgca -b 1
```

vgc-config

If this is a new Flash Drive or if you want to clear the user data, always use the following procedure to format the drive. Formatting is done at a low level of the Flash Drive, and is different from the formatting performed by the OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

Command:

```
# vgc-config -d < drive name > -m < maxcapacity or maxperformance > -n 1
```

Example: To format using the Maximum Capacity mode

```
# vgc-config -d /dev/vgcx -m maxcapacity -n 1
```

* Use the vgc-monitor command to find out the "x" in "vgcx".

Example: To format using the Maximum Performance mode

```
# vgc-config -d /dev/vgcx -m maxperformance -n 1
```

* Use the vgc-monitor command to find out the "x" in "vgcx".

(2) When the following message appears, enter "yes" and press the Enter key.

```
***WARNING:this operation will erase ALL data on drive,type<yes>to  
continue:
```

(3) The following message appears.

```
***Formatting drive. Please wait...***
```

(4) After the message disappears, it takes about 15 minutes for formatting to finish.

Therefore, wait for 15 minutes or more and then proceed to the next step.

(5) Create a file system.

Use the mkfs command to create a file system.

Example: `mkfs -t ext4 -J size=400 /dev/vgcx0`

* Use the vgc-monitor command to find out the "x" in "vgcx0".



Formatting cannot be performed if the Flash Drive is still mounted.



During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 15 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

Flash Drive Utility (ESXi)

This section describes the utility for the Flash Drive.

vgc-monitor

This is the main command you use to check the status of a Flash Drive. Executing this command without any parameters outputs a list of all Flash Drives installed on the server.

Command:

```
# /opt/vgc/bin/vgc-monitor -d < drive name >
```

Example: To check the status of the Flash Drive in vgca

```
# /opt/vgc/bin/vgc-monitor -d vgca
```

Use the `/opt/vgc/bin/vgc-monitor -d` command to find out the **x** in “vgcx”.

```
esxcli vgc-monitor -d output example
```

```
vgc-monitor x.x(xxxxx.xx)
```

```
Driver Uptime:xx:xx
```

Card Name	Num Partitions	Card Type	Status
vgca	1	HIT-MX-LP-XXXX-XX	Good

```
Serial Number      :xxxxxxxx
```

```
Card Info          :Part: SJTxxxxx
```

```
Rev:FlashMAX xxxxx,x8 Gen2
```

```
Temperature         :xxC(Safe)
```

```
Temp Throttle       :Inactive
```

```
Card State Details  :Normal
```

```
Action Required     :None
```

Partition	Usable Capacity	RAID
vgca0	xxxxxGB	enabled

```
Mode                :maxcapacity
```

```
Total Flash Bytes  :xxxxxxxxxxxxxxxx (xx.xxTB) (reads)
```

```
xxxxxxxxxxxxxxxx (xx.xxTB) (writes)
```

```
Remaining Life      :xx.xx%
```

```
Partition State     :READY
```

```
Flash Reserves Left :xx.xx%
```

vgc-diags

You can use this command to save support information (log file, system configuration, drive configuration, drive metadata) necessary for analysis when a fault occurs. The information is saved to a file named vgc.diags.tar.gz. It is recommended that you execute this command immediately after a Flash Drive error occurs. Send this vgc.diags.tar.gz file to the maintenance personnel.

Command:

```
# /opt/vgc/bin/vgc-diags -p <output path> < drive-name >
```

Example: To get log information of all Flash Drives

```
# /opt/vgc/bin/vgc-diags -p <output path>
```

Example: To get log information of only vgcb

```
# /opt/vgc/bin/vgc-diags -p <output path> vgcb
```

vgc-beacon

When multiple Flash Drives are connected to one server, to make it easy to link device name (dev/vgcx)vgcx (can be checked from the OS) with this device, turn on all LEDs on the PCI bracket; this makes it possible to pinpoint a card.

Command:

```
# /opt/vgc/bin/vgc-beacon -d < drive-name > -b < 1 or 0 >
```

Example: To turn on LED in /dev/vgca

```
# /opt/vgc/bin/vgc-beacon -d vgca -b 1
```

Example: To turn off LED in /dev/vgca

```
# /opt/vgc/bin/vgc-beacon -d vgca -b 0
```

vgc-config

If this is a new Flash Drive or if you want to clear the user data, always use the following procedure to format the drive. Formatting is done at a low level of the Flash Drive, and is different from the formatting performed by the OS.

Two modes are available for formatting: Maximum Capacity mode or Maximum Performance mode. The Maximum Capacity mode is effective for applications with intensive write, and the Maximum Performance mode requires a 15% sacrifice in user capacity but can double the random write performance when compared with the Maximum Capacity mode. (However, in terms of performance in read and sequential write, there is no difference between the two modes.) If the available capacity is large, the Maximum Performance mode is recommended.

Command:

```
# /opt/vgc/bin/vgc-config -d vgcx -m < maxcapacity or maxperformance  
> -n 1
```

Example: To format using the Maximum Capacity mode

```
# /opt/vgc/bin/vgc-monitor -d vgcx -m maxcapacity -n 1
```

- Use the `esxcli vgc monitor` command to find out the **x** in "vgcx".
- Enter all paths for `vgc-config`.

Example: To format using the Maximum Performance mode

```
# /opt/vgc/bin/vgc config -d vgcx -m maxperformance -n 1
```

- Use the `esxcli vgc-monitor` command to find out the **x** in "vgcx".
- Enter all paths for `vgc-config`.



During the formatting process, the expected I/O performance cannot be achieved. Once formatting starts, keep the power turned on for about 15 minutes. (Turning off the power during formatting will not cause any damage. When the power is turned on, formatting will automatically restart.)

Specifications

This chapter describes the various specifications of the Flash Drive.

□ [Basic Specifications](#)

Basic Specifications

Items	Specifications		
Product name	HGST 1.1TB PCIe Flash Drive	HGST 2.2TB PCIe Flash Drive	HGST 4.8TB PCIe Flash Drive
Capacity	1.1TB	2.2TB	4.8TB
NAND Type	Multi Level cell (MLC)		
Read Bandwidth (64KB)	2.8GB/s		2.6GB/s
Write Bandwidth (64KB)	1.2GB/s		700MB/s
Read Access Latency	120μs		78μs
Write Access Latency	20μs		18μs
Endurance	4PB	8PB	30PB
Interface specification	PCI-Express Gen2 x8		
Dimensions	H: 18.1mm × L: 167.5mm × W: 68.9mm (bracket)		
Mass	0.22kg		0.18kg
Operating temperature	0 to 55 °C		
Operating humidity	5 to 95%Rh		
Power source	12V		
Power consumption	25W		26W

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