

Oracle® Flash Accelerator F160 PCIe Card User Guide

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Using This Documentation

- **Overview** – This user guide provides detailed procedures that describe installation, configuration, and service of the Oracle Flash Accelerator F160 PCIe Card.
- **Audience** – This guide is intended for trained technicians and authorized service personnel who have been instructed on the hazards within the equipment and qualified to remove and replace hardware.
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware.

This preface contains the following sections:

- [“Product Documentation Library” on page 7](#)
- [“Change History” on page 8](#)

Product Documentation Library

Late-breaking information and known issues for this product are included in the product notes. Refer to the Oracle Flash Accelerator F160 PCIe Card Documentation Library:

<http://www.oracle.com/goto/oracleflashf160/docs>

Note - For specific installation instructions, refer to your server documentation. For information about restrictions and use of the Oracle Flash Accelerator F160 PCIe Card on your server, see the most recent version of the server product notes.

Documentation	Link
All Oracle products (Including servers.)	https://docs.oracle.com
Oracle Flash Accelerator F160 PCIe Card Documentation Library	http://www.oracle.com/goto/oracleflashf160/docs
Oracle System Assistant	Refer to the server's administration guide.
Oracle Integrated Lights Out Manager (ILOM)	http://www.oracle.com/goto/ilom/docs

Documentation	Link
Oracle Hardware Management Pack	Refer to the server's administration guide. http://www.oracle.com/goto/ohmp/docs
My Oracle Support	https://support.oracle.com

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Provide feedback about this documentation at: <http://www.oracle.com/goto/docfeedback>

Change History

The following lists the release history of this documentation set:

- April 2016. Edit revision.
- October 2015. Added SPARC Server M7 support. Revised electrical specifications.
- July 2015. Initial publication.

Product Overview

These topics describe specifications and capabilities of the Oracle Flash Accelerator F160 PCIe Card (non-volatile memory express, solid-state drive).

Review the following product information topics before you install or service your Oracle F160 Flash Card:

Description	Links
Learn about Oracle Flash Accelerator F160 PCIe Card features and functions.	“Oracle Flash Accelerator F160 PCIe Card Overview” on page 9
Review specifications and capabilities.	“Specifications” on page 14

Oracle Flash Accelerator F160 PCIe Card Overview

These topics provide an overview of Oracle Flash Accelerator F160 PCIe Card features and functions:

- [“About the Oracle Flash Accelerator F160 PCIe Card” on page 9](#)
- [“Key Features” on page 11](#)
- [“Characteristics” on page 11](#)
- [“Status Indicators” on page 13](#)

About the Oracle Flash Accelerator F160 PCIe Card

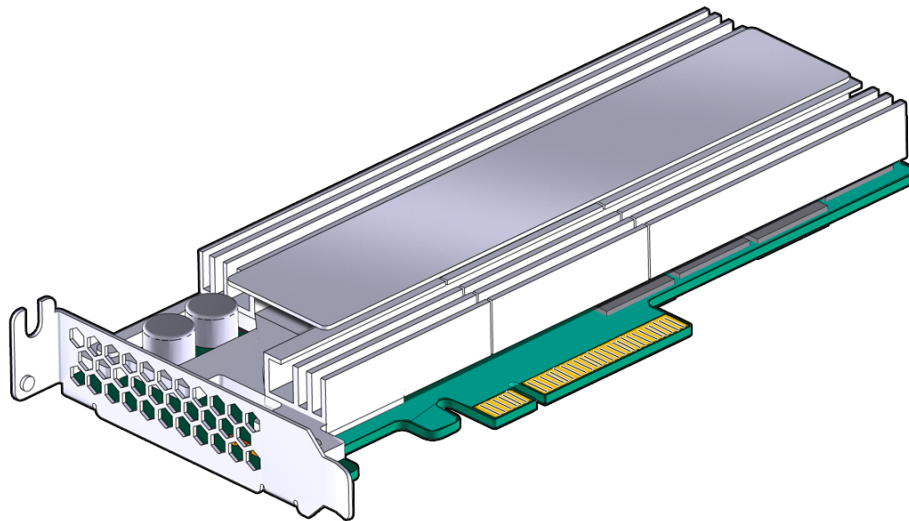
The Oracle Flash Accelerator F160 PCIe Card offers high performance with low latency and a low CPU burden. The 1.6 TB NVMe PCIe Flash Card is a PCIe Gen3 storage drive that is

designed with the new high performance controller interface – NVMe (Non-Volatile Memory express) delivering leading performance, low latency and high quality of service.

The Oracle Flash Accelerator F160 PCIe Card is designed with advanced enterprise multi-level cell NAND (eMLC) technology for high-level performance and write durability. With PCIe Gen3 support and NVMe queuing interface, the 1.6 TB NVMe SSD delivers excellent sequential read performance of up to 2500MB/sec and sequential write speeds of up to 1500MB/sec. The Oracle Flash Accelerator F160 PCIe Card delivers very high random read IOPS of 260K and random write IOPS of 42K for 8KB operations, and random read IOPS of 440K and random write IOPS of 70K for 4KB operations. Taking advantage of the direct path from the storage to the CPU by means of NVMe, Oracle Flash Accelerator F160 PCIe Card exhibits low latency of less than 20 μ sec for sequential access to the storage drive.

The Oracle Flash Accelerator F160 PCIe Card is a block storage device, with block sizing optimization capabilities. You can use the NVMe SSD for either nonpersistent or persistent data.

The following illustration shows an Oracle Flash Accelerator F160 PCIe Card:



Related Information

- [“Specifications” on page 14](#)
- [“Product Overview” on page 9](#)

Key Features

The Oracle Flash Accelerator F160 PCIe Card has the following key features:

Key Feature	Description
Consistently high IOPS and throughput	<ul style="list-style-type: none"> ■ Sequential read speeds of up to 2500MB/sec (2.5GB/sec) ■ Sequential write speeds of up to 1500MB/sec. ■ Delivers random read IOPS of 440K and random write IOPS of 70K for 4KB operations.
Sustained low latency	<ul style="list-style-type: none"> ■ Offers high-performance with low latency and a low CPU burden. ■ Less than 20 µsec for sequential access to the SSD.
High Endurance Technology (HET)	<ul style="list-style-type: none"> ■ Includes High Endurance Technology (HET) NAND silicon enhancements. ■ Includes SSD NAND management techniques to extend SSD write endurance up to 5 drive writes per day for five years.
End-to-end data-path protection	Includes multiple levels of data-path protection.
Enhanced power-loss data protection	Energy storage components complete buffered writes to the persistent flash storage in case of a sudden power loss.
Power loss protection capacitor self-test	Supports testing of the power loss capacitor. Power is monitored using SMART attribute critical warning.
Out-of-band management	Managed through the SMBUS.
Thermal throttling and monitoring	Provides continuous full bandwidth performance with flash memory module temperatures up to 73° C.

Related Information

- [“Specifications” on page 14](#)
- [“Product Overview” on page 9](#)

Characteristics

The Oracle Flash Accelerator F160 PCIe Card has the following hardware and software characteristics:

Characteristic	Value
Device name	■ 1.6 TB NVMe PCIe Flash Card

Characteristic	Value
	SSDPEDME016T4S
Manufacturing name	<ul style="list-style-type: none"> ■ Oracle Flash Accelerator F160 PCIe Card SSDPEDME016T4S
Style	<ul style="list-style-type: none"> ■ Add-in Card (AIC) Form Factor ■ Single slot x4 connector ■ Half-height, half-width, half-length, low-profile PCIe 3.0 board
Capacity	1.6 TB
NAND	Advanced enterprise multi-level cell NAND (eMLC) technology for high-level performance and write durability
Flash controller	Intel® Flash Memory NVMe Controller
Flash controller firmware	Intel custom and proprietary PCIe to NAND flash controller
Minimum operating system versions	<ul style="list-style-type: none"> ■ x86 servers: <ul style="list-style-type: none"> Oracle Solaris 11.2 (SRU 10) Oracle Linux 6.6, based on UEK3 (Unbreakable Linux kernel Release 3) Oracle Solaris 11.3 ■ SPARC servers: <ul style="list-style-type: none"> Oracle Solaris 11.2 (SRU 11) for Fujitsu M10 series servers Oracle Solaris 11.3 for SPARC M7 series servers ■ Oracle Linux 6.5, based on UEK3 (Unbreakable Linux Kernel Release 3)
Management utilities	<ul style="list-style-type: none"> ■ Oracle Hardware Management Pack ■ Oracle System Assistant <p>For more information about management utilities, refer to the server documentation.</p>
Hardware, firmware, and software compatibility	Refer to: “Oracle Flash Accelerator F160 PCIe Card Product Notes” in <i>Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes</i>
Life monitoring capability	<ul style="list-style-type: none"> ■ Provides alerts for proactive replacement of the drive before the endurance is depleted ■ Provides endurance remaining in NVMe SMART logs
Status indicators	<ul style="list-style-type: none"> ■ Amber, red, yellow, and green LEDs on drive bracket indicate status ■ See: “Status Indicators” on page 13

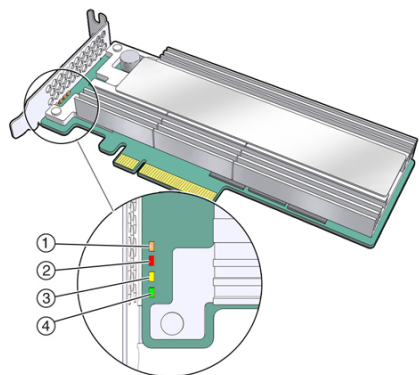
Related Information

- [“Specifications”](#) on page 14
- [“Product Overview”](#) on page 9
- [“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack”](#) on page 50

Status Indicators

Use the Oracle Flash Accelerator F160 PCIe Card status indicators to determine the status of each drive and perform service actions as required. Four status indicator LEDs are located on the drive bracket to indicate status and diagnose NVMe storage drive issues.

The following illustration shows status indicator LEDs for Oracle Flash Accelerator F160 PCIe Card.



Indicator	Color	Status
(1) IO	Amber	Drive IO (data input/output) activity <ul style="list-style-type: none"> ■ OFF – Normal operation. ■ BLINK, variable – Drive activity. Blinks at the rate of 375 msec high, 125 msec low to indicate IO activity. On if idle. ■ STEADY ON – Idle IO, no activity.
(2) Fail	Red	Drive fail <ul style="list-style-type: none"> ■ OFF – Power is off, or normal operation. ■ STEADY ON – Service Action Required. Drive is in disabled logical mode.
(3) Pre-fail	Yellow	Drive pre-fail <ul style="list-style-type: none"> ■ OFF – Power is off, or normal operation. ■ STEADY ON (does not blink) – Service Action Required. Critical warnings in log triggered.
(4) Health	Green	Drive health <ul style="list-style-type: none"> ■ OFF – Power is off, or drive is unhealthy – Service Action Required.

Indicator	Color	Status
		<ul style="list-style-type: none"> ■ STEADY ON (does not blink) – Drive is healthy. Drive is engaged and is receiving full power. Normal operation.

Related Information

- [“Oracle F160 Flash Card Service Overview” on page 37](#)

Specifications

The following sections provide the specifications and capabilities of the Oracle Flash Accelerator F160 PCIe Card:

- [“Product Specification” on page 14](#)
- [“Environmental Specifications” on page 16](#)
- [“Electrical Specifications” on page 17](#)
- [“Reliability Specifications” on page 18](#)
- [“Physical Dimensions” on page 19](#)

Note - For server specifications, see the most recent version of the server product notes.

Product Specification

Oracle Flash Accelerator F160 PCIe Card general specifications are shown in the following table:

Specification	Value
Capacity	Usable capacity 1.6 TB Unformatted capacity (total user addressable sectors in LBA mode) 3,125,627,568
PCIe	<ul style="list-style-type: none"> ■ PCIe Gen3 half-height, half-width, single-slot x4 connector ■ Low-profile, half-height, and half-length PCIe 3.0 board ■ PCIe interface that complies with the PCI Express Specification 3.0 ■ PCI low-profile MD2 specification
Form factor	<ul style="list-style-type: none"> ■ Add-in Card (AIC) Form Factor ■ Single slot x4 connector

Specification	Value
Performance ^{†‡}	<ul style="list-style-type: none"> ■ Half-height, half-width, half-length, low-profile PCIe 3.0 board Sequential Read/Write: Up to 2500/1500 MB/sec Sequential Latency (typical) Read/Write: 20/20 µsec Random Latency (typical) Read/Write: 120/30 µsec Power On to Ready Latency (typical): 2 sec IOPS <ul style="list-style-type: none"> ■ Random Read/Write 4KB 70/30: Up to 160,000 ■ Random Read/Write 8KB 70/30: Up to 75,000 ■ Random 4K Read: Up to 440,000 ■ Random 4K Write: Up to 70,000 ■ Random 8K Read: Up to 260,000 ■ Random 8K Write: Up to 42,000 ■ Random Read/Write Consistency 4K/8K: 90%
Components	<ul style="list-style-type: none"> ■ High Endurance Intel® 20nm eMLC NAND Flash Memory ■ Intel® Flash Memory NVMe Controller ASIC
Reliability	<ul style="list-style-type: none"> ■ Uncorrectable Bit Error Rate (UBER): 1 sector per 10¹⁷ bits read ■ Mean Time Between Failure (MTBF): 2 million hours ■ T10 DIF protection <p>“Reliability Specifications” on page 18</p>
Power	<ul style="list-style-type: none"> ■ 3.3V and 12V supply rail ■ Active/Idle (typical): Up to 25W/4W (typical) ■ Enhanced power-loss data protection <p>“Electrical Specifications” on page 17</p>
Certifications and declarations	UL, CE, C-Tick, BSMI, KCC, Microsoft WHQL, VCCI
Compliance	<p>For compliance specifications, refer to the Oracle Flash Accelerator F160 PCIe Card Safety and Compliance Guide.</p> <ul style="list-style-type: none"> ■ NVM Express 1.0c ■ PCI Express Base Specification Rev 3.0 ■ Enterprise SSD Form Factor Version 1.0a ■ PCI Express Card Electro-Mechanical (CEM) Specification Rev 2.0
Endurance rating	<ul style="list-style-type: none"> ■ Up to 14 PBW (petabytes written) ■ 5 Drive Writes/day (JESD219 workload)
Altitude (simulated)	<ul style="list-style-type: none"> ■ Operating: -1,000 to 10,000 ft ■ Non-Operating: -1,000 to 40,000 ft
Temperature	<ul style="list-style-type: none"> ■ Operating: <ul style="list-style-type: none"> ■ 0 to 55° C ambient, with specified airflow out of server through PCIe Card Slot ■ Temperature monitoring (In-band and by way of SMBUS)

Specification	Value
	<ul style="list-style-type: none"> ■ Thermal throttling ■ Non-Operating: -55 to 95° C
Airflow	More than 300 LFM (linear feet/minute, Airflow towards IO bracket. Airflow out of server through PCIe Card Slot (55° C)).
Weight	Up to 195 gm
Shock	50 G Trapezoidal, 170 in/s
Vibration	<ul style="list-style-type: none"> ■ Operating: 2.17 GRMS (5-700Hz) ■ Non-Operating: 3.13 GRMS (5-800Hz)
Product ecological compliance	RoHS

[†]Performance values vary by capacity and form factor.

[‡]Performance specifications apply to both compressible and incompressible data.

Related Information

- [“Product Overview” on page 9](#)

Environmental Specifications

The Oracle Flash Accelerator F160 PCIe Card operates and is stored in an environment defined by the parameters and specifications in the following table:

Specification	Value
Operating temperature	0 to 55° C with specified airflow
Non-operating temperature	Storage and transit environment: -55° C to 95° C (dry bulb)
Temperature monitoring	<ul style="list-style-type: none"> ■ Temperature monitoring in-band and by way of SMBUS ■ See “Troubleshooting Oracle F160 Flash Card Cooling” on page 49 for more information on thermal throttling.
Dry bulb temperature	Maximum dry bulb temperature shall be derated by 3.3° C per 1000 m above 500 m
Altitude (Simulated)	<ul style="list-style-type: none"> ■ Operating: -1,000 to 10,000 ft ■ Non-Operating: -1,000 to 40,000 ft
Relative humidity range	<ul style="list-style-type: none"> ■ Operational environment: 8% to 80% noncondensing ■ Storage and transit environment: 5% to 95% noncondensing ■ Non-operating: -20° C to 75° C noncondensing
Thermal sensors	<ul style="list-style-type: none"> ■ Thermal sensors on the storage drives monitor flash memory modules ■ Thermal sensor temperature cannot exceed 73° C ■ See illustration in “Troubleshooting Oracle F160 Flash Card Cooling” on page 49 for thermal sensor locations.

Specification	Value
Airflow requirement	More than 300 LFM (linear feet/minute) at 55° C with airflow towards IO bracket

Note - For specific site planning guidelines and best practices, refer to the server documentation and product notes for your server. Refer to the system site planning guide, if available.

Related Information

- [“Product Overview” on page 9](#)

Electrical Specifications

Oracle Flash Accelerator F160 PCIe Card electrical specifications are shown in the following table:

Specification	Value
Power feeds	<ul style="list-style-type: none"> ■ 3.3V and 12V Supply Rail
Enhanced power-loss data protection	Active/Idle: Up to 25W/4W (typical)
Power consumption	<ul style="list-style-type: none"> ■ Active Write - Average = 22W ■ Active Read - Average = 10W ■ Idle = 4W

The Oracle Flash Accelerator F160 PCIe Card receives electrical power from the PCI Express +12 VDC and +3.3 VDC power rails as shown in the following table:

Specification	12 V Operating Characteristics	3.3 V Operating Characteristics	3.3 Vaux Operating Characteristics
Operating voltage range	12 V (+10%/-20%)	3.3 V (+-9%)	3.3 V (+-9%)
Rise time (Max/Min)	50ms/1ms	50ms/1ms	50ms/1ms
Fall time (Max/Min)	5s/1ms	5s/1ms	5s/1ms
Noise level	1000 mV pp at 10Hz – 100KHz	300 mV pp at 10Hz – 100KHz	300 mV pp at 10Hz – 100KHz
	100 mV pp at 100KHz – 20 MHz	50 mV pp at 100KHz – 20 MHz	50 mV pp at 100KHz – 20 MHz
Min off time	3s	3s	3s

Specification	12 V Operating Characteristics	3.3 V Operating Characteristics	3.3 Vaux Operating Characteristics
Inrush current (typical peak)	1.5 A	1.5 A	1.5 A
Max average current	2.45 A	3.0 A	1 mA

Related Information

- [“Product Overview” on page 9](#)

Reliability Specifications

The Oracle Flash Accelerator F160 PCIe Card reliability specifications are shown in the following table:

Specification	Value
Uncorrectable Bit Error Rate (UBER)	<p>Uncorrectable bit error rate will not exceed one sector in the specified number of bits read.</p> <p>In the unlikely event of a non-recoverable read error, the storage drive will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host.</p> <p>< 1 sector per 10¹⁷ bits read</p>
Mean Time Between Failures (MTBF)	<p>2 million hours</p> <p>Mean Time Between Failures is estimated based on Telcordia methodology and demonstrated through Reliability Demonstration Test (RDT).</p>
Data Retention	<p>The time period for retaining data in the NAND at maximum rated endurance. 3 months power-off retention once storage drive reaches rated write endurance at 40° C.</p>
Endurance Rating	<ul style="list-style-type: none"> ■ Up to 14 PBW (petabytes written) <p>Endurance rating verification is defined to establish UBER <1E-16 at 60% upper confidence limit.</p> <ul style="list-style-type: none"> ■ 5 Drive Writes/day (JESD219 workload) <p>The number of drive writes such that the storage drive meets the requirements according to the JESD219 standard.</p>
Temperature Sensor	<p>Internal temperature sensor with an accuracy of +/-2° C over a range of -10° C to +85° C which can be monitored using NVMe Health Log.</p> <p>The sensor has an accuracy of +/- 3° C over a range of -20° C to 125° C. SMBUS temperature sensor is not reported in NVMe Health Log.</p> <p>Drive provides out-of-band access to temperature by means of SMBUS.</p>
Out of Band Management (SMBUS)	<p>Provides out-of-band management by means of SMBUS interface. This requires 3.3V auxiliary voltage.</p>

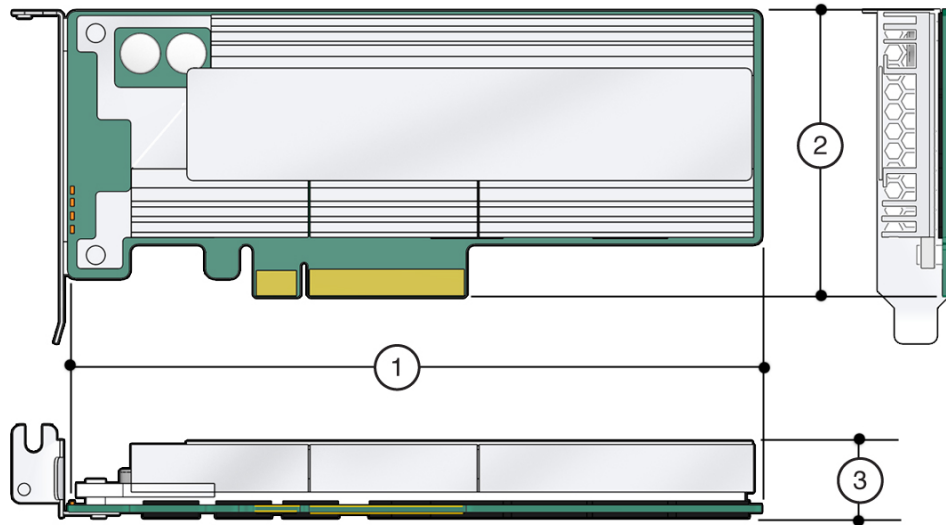
Specification	Value
	SMBUS access includes the VPD page and temperature sensor.
Hot Plug Support	Supports PCIe presence detect and link-up detect.
	Device advanced power loss protection provides robust data integrity. During IOs, the SSD's integrated monitoring enables the integrity of already committed data on the media and commits acknowledged writes to the media.
	See “Servicing the Oracle F160 Flash Card” on page 37.

Related Information

- [“Product Overview”](#) on page 9
- [“Servicing the Oracle F160 Flash Card”](#) on page 37

Physical Dimensions

The following diagram shows Oracle Flash Accelerator F160 PCIe Card physical dimensions:



Specifications

Specification	Dimension
(1) Length	167.55 mm maximum (6.59 in.)
(2) Width	56.15 +/- 0.25 mm (2.21 +/- 0.0098 in.)
(3) Height	118.74 mm (4.67 in.)
Weight	195 g maximum (6.87 oz)

Related Information

- [“Product Overview” on page 9](#)

Preparing the Oracle F160 Flash Card for Installation

These topics contain information about preparing an Oracle Flash Accelerator F160 PCIe Card for installation:

Description	Links
Prepare for installation (task).	“Prepare for Installation” on page 21
Gather the required tools.	“Required Tools” on page 22
Unpack the shipping kit.	“Ship Kit Contents” on page 22
Review safety information.	“Observing Safety Precautions” on page 24
Review electrostatic discharge (ESD) safety measures.	“ESD Safety Measures” on page 25
Review Oracle F160 Flash Card optimization Guidelines.	“Oracle Flash Accelerator F160 PCIe Card Optimization Guidelines” on page 26
Update your system to the latest software release.	“Update Your System to the Latest Software Release” on page 27

Note - For specific installation instructions, see your system installation guide. For information about installation and use of the card on your server, see the most recent version of the server product notes.

Note - NVMe storage drives are supported only on servers that are running Oracle Solaris or Oracle Linux operating systems. Servers that are running Oracle VM, Windows Server, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, or VMware ESXi do not support NVMe drives.

▼ Prepare for Installation

1. Gather the required tools.

See “Required Tools” on page 22.

2. **Unpack the shipping kit that includes the card.**
 - a. **Unpack the card in a static free environment.**
See “Ship Kit Contents” on page 22.
 - b. **Remove the card drive from its packaging and place the drive on an antistatic mat, using good antistatic grounding procedures.**
See “ESD Safety Measures” on page 25.
3. **Carefully inspect the card drive for damage.**
 - a. **Inspect the drive for shipment damage. If any damage is detected, contact your supplier.**
 - b. **If you notice any damage, contact Oracle support or your reseller support representative. Go to: <https://support.oracle.com>.**

Required Tools

You will need the following tools for most service operations:

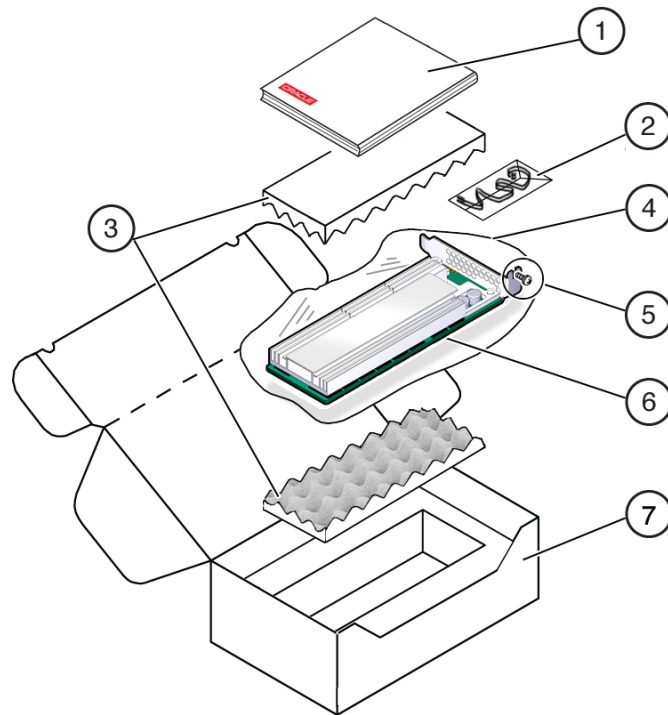
- Antistatic wrist strap
- Antistatic mat
- No. 1 Phillips screwdriver

Related Information

- “Preparing the Oracle F160 Flash Card for Installation” on page 21
- “ESD Safety Measures” on page 25

Ship Kit Contents

The Oracle Flash Accelerator F160 PCIe Card ship kit contains the components shown in the following illustration:



1. Documentation
2. Antistatic wrist-strap (Note: Not included in some ship kits)
3. Foam
4. Antistatic bag
5. Bracket screw
6. Oracle Flash Accelerator F160 PCIe Card with low profile PCIe mounting bracket
7. Packaging

Related Information

- [“Preparing the Oracle F160 Flash Card for Installation” on page 21](#)
- [“Product Overview” on page 9](#)

Observing Safety Precautions

This section contains safety information about safeguarding the equipment and personnel from damage:

- [“General Safety Information” on page 24](#)
- [“Safety Symbols” on page 24](#)
- [“ESD Safety Measures” on page 25](#)
- [“Perform ESD Prevention Measures” on page 25](#)

General Safety Information

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions marked on the equipment.
- Follow all cautions and instructions described in the documentation shipped with your system, and described in the server's safety information.
- Follow the electrostatic discharge safety practices as described in this section.
- Handle the card by the edges.

Safety Symbols

Note the meanings of the following symbols that might appear in this document:



Caution - There is a risk of personal injury or equipment damage. To avoid personal injury and equipment damage, follow the instructions.



Caution - Hot surface. Avoid contact. Surfaces are hot and might cause personal injury if touched.



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

ESD Safety Measures

Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Electrostatic discharge (ESD) sensitive devices, such as the drives, require special handling.

- Place ESD-sensitive components and other PCBs on an antistatic mat (not provided).
- Wear an antistatic wrist strap when handling ESD-sensitive components.



Caution - Possible component damage. Do not touch components along connector edges.

Related Information

- [“Perform ESD Prevention Measures” on page 25](#)

▼ Perform ESD Prevention Measures

1. **Prepare an antistatic surface to set parts on during the removal, installation, or replacement process.**

Place ESD-sensitive components such as the printed circuit boards on an antistatic mat. The following items can be used as an antistatic mat:

- **Antistatic bag used to wrap a replacement part**
- **ESD mat**
- **A disposable ESD mat (shipped with some replacement parts or optional system components)**

2. **Attach an antistatic wrist strap (not provided).**

When servicing or removing server components, attach an antistatic strap to your wrist and then to a metal area on the chassis.

Related Information

- [“ESD Safety Measures” on page 25](#)

Oracle Flash Accelerator F160 PCIe Card Optimization Guidelines

To optimize performance, observe the following guidelines when setting up Oracle Flash Accelerator F160 PCIe Cards in a server.

- Block size can be configured through a server operating system or file system and is set to a default size with Oracle databases.
- The Oracle Flash Accelerator F160 PCIe Card is designed to provide best performance for data transfers that are multiples of 4k size and using addresses that are 4k aligned. Partitions should be aligned to start on 4k boundaries.
- The ZFS file system might require manual alignment. The Oracle Flash Accelerator F160 PCIe Card has a maximum transfer size of 128k. IO requests for larger transfer sizes will be broken into transfer sizes of size 128k or smaller. For optimal performance, transfer sizes should be limited to 128k to avoid additional overhead associated with breaking into smaller transfer sizes.
- The Oracle Flash Accelerator F160 PCIe Card should be formatted using a label of type EFI (`format -e` command).

Ensure that when the EFI label is created by ZFS, the default start sector is 256, which aligns S1 with 128k (if the block size is 512). The vtoc label default cylinder size is 50176 (224*224) blocks. If the block size is 512, the default Oracle Solaris Operating System partition aligns with 512k. For example: $50176 * 512 = 49 * 512 * 1024$.

Specify and ensure 4k alignment: The default start sector of 34 for EFI labels is not a 4k aligned value. Use the partition subcommand of the Solaris `format` command to change the start sector to 256, or any other 128k aligned value. Note that there are 512B per sector.

- The ZFS file system automatically aligns partitions to start on 8k boundaries when a full disk is allocated to ZFS (recommended). If you allocate individual EFI partitions to a ZFS pool, ensure the partition is 4k-aligned as discussed above. For optimal performance of ZFS with the Oracle Flash Accelerator F160 PCIe Card, refer to the *ZFS Best Practices Guide* and the *ZFS Evil Tuning Guide*.
- For highest performance, make sure that the system meets the physical, environmental, and electrical specifications listed in [“Specifications” on page 14](#).

Related Information

- [“Preparing the Oracle F160 Flash Card for Installation” on page 21](#)
- Tuning ZFS When Using Flash Storage: http://docs.oracle.com/cd/E26502_01/html/E29022/chapterzfs-flash.html

Drive Volume Management

A volume manager can present multiple card devices as one larger volume. Use the Automatic Storage Management (ASM) volume manager or other volume manager to concatenate multiple flash memory domains. For example, a volume manager can be used to concatenate four 1.6 TB domains into a single 6.4 TB volume.

Refer to the documentation for more information at http://docs.oracle.com/cd/B28359_01/server.111/b31107/asmcon.htm.

▼ Update Your System to the Latest Software Release

It is highly recommended that you update your system to the latest software release before you use the system. Software releases often include bug fixes, and updating ensures that your server software is compatible with the latest server firmware and other component firmware and software.

Note - System firmware update releases include Oracle Flash Accelerator F160 PCIe Card component firmware updates. When system firmware updates, as described in the server documentation, the Oracle Flash Accelerator F160 PCIe Card firmware automatically updates.

1. Check the **“Minimum Supported Oracle 1.6 TB NVMe SSD Firmware Version”** in **Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes** for the latest firmware requirements, available at:
<http://www.oracle.com/goto/oracleflashf160/docs>.
2. Download and install any firmware updates required to support the card, host bus adapter (HBA), drive backplane, system BIOS, or OBP/system (SPARC) firmware.
 - You can get the latest available system BIOS, Oracle Integrated Lights Out Manager (ILOM), firmware, and drivers from Oracle by performing the **Get Updates** task in Oracle System Assistant.
An Internet connection is required. For instructions on how to use the **Get Updates** task, see the server's administration guide.
 - You also can download the latest firmware and software updates from My Oracle Support at <https://support.oracle.com>.

For information about downloading firmware and software from My Oracle Support, see “Getting Server Firmware and Software Updates” in the server documentation.

Related Information

- [“Downloading the SSD Software Package” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*](#)
- [“Update the NVMe Storage Drive Firmware” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*](#)
- [“Verify Oracle Oracle Flash Accelerator F160 PCIe Card Operation” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*](#)
- [“Product Overview” on page 9](#)
- [“Technical Support” on page 48](#)

Installing the Oracle F160 Flash Card

These topics contain information about installing the Oracle Flash Accelerator F160 PCIe Card into a server PCIe slot.

Description	Links
Review installation tasks and performance tuning information before installing card.	“Installation Overview” on page 29
Install a new card into a server when the card is cold plug inserted into a PCIe slot.	“Install a New Oracle F160 Flash Card (Server Power-Off)” on page 30
Install a new card into a server when the card is hot plug inserted into a PCIe carrier.	“Install a New Oracle F160 Flash Card (Server Power-On)” on page 33

Installation Overview

Read this overview information section before installing the Oracle Flash Accelerator F160 PCIe Card into a server.

- [“Oracle F160 Flash Card Installation Overview” on page 30](#)

For information on how to install your Oracle F160 Flash Card, refer to your server documentation. Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card installation instructions.

The bracket assembly should not be disassembled for any reason by the user.



Caution - Hazardous voltages are present. You must disconnect all server power supplies before servicing any of the components documented in this guide.

Oracle F160 Flash Card Installation Overview

To install your Oracle 1.6TB NVMe PCIe 3.0 Flash Card into a system, refer to the following table:

Steps	Task	See
1.	Prepare the Oracle F160 Flash Card for installation. Carefully unpack the Oracle F160 Flash Card. Inspect the card for damage. Follow ESD precautions.	“Preparing the Oracle F160 Flash Card for Installation” on page 21
2.	Insert the Oracle F160 Flash Card in an available PCIe slot with server power in the off state.	“Install a New Oracle F160 Flash Card (Server Power-Off)” on page 30
	or	or
	Insert the Oracle F160 Flash Card in an available PCIe carrier with server power in the on state.	“Install a New Oracle F160 Flash Card (Server Power-On)” on page 33

Refer to the server's service manual for additional information.

Related Information

- [“Oracle F160 Flash Card Service Overview” on page 37](#)
- [“Replace Oracle F160 Flash Card \(Server Power-Off\)” on page 39](#)
- [“Replace Oracle F160 Flash Card \(Server Power-On\)” on page 45](#)

▼ Install a New Oracle F160 Flash Card (Server Power-Off)

To install a new Oracle Flash Accelerator F160 PCIe Card into a supported server:

Note - Refer to the server's service manual for PCIe card installation instructions.

- 1. Prepare the Oracle F160 Flash Card for installation.**
See [“Preparing the Oracle F160 Flash Card for Installation” on page 21](#).
- 2. Back up your data, as required, before changing your server configuration.**
- 3. Identify a supported and available PCIe slot in the server.**
Refer to the server's service manual for PCIe slot locations in the server.

Refer to “Supported Hardware and Software” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes* at:

<http://www.oracle.com/goto/oracleflashf160/docs>

4. Prepare the server for service.



Caution - Hazardous voltages are present. Disconnect the server from the main power and from any networks before installing the card to avoid electrical shock.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card installation instructions.

a. Ensure that you have already taken antistatic measures.

See “ESD Safety Measures” on page 25.

b. Remove the server from active operation.

c. Turn off the server.

Power down the system.

d. Disconnect all power cords from the server power supplies.

e. Remove the cover from the chassis.

5. Record the serial number of the Oracle F160 Flash Card and PCIe slot number where the card will be installed.

This server slot information can be used at a later time for identifying Oracle F160 Flash Cards from the console.

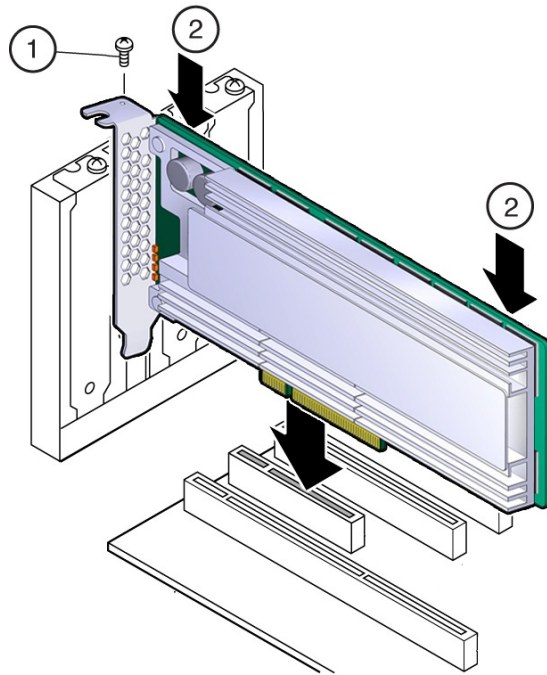
Refer to the server's service manual.

6. Insert the Oracle F160 Flash Card in the supported PCIe slot.

a. Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot. Save the bracket screw, if applicable.

b. Press down gently, but firmly, to properly seat the card in the slot.

The following figure shows how to insert the Oracle F160 Flash Card in a PCI Express slot:



Note - Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card installation instructions.

- 7. Secure the card bracket to the server chassis.**
Engage the server retention mechanism to secure the card to the server chassis.
or: Install the bracket screw, as required to secure the card to the server chassis.
- 8. Return the server to service.**
Refer to the servers service manual.
 - a. Replace the cover if applicable.**
 - b. Reconnect the power cord and any network cables.**

c. Power on the system.

The card hardware insertion is complete

9. Configure the server for the new Oracle F160 Flash Card.

Refer to the servers administration guide or the OS documentation.

a. If applicable, perform any required commands for your system to install the device driver for the new Oracle F160 Flash Card.

b. If applicable, perform any required commands for your system to recognize the new Oracle F160 Flash Card.

c. Verify successful installation of the Oracle F160 Flash Card through your server operating system.

When the installation is complete, the Oracle Flash Accelerator F160 PCIe Card is visible to your server operating system.

d. Configure the system to maximize flash technology.

Related Information

- [“Oracle Flash Accelerator F160 PCIe Card Optimization Guidelines” on page 26](#)
- [“Product Overview” on page 9](#)
- [“Installation Overview” on page 29](#)
- [“Oracle F160 Flash Card Service Overview” on page 37](#)

▼ **Install a New Oracle F160 Flash Card (Server Power-On)**

To install a new Oracle Flash Accelerator F160 PCIe Card into a supported server when the card is hot plug inserted into an empty PCIe carrier:

Note - Refer to the server's service manual for PCIe card installation instructions.

1. Prepare the Oracle F160 Flash Card for installation.

See [“Preparing the Oracle F160 Flash Card for Installation” on page 21.](#)

2. Back up your data, as required, before changing your server configuration.

3. Identify a supported and available PCIe carrier in the server.

Refer to the server's service manual for PCIe carrier and slot locations in the server.

Refer to “Supported Hardware and Software” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes* at:

<http://www.oracle.com/goto/oracleflashf160/docs>

4. Prepare the server for service.

a. Refer to the server's service manual for instructions.

b. Remove the domain from active operation, as required.

c. Ensure that you have already taken antistatic measures.

See “ESD Safety Measures” on page 25.

5. Remove the carrier from the server slot.

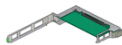
Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card installation instructions.

6. Record the serial number of the Oracle F160 Flash Card and PCIe slot number where the card will be installed.

This server slot information can be used at a later time for identifying Oracle F160 Flash Cards from the console.

Refer to the server's service manual.

7. Install the Oracle F160 Flash Card in the carrier.



a. Unlatch and swing open the arm of the PCIe card carrier, and insert the new Oracle F160 Flash Card until the bottom connector is firmly seated in the carrier's connector.

The card is correctly seated only when the notch at the top of the card bracket fits around a guide post on the carrier.



Caution - Do not twist or turn the PCIe card as you insert it into the carrier. The card's connector must be fully seated in the carrier's slot before you attempt to close the top cover.

Note - If the PCIe card includes a mounting screw, do not use the mounting screw. The carrier does not accept mounting screws.

b. Close the top of the carrier.

The green latch should click into place. If the top is difficult to close, verify that the notch of the card bracket or filler panel fits around the guide post.

8. Insert the carrier into the server chassis.

9. Return the server to service.

Refer to the server's service manual.

10. Configure the server for the new Oracle F160 Flash Card.

Refer to the server's administration guide.

a. If applicable, perform any required commands for your system to install the device driver for the new Oracle F160 Flash Card.

b. If applicable, perform any required commands for your system to recognize the new Oracle F160 Flash Card.

c. Verify successful installation of the Oracle F160 Flash Card through your system's OS.

When the installation is complete, the Oracle Flash Accelerator F160 PCIe Card is visible to your server operating system.

d. Configure the system to maximize flash technology.

Related Information

- [“Oracle Flash Accelerator F160 PCIe Card Optimization Guidelines” on page 26](#)
- [“Product Overview” on page 9](#)
- [“Installation Overview” on page 29](#)
- [“Oracle F160 Flash Card Service Overview” on page 37](#)

Servicing the Oracle F160 Flash Card

These topics provide service information and procedures for the Oracle Flash Accelerator F160 PCIe Card.

Description	Links
Review service task and troubleshooting information.	“Oracle F160 Flash Card Service Overview” on page 37
Review NVMe drive component serviceability information.	“Component Serviceability” on page 38
Remove and replace Oracle F160 Flash Cards.	“Replace Oracle F160 Flash Card (Server Power-Off)” on page 39 “Replace Oracle F160 Flash Card (Server Power-On)” on page 45
Contact My Oracle Support (MOS).	“Technical Support” on page 48
Troubleshoot Oracle F160 Flash Card thermal issues.	“Troubleshooting Oracle F160 Flash Card Cooling” on page 49
Use Oracle Hardware Management Pack utilities command line interface (CLI) tools to service the Oracle F160 Flash Card.	“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack” on page 50

Oracle F160 Flash Card Service Overview

For service, the Oracle Flash Accelerator F160 PCIe Card contains updatable flash ROM for storing the BIOS and firmware, as well as NVRAM for storing nonvolatile configuration data. Use Oracle Hardware Management Pack to monitor and service the Oracle F160 Flash Card. You can also use Oracle Hardware Management Pack for troubleshooting. See [“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack” on page 50](#).

In addition, you can monitor Oracle Flash Accelerator F160 PCIe Card health and flash media drive life through card bracket status indicators. The Oracle F160 Flash Card has four

status indicators on the card bracket to indicate activity, drive health, and status. See [“Status Indicators” on page 13](#).

The Oracle Flash Accelerator F160 PCIe Card requires no periodic maintenance. For data protection, the Oracle F160 Flash Card is designed with energy storage components to complete buffered writes to the persistent flash storage in case of a sudden power loss. These energy storage components are designed for the life of the Oracle F160 Flash Card and do not require periodic maintenance.

Note - Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card removal and replacement instructions.

Note - Refer to the server documentation for additional Oracle F160 Flash Card service and firmware download information.

Component Serviceability

The following service actions can be performed on an Oracle F160 Flash Card.

- Unmount an NVMe Storage Drive
- Remove an NVMe Storage Drive From the Server
- Verify Removal of an NVMe Storage Drive
- Install an NVMe Storage Drive in the Server
- Power On an NVMe Storage Drive and Attach a Device Driver

Refer to the server documentation for additional service information.

Components are either hot serviceable or cold serviceable. Hot service capability allows you to safely remove this component while the server is running. Cold service capability requires a powered off state, so you need to remove power from the server.

Components are designated either CRU (customer-replaceable unit) or FRU (field-replaceable unit). CRU service capability allows trained technicians and authorized field service personnel to service this component. FRU service capability allows only authorized service personnel to service this component.



Caution - Hazardous voltages are present. Disconnect the server from the main power and from any networks before servicing the card to avoid electrical shock.

The following table lists the serviceability of NVMe components and directs you to replacement instructions.

Component	Serviceability	Replacement Instructions
Oracle Flash Accelerator F160 PCIe Card	Cold for servers with motherboard PCIe connections or Hot for servers with PCIe carriers. CRU	<p>“Installing the Oracle F160 Flash Card” on page 29</p> <p>Note - Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card removal and replacement instructions.</p> <p>“Replace Oracle F160 Flash Card (Server Power-Off)” on page 39</p> <p>“Replace Oracle F160 Flash Card (Server Power-On)” on page 45</p> <p>For instructions on safe installation and removal of Oracle F160 Flash Cards, refer to the server's service manual.</p>

See Also:

- [“Product Overview” on page 9](#)
- [“Technical Support” on page 48](#)

▼ Replace Oracle F160 Flash Card (Server Power-Off)

Replace an existing Oracle Flash Accelerator F160 PCIe Card if the drive fails or the usable drive life has been exceeded.



Caution - Possible data loss. Exceeding the maximum number of Oracle 1.6TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in host platform error report and shutdown.



Caution - Possible component damage. Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components along their connector edges. These procedures require that you handle components that are sensitive to electrostatic discharge. This sensitivity can cause the components to fail. To avoid damage, ensure that you follow anti-static practices as described in [“ESD Safety Measures” on page 25](#).



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card removal and replacement instructions.

The following task describes an example procedure. Follow the server's service manual detailed instructions.

1. **Prepare the server operating system, as required, before you remove drives.**
 - Follow the server's service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions.
 - Unmount the Oracle F160 Flash Cards. Refer to the server's service manual for instructions.
2. **Observe the status indicators (LEDs) on the rear panel of the server to verify which Oracle F160 Flash Card in the server requires replacement.**
 - Amber (IO), Red (Fail), Yellow (Pre-fail), Green (operational) See [“Status Indicators” on page 13](#).
 - If necessary, make a note of where the PCIe cards are installed.
3. **Prepare the server for service.**

Refer to the server's service manual for instructions.



Caution - Hazardous voltages are present. Disconnect the server from the main power and from any networks before installing the card to avoid electrical shock.

- a. **Remove the server from active operation.**



Caution - Possible data loss. Exceeding the maximum number of Oracle 1.6TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in host platform error report and shutdown.

- b. **Turn off the server.**

Power down the system.
- c. **Disconnect all power cords from the server power supplies.**

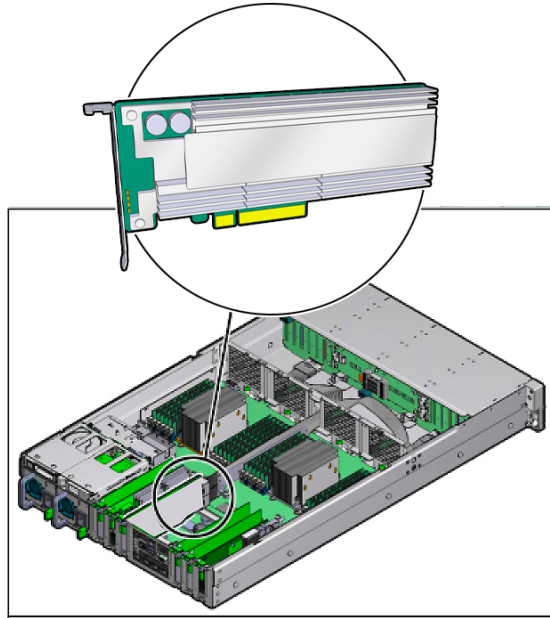
d. Remove the cover from the chassis.

Your server chassis might use another configuration. Refer to the server's service manual for instructions.

4. Identify the physical location of the Oracle F160 Flash Card that you want to remove.

Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow. Refer to the server's service manual for instructions.

Refer to [“Supported Hardware and Software” in Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes.](#)

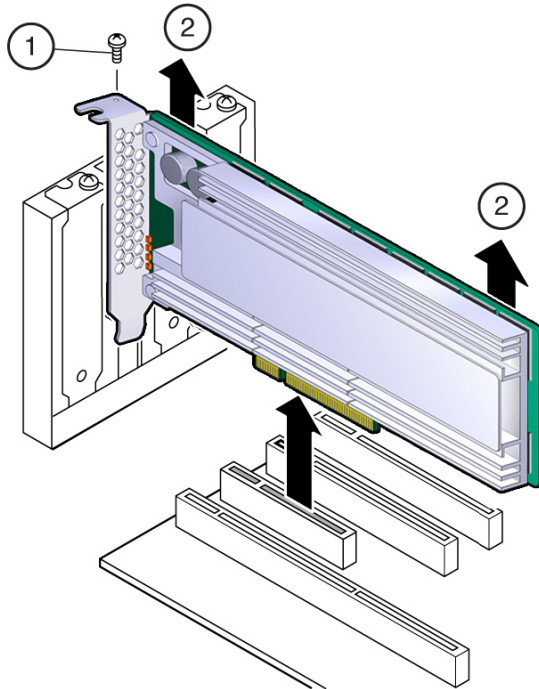


5. Remove the bracket from the server chassis [1].

Remove the bracket screw.

6. Remove the card from the server chassis [2].

Carefully lift the card out of the PCIe slot to remove the card.



Caution - Hot surface. Avoid contact. Surfaces are hot and might cause personal injury if touched.

Note - Whenever you remove a PCIe card, you should replace it with another PCIe card or a PCIe filler panel. Installing PCIe filler panels in vacant PCIe slots helps reduce the level of electromagnetic interference (EMI) emitted by the server.

7. **Place the PCIe card on an antistatic mat.**
8. **Locate the proper PCIe slot for the card you are replacing.**
If necessary, remove the PCIe filler panel from the slot.
9. **Insert the replacement card in the supported PCIe slot.**

Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow.

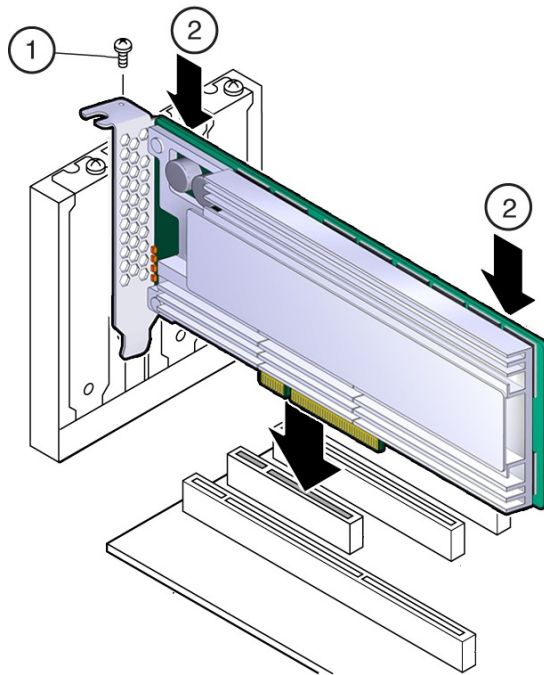
Your server chassis might contain a card riser or other configuration. Refer to the server's service manual for card installation instructions.

- a. **Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot.**

Save the bracket screw, if applicable.

- b. **Press down gently, but firmly, to properly seat the card in the slot.**

The following figure shows how to insert the card in a PCI Express slot:



Your server chassis might contain a card riser or other configuration. Refer to the server's service manual for card installation instructions.

10. **Secure the card bracket to the server chassis.**

Install the bracket screw, as required to secure the card to the server chassis.

Or: engage the server retention mechanism to secure the card to the server chassis.

11. Return the server to service.

Refer to the server's service manual.

a. Replace the cover.

Your server chassis might use another configuration. Refer to the server's service manual for instructions.

b. Reconnect the power cord and any network cables.

c. Power on the system.

The card hardware insertion is complete.

12. Configure the Oracle F160 Flash Card and verify drive availability.

- Follow the server's service manual instructions for Oracle F160 Flash Card NVMe storage drive configuration and identification.
- Use appropriate software commands to return the system to an operational state:
 - Power on the Oracle F160 Flash Card as required.
 - Attach a device driver as required.
 - Re-activate mirror if manual intervention is required.
 - Re-sync mirror if manual intervention is required.

13. Verify that:

- The Fail LED is not lit .
- The green Health LED is lit on the card that you installed.

See [“Status Indicators” on page 13](#).

Related Information

- [“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack” on page 50](#)
- [“Product Overview” on page 9](#)

▼ Replace Oracle F160 Flash Card (Server Power-On)

Replace an existing Oracle Flash Accelerator F160 PCIe Card if the drive fails or the usable drive life has been exceeded.



Caution - Possible data loss. Exceeding the maximum number of Oracle 1.6TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in host platform error report and shutdown.



Caution - Possible component damage. Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components along their connector edges. These procedures require that you handle components that are sensitive to electrostatic discharge. This sensitivity can cause the components to fail. To avoid damage, ensure that you follow anti-static practices as described in [“ESD Safety Measures” on page 25](#).



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F160 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the server's service manual for PCIe card removal and replacement instructions.

The following task describes an example procedure. Follow the server's service manual detailed instructions.

- 1. Ensure that you have already taken antistatic measures.**

See [“ESD Safety Measures” on page 25](#).

- 2. Prepare the server operating system, as required, before you remove drives.**

Some Oracle F160 Flash Cards are hot-service components that can be replaced at any time if the card is not currently in use. Follow the server's service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions.

Unmount the Oracle F160 Flash Cards. Refer to the server's service manual for instructions.

3. Identify the physical location of the carrier and Oracle F160 Flash Card that you want to remove.

Your server chassis might contain a card riser or other configuration. Refer to the server's service manual for instructions.

Refer to [“Supported Hardware and Software”](#) in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*.

4. Observe the status indicators (LEDs) on the server to verify which Oracle F160 Flash Card in the server requires replacement.

- Amber (IO), Red (Fail), Yellow (Pre-fail), Green (operational)

See [“Status Indicators”](#) on page 13.

- If necessary, make a note of where the PCIe cards are installed.

5. Remove the carrier from the server slot.

6. Carefully remove the Oracle F160 Flash Card from the carrier.



- a. Press the green tab to unlock the carrier latch and open the top of the PCIe carrier.

- b. Slide the card from the slot.



Caution - Avoid twisting, tilting, or pulling unevenly on the PCIe card, which could damage the carrier slot or components on the PCIe carrier circuit board.

7. Place the card on an antistatic mat.

See [“ESD Safety Measures”](#) on page 25

8. Locate the PCIe slot in the carrier for the card you are replacing.

If necessary, remove the PCIe filler panel from the slot.

9. Insert the replacement card in the supported PCIe slot in the carrier.

- a. Remove the blank bracket panel on the carrier that aligns with the empty PCIe slot (optional).

Save the bracket screw, if applicable.

b. Press down gently, but firmly, to properly seat the card in the slot.

10. Secure the card bracket to the carrier.

Note - If the PCIe card includes a mounting screw, do not use the mounting screw. The carrier does not accept mounting screws.

Engage the server retention mechanism to secure the card to the carrier.

11. Insert the carrier into the server chassis.

12. For hot plug service actions, configure the Oracle F160 Flash Card and verify drive availability.

- Follow the server's service manual instructions for Oracle F160 Flash Card NVMe storage drive configuration and identification.
- Use appropriate software commands to return the system to an operational state:
 - Power on the Oracle F160 Flash Card as required.
 - Attach a device driver as required.
 - Re-activate mirror if manual intervention is required.
 - Re-sync mirror if manual intervention is required.

13. At a terminal, use the `hotplug` command to ensure that the card is connected.

For example:

```
# hotplug list /SYS/CMIOU0/PCIE1
[/SYS/CMIOU0/PCIE1] ENABLED
network@0 <pci.0,0> ONLINE
network@0,1 <pci.0,1> ONLINE
network@0,2 <pci.0,2> ONLINE
network@0,3 <pci.0,3> ONLINE
```

14. Verify that the Fail LED is not lit and that the green Health LED is lit on the card that you installed.

See [“Status Indicators” on page 13](#).

Related Information

- [“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack” on page 50](#)

- [“Product Overview” on page 9](#)

Technical Support

For assistance installing, configuring, or running the Oracle Flash Accelerator F160 PCIe Card, contact My Oracle Support (MOS).

Related Information

- [“Contacting Technical Support” on page 48](#)
- [“Oracle Flash Accelerator F160 PCIe Card Product Notes” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*](#)

▼ Contacting Technical Support

For assistance installing, configuring, or running the Oracle Flash Accelerator F160 PCIe Card, contact My Oracle Support (MOS).

Before You Begin Please have your CSI Customer Support ID ready.

● Go to My Oracle Support:

- **Go to:** <https://support.oracle.com>
Sign in to My Oracle Support to open a service request.
- **Call Oracle support, using the appropriate number from the Oracle Global Customer Support Contacts Directory:**
<http://www.oracle.com/us/support/contact-068555.html>

Related Information

- [“Technical Support” on page 48](#)
- [“Oracle Flash Accelerator F160 PCIe Card Product Notes” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes*](#)

Troubleshooting Oracle F160 Flash Card Cooling

Maintaining the proper internal operating temperature of the server is crucial to the health of the server. To prevent server shutdown and damage to components, address over temperature and hardware-related issues as soon as they occur.

The Oracle F160 Flash Card is designed to provide continuous full bandwidth performance with temperatures up to 73° C. Qualified host platforms with required software updates operate with sufficient margin to the maximum temperature under worst case environments.

Use the status indicators to determine the status of the Oracle Flash Accelerator F160 PCIe Card. The LEDs provide key status indicators to diagnose Oracle F160 Flash Card issues. See [“Status Indicators” on page 13](#).

Should the system exceed the maximum operating temperature, or a system fault occur which causes internal temperatures of the flash memory modules to rise above this limit, the Oracle F160 Flash Card responds as follows:

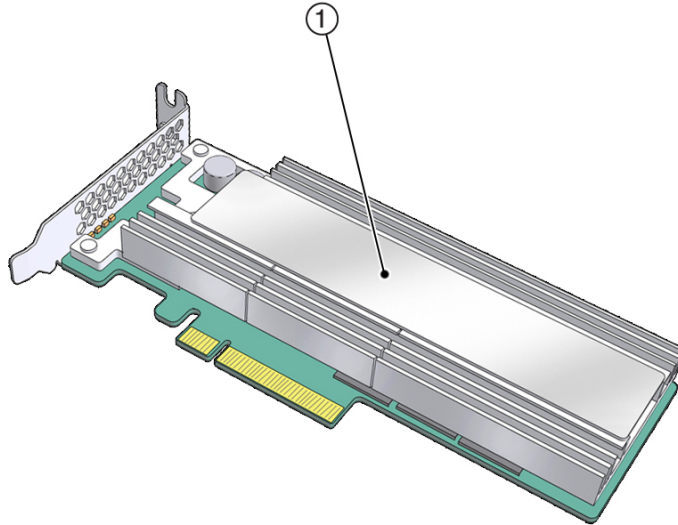
- 73° C - Drive write throttling is engaged to reduce Oracle F160 Flash Card power.
 - Oracle F160 Flash Card status indicator amber is lit, Service Action Required.
 - Temperature warning displays in utility output.
- 78° C - Additional drive write throttling is engaged.
 - Oracle F160 Flash Card status indicator amber is lit, Service Action Required.
 - Critical temperature status displays in utility output.



Caution - Sustained critical temperatures might cause data loss.

Refer to the server documentation for additional service information.

The following image shows the Oracle F160 Flash Card temperature sensor locations on both sides of the circuit board:



(1): Oracle F160 Flash Card temperature sensor location

Related Information

- [“Status Indicators” on page 13](#)
- [“Product Overview” on page 9](#)
- [“Technical Support” on page 48](#)

Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack

The Oracle Hardware Management Pack utilities provide command line interface (CLI) tools to service the Oracle Flash Accelerator F160 PCIe Card. Oracle Hardware Management Pack tools provide commands and agents that operate at the operating system level and can be used across multiple systems. You can monitor hardware through the operating system, either remotely using SNMP or locally using CLI tools.

This section includes the following sections:

- [“Oracle Hardware Management Pack Documentation” on page 51](#)

- [“Access Command Line Interface \(CLI\) in Oracle Hardware Management Pack Utility” on page 51](#)

Oracle Hardware Management Pack Documentation

Documentation for Oracle Hardware Management Pack can be found at:

<http://www.oracle.com/goto/ohmp/docs>

The following table lists the Oracle Hardware Management Pack documentation.

Guide	Number	Description
Oracle Hardware Management Pack 2.3 Installation Guide	E52097	Overview of Hardware Management Pack components and instructions on installing Hardware Management Pack.
Oracle Server CLI Tools 2.3 User's Guide	E52099	Instructions on how to use the Oracle Hardware Management Pack CLI tools. Includes information on NVMe controller administration.
Oracle Server Management Agents 2.3 User's Guide	E52098	Details about installing and configuring the Oracle Server Management Agents, which enable you to manage server's at the operating system level.

Related Information

- [“Access Command Line Interface \(CLI\) in Oracle Hardware Management Pack Utility” on page 51](#)
- [“Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack” on page 50](#)
- [“Product Overview” on page 9](#)

▼ Access Command Line Interface (CLI) in Oracle Hardware Management Pack Utility

To access the Oracle Hardware Management Pack CLI:

1. **Obtain Oracle Hardware Management Pack.**

- **Download the Oracle Hardware Management Pack at:**

<https://support.oracle.com>

- **Get the Add-on software pack from Oracle System Assistant.**

Refer to the “[Oracle Flash Accelerator F160 PCIe Card Product Notes](#)” in *Oracle Flash Accelerator F160 PCIe Card and Oracle 1.6 TB NVMe SSD Product Notes* for additional download information at:

<http://www.oracle.com/goto/oracleflashf160/docs>

2. Access host server console devices remotely or locally.

Ensure that a KVM console is remotely or locally connected to the server.

Refer to the server's service manual.

- Connect an Ethernet cable to the Gigabit Ethernet (NET) connectors as needed for OS support.
- Connect to the service processor's Oracle ILOM over the network, connect an Ethernet cable to the Ethernet port labeled NET MGT.
- Access the Oracle ILOM command-line interface (CLI) locally using the management port, connect a serial null modem cable to the RJ-45 serial port labeled SER MGT.
- To interact with the system console locally, connect a mouse and keyboard to the USB connectors and a monitor to the DB-15 video connector.

3. Open a CLI terminal.

4. Type a command.

See “[Oracle Hardware Management Pack Documentation](#)” on page 51.

Refer to the server documentation.

Related Information

- “[Oracle Hardware Management Pack Documentation](#)” on page 51
- “[Servicing the Oracle F160 Flash Card Using Oracle Hardware Management Pack](#)” on page 50
- “[Product Overview](#)” on page 9

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