Oracle® Flash Accelerator F320 PCIe Card User Guide

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Oracle Flash Accelerator F320 PCIe Card User Guide

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Contents

Using This Documentation

- **Overview** – This user guide provides detailed procedures that describe installation, configuration, and service of the Oracle Flash Accelerator F320 PCIe Card.
- **Audience** – Technicians, system administrators, authorized service providers, and users.
- **Required knowledge** – Experience with servers and advanced understanding of server storage systems. Advanced experience troubleshooting and replacing hardware.

Product Documentation Library

Documentation and resources for this product and related products are available at `http://www.oracle.com/goto/oracleflashf320/docs`.

Feedback

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

Product Overview

These topics describe the specifications and capabilities of the Oracle Flash Accelerator F320 PCIe Card (non-volatile memory express, solid-state drive).

Review the following product information topics before you install or service your Oracle F320 Flash Card:

Description	Links
Learn about Oracle Flash Accelerator F320 PCIe Card features and functions.	"Oracle Flash Accelerator F320 PCIe Card Overview" on page 9
Review specifications and capabilities.	"Specifications" on page 14

Oracle Flash Accelerator F320 PCIe Card Overview

These topics provide an overview of Oracle Flash Accelerator F320 PCIe Card features and functions:

- "About the Oracle Flash Accelerator F320 PCIe Card" on page 9
- "Key Features" on page 11
- "Characteristics" on page 11
- "Status Indicators" on page 12

About the Oracle Flash Accelerator F320 PCIe Card

The Oracle Flash Accelerator F320 PCIe Card presents outstanding performance with instant responsiveness to the host system, by applying the Peripheral Component Interconnect Express

(PCIe) 3.0 interface standard, and the highly efficient Non-Volatile Memory Express (NVMe) protocol. The Oracle Flash Accelerator F320 PCIe Card delivers wide bandwidth of 5.5 GB/s for sequential read speed and 1.8 GB/s for a sequential write speed under up to 25W of power. With the help of a Toggle 2.0 NAND Flash interface, the Oracle Flash Accelerator F320 PCIe Card delivers Quality of Service of 95 µsec for random 4 KB read of 1 M IOPS and 60 µsec for random 4 KB write of 120 K IOPS in the sustained state. By combining the enhanced reliability Samsung NAND Flash memory silicon with NAND Flash management technologies, the Oracle Flash Accelerator F320 PCIe Card delivers the extended endurance of up to 5 Drive Writes Per Day (DWPD) for 5 years, which is suitable for enterprise applications.

The Oracle Flash Accelerator F320 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 F320 PCIe Card:

Related Information

- "Specifications" on page 14
- "Product Overview" on page 9

Key Features

The Oracle Flash Accelerator F320 PCIe Card has the following key features:

- NVM Express (NVMe)
- PCI Express Gen3 - Single port x8 lanes
- Enhanced Power-Loss Data Protection
- LDPC and XOR Engine ECC
- End-to-End Data Protection
- Up to 128 I/O Queues per Port
- Deallocate (TRIM) Command
- PCI Express AER (Advanced Error Reporting)
- 129 vectors for MSI-X Support
- SSD Enhanced S.M.A.R.T. Feature Set
- Hardware based AES-XTS 256-bit Encryption Engine
- Static and Dynamic Wear Leveling

Related Information

Characteristics

The Oracle Flash Accelerator F320 PCIe Card has the following hardware and software characteristics:

Characteristic	Value
Device name	3.2 TB NVMe PCIe Flash Card
Manufacturing name	MZPLK3T2HCJL
Style	- Add-in Card (AIC) Form Factor - Single slot x8 connector - Half-height, half-width, half-length, low-profile PCIe 3.0 board

Characteristic	Value
Capacity	3.2 TB
NAND	Samsung 3D (V-NAND), 3 Cell (TLC)
	V2_TLC HDP 16Landing (533Mbps)
Flash controller	Samsung EPIC controller
Flash controller firmware	Flash controller
Minimum operating system versions	■ Oracle Solaris 11.3 (SRU 2) ■ Oracle Linux 6.7, based on UEK3 (Unbreakable Linux Kernel Release 4) ■ Oracle Linux 7.1, based on UEK3 (Unbreakable Linux Kernel Release 4) Refer to "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.
Management utilities	Oracle Hardware Management Pack For more information about management utilities, refer to the server documentation.
Hardware, firmware, and software compatibility	Refer to "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.
Life monitoring capability	Provides alerts for proactive replacement of the drive before the endurance is depleted
Status indicators	■ Amber and two green LEDs on the drive bracket indicate status ■ See: "Status Indicators" on page 12

Related Information

- "Specifications" on page 14
- "Product Overview" on page 9
- "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52

Status Indicators

Use the Oracle Flash Accelerator F320 PCIe Card status indicators to determine the status of each drive and perform service actions as required. Three 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 on the Oracle Flash Accelerator F320 PCIe Card.
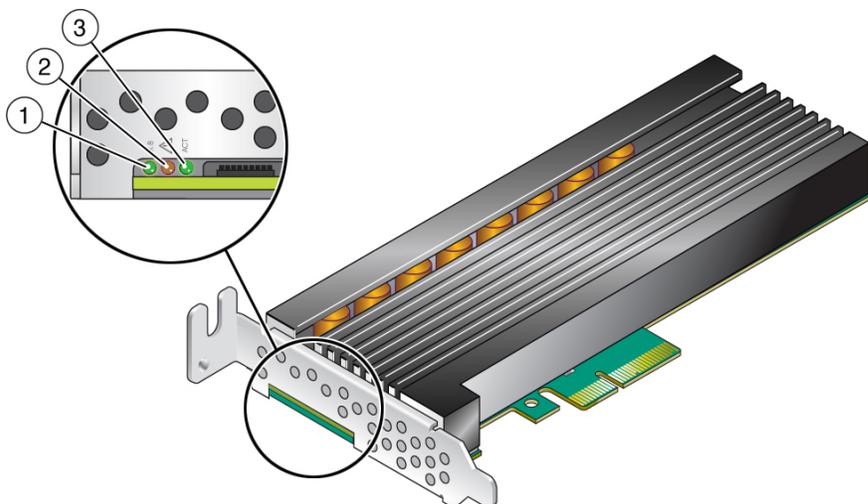
Indicator	Color	Status
(1) x8 Lane	Green	Transfer Speed ■ STEADY ON, x8 Lane Transfer – Normal operation. ■ OFF - Power is off, or x4 Lane Transfer
(2) Fail	Amber	Drive State ■ OFF – Power is off, or normal operation - drive healthy. ■ STEADY ON – Service Action Required. Critical warnings in log triggered. Drive is in disabled logical mode.
(3) ACT Activity	Green	Drive Operation ■ OFF – Power is off, or normal operation. ■ BLINK, Read/Write Rate – IO operation Drive activity. Blinks at the rate of 375 msec high, 175 msec low to indicate IO activity. ■ STEADY ON (does not blink) – On if idle.

Related Information

■ "Oracle F320 Flash Card Service Overview" on page 39

Specifications

The following sections provide the specifications and capabilities of the Oracle Flash Accelerator F320 PCIe Card:

- "Product Specification" on page 14
- "Environmental Specifications" on page 17
- "Electrical Specifications" on page 18
- "Reliability Specifications" on page 19
- "Physical Dimensions" on page 20

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

Product Specification

Oracle Flash Accelerator F320 PCIe Card general specifications are shown in the following table:

Specification	Value
Capacity[†]	- Usable capacity 3.2 TB - Max LBA: 6,251,233,968[‡]
PCIe	- PCIe Gen3 half-height, half-width, single-slot x8 connector - PCIe interface that complies with the PCI Express Specification 3.0 - PCI low-profile MD2 specification
Form factor	- Add-in Card (AIC) Form Factor - Single slot x8 connector - Half-height, half-width, half-length, low-profile PCIe 3.0 board
NAND	- V2 128Gb NAND Flash Memory - V2_TLC HDP 16Landing (533Mbps)
Features	- NVM Express (NVMe) - PCI Express Gen3 - Single port x8 lanes - Enhanced Power-Loss Data Protection - LDPC and XOR Engine ECC - End-to-End Data Protection - Up to 128 I/O Queues per Port - Deallocate (TRIM) Command - PCI Express AER (Advanced Error Reporting) - 129 vectors for MSI-X Support

Specification	Value
	■ SSD Enhanced S.M.A.R.T. Feature Set
	■ Hardware based AES-XTS 256-bit Encryption Engine
	■ Static and Dynamic Wear Leveling
Drive Configuration	■ Half-height, half-length
	■ Interface: PCI Express Gen3 x8
	■ Bytes per Sector: 512, 520, 4096, 4160 Bytes
Performance Specifications [*][·]	■ Data Transfer Rate: (128KB data size) [5]
	■ Sequential Read Up to 5,500 MB/s
	■ Sequential Write Up to 1,800 MB/s
	■ Data I/O Speed: [6] (4KB data size, Sustained)
	■ Random Read Up to 750K IOPS [7]
	■ Random Write Up to 120K IOPS [8]
	■ Latency: (Sustained random workload) [9]
	■ Random Read (typical): 90 μsec[10]
	■ Write (typical): 20 μsec [11]
	■ Drive Ready Time (typical): 2 sec [12]
	■ Quality of service (QoS) - Read/Write (99%) 95/60 μsec
	■ Performance Consistency - Read/Write (99.9%) Up to 98/94%
Compliance	■ PCI Express Base Specification Rev. 3.0
	■ NVM Express Specification Rev. 1.1b
	■ Enterprise SSD Form Factor Ver. 1.0a
Certifications And Declarations	cUL, CE, TUV-GS, CB, CE, BSMI, KCC, VCCI, C-Tick, FCC
Product Ecological Compliance	RoHS
Reliability Specifications	■ Uncorrectable Bit Error Rate 1 sector per 10^{17} bits read
	■ MTBF: 2,000,000 hours
	■ Power on Cycles (Ambient): 20,000
	■ Component Design Life: 5 years
	■ Endurance: 5 DWPD
	■ PBW (@4KB Random Write): 29.2 PB
	■ Data Retention: 3 months
Environmental Specifications	■ Temperature, Case (Tc[5]) [13]
	■ Operating 0 ~ 55° C
	■ Non-operating -45 ~ 85° C [14]
	■ Humidity (Non-operating) 5 ~ 95%
	■ Shock 1,500 G / 0.5msec
	■ Vibration - Sinusoidal 20 Gpeak, 10 ~ 2000Hz
Power Requirements	■ Supply Voltage / Tolerance: 12V±10%
	■ Active (max. RMS): 25 W [15]
	■ Idle (typ.): 7 W
Physical Dimension	■ Width: 69.85 +/-0.25 mm

Specification	Value
	■ Length: 167.65 +/-0.25 mm
	■ Height: 18.71 +/-0.20 mm
	■ Weight: Up to 330 g
Operating Systems	■ Oracle Solaris 11.3 (SRU 2)
	■ Oracle Linux 6.7, based on UEK4 (Unbreakable Linux Kernel Release 4)
	■ Oracle Linux 7.1, based on UEK4 (Unbreakable Linux Kernel Release 4)
	Oracle VM 3.3.3/3.4.1
	Refer to the "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.

[†]Capacity shown represents the total usable capacity of the SSD which may be less than the total physical capacity. A certain area in physical capacity, not in the area shown to the user, might be used for the purpose of NAND flash management.

[‡]Max. LBA shown represents the total user addressable sectors in LBA mode and calculated by IDEMA rule.

[*]Based on PCI Express Gen3 x4, Random performance measured using FIO in Ubuntu with queue depth 32 by 16 workers and Sequential performance with queue depth 32 by 16 worker. Actual performance may vary depending on use conditions and environment.

[ˑ]Random performance was measured by using FIO in Ubuntu with queue depth 32 by 16 workers. Measurements were performed on a full Logical Block Address (LBA) span of the drive in sustained state. Actual performance may vary depending on use conditions and environment.

[5]Sequential performance was measured by using FIO in Ubuntu with queue depth 32 by 16 workloads. Actual performance may vary depending on use conditions and environment.

[6]Random performance was measured by using FIO in Ubuntu with queue depth 32 by 16 workloads. Measurements were performed on a full Logical Block Address (LBA) span of the drive in sustained state. Actual performance may vary depending on use conditions and environment.

[7]The read latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a random workload of sustained state.

[8]The write latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a sequential workload of sustained state.

[9]Typical values.

[10]The random read/write latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a random workload of sustained state.

[11]The sequential read/write latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a sequential workload of sustained state.

[12]The maximum taking time to be ready for receiving commands after power-up (CSTS.Ready=1). It is expected that I/O commands may not be completed at this point.

[13]Tc is measured at the hottest point on the case with the airflow condition of more than 2.5CFM at 25℃ of ambient temperature.

[14]Storing (or shipping) without power connection.

[15]Active power is measured using IOMeter2006.

Related Information

■ "Product Overview" on page 9

Environmental Specifications

The Oracle Flash Accelerator F320 PCIe Card operates and is stored in an environment defined by the parameters and specifications that are shown in the following table:

Specification	Value
Operating temperature [†]	0 to 55° C at 300 LFM minimum airflow
Non-operating temperature [‡]	Storage and transit environment: –-45 to 85° C
Altitude (Simulated)	■ Operating: -1,000 to 10,000 ft ■ Non-Operating: -1,000 to 40,000 ft
Relative humidity range	■ Operational environment: 8% to 80% noncondensing ■ Storage and transit environment: 5% to 95% noncondensing
Temperature monitoring	■ Temperature monitoring in-band and by way of SMBUS. ■ See "Troubleshooting Oracle F320 Flash Card Cooling" on page 50 for more information on thermal throttling.
Thermal sensors	■ Thermal sensors on the storage drives monitor flash memory modules. ■ Thermal sensor temperature cannot exceed 78° C ■ See illustration in "Troubleshooting Oracle F320 Flash Card Cooling" on page 50 for thermal sensor locations.
Airflow requirement	More than 300 LFM (linear feet/minute, at 25/35° C, airflow towards the IO bracket)
Shock [*]	Non-operating 1,500G
Vibration [•]	Operating: 2.17G RMS PSD (random 5 to 700Hz, zero to peak in x, y or z-axis, flat response) Non-operating: 3.13G RMS PSD (random 10 to 800Hz, zero to peak in x, y or z-axis, flat response) 20G RMS (10~2,000Hz, Sweep sine)

[†]Ta is ambient temperature measured at the hottest point on the heatsink with airflow at more than 2.5 CFM and at 25° C ambient temperature.

[‡]Storing (or shipping) without power connection.

[*]Shock specifications assume that SSD shall be mounted with screws when input vibration is applied. Vibration may be applied in 3 axes (x, y and z) with a half sine waveform of 0.5ms duration in non-operating condition.

[•]Vibration specifications assume that SSD shall be mounted with screws when input vibration is applied. The input vibration may be applied in 3 axes (x, y and z) and lasts during 15 minutes per axis.

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

The Oracle Flash Accelerator F320 PCIe Card receives electrical power from the PCI Express +12 VDC and +3.3 VDC power rails.

Oracle Flash Accelerator F320 PCIe Card electrical specifications are shown in the following table:

Specification	12 V Operating Characteristics	3.3 Vaux Operating Characteristics
Operating voltage range [†]	12 V (+10%/-20%)[‡]	3.3 V (+-9%) [*]
Rise time (Max/Min)	50 ms/1 ms	50 ms/1 ms
Fall time (Max/Min) [•]	5 s/1 ms	5 s/1 ms
Noise level	300 mV pp 10Hz – 100 KHz	300 mV pp 10Hz – 100 KHz
	50 mV pp 100KHz – 20 MHz	50 mV pp 100KHz – 20 MHz
Power Consumption [5]	12 V Active [6] ■ Read 16 W ■ Write 20 W Idle[7]: 7 W Off: 0 W	Max 1 mA (at Read current)
Inrush Current	1.8 A	10 mA (1 ms rising time)

[†]The components inside the SSD were designed to endure a range of voltage fluctuations, which might be induced by the host system,

[‡]For 12V operating voltage, the minimum allowable is 10.8V and the maximum 13.2V.

[*]For 3.3Vaux, the minimum allowable voltage is 2.97V and the maximum 3.63V.

[•]Fall time needs to be equal or better than minimum in order to guarantee full functionality of enhanced power loss management.

[5]Power consumption was measured in the 12V power pins (#P13~#P15) of the connector plug in SSD. The active and idle power is defined as the highest averaged power value, which is the maximum RMS average value over 100 ms duration.

[6]The measurement condition for active power is assumed for 100% sequential read or write.

[7]The idle state is defined as the state that the host system can issue any commands into SSD at any time.

Related Information

■ "Product Overview" on page 9

Reliability Specifications

The Oracle Flash Accelerator F320 PCIe Card reliability specifications are shown in the following table:

Specification	Value
Uncorrectable Bit Error Rate (UBER) [†]	< 1 sector per 10^{17} bits read
	Rate of occurrence of data errors, equal to the number of data errors per bits read as specified in the JESD218 document of JEDEC standard.
Mean Time Between Failures (MTBF) [‡]	2 million hours
Data Retention [*]	3 months
Drive Write Per Day (DWPD) [•]	5 drive writes per day over 5 years
Petabyte Written (PBW) [5]	29.2 PB
Sustained Random Read/Write Performance (IOPS) - Maximum[6]	■ Random 4KB Read: 750K ■ Random 4KB Write: 120K ■ Random 8KB Read: 390K ■ Random 8KB Write: 60K
Sequential Read/ Write Performance - Maximum [7]	■ Sequential 128KB Read MB/s 5,500 ■ Sequential 128KB Write MB/s 1,800
Latency [8] (sustained state)	■ Random Read/Write[9]: 90 / 20 μsec ■ Sequential Read/Write[10]: 90 / 20 μsec ■ Drive Ready Time[11]: 2 seconds

Quality of Service (QoS) [12]	■ Quality of Service (99%) [13]
	  ■ Read (4 KB) μsec
	    QD=1 95, QD=128435
	  ■ Write (4 KB) μsec
	    QD=1 60, QD=128 5795
	■ Quality of Service (99.99%) [14]
	  ■ Read (4 KB) μsec
	    QD=1 140, QD=128 565
	  ■ Write (4 KB) μsec
	    QD=1 200, QD=128 9540

IOPS Consistency [15]	■ Random Read (4 KB) % 97 ■ Random Write (4 KB) % 94 ■ Random Read (8 KB) % 94 ■ Random Write (8 KB) % 92

Specification	Value
Out of Band Management (SMBUS)	Provides out-of-band management by means of SMBUS interface. This requires 3.3V auxiliary voltage. SMBUS access includes the VPD page and temperature sensor.
Hot Plug Support	Supports PCIe presence detect and link-up detect

[†]For the enterprise application, JEDEC recommends that UBER shall be below 10-16

[‡]By definition, Mean Time between Failures (MTBF) is the estimated time between failures occurring during SSD operation.

[*]Data retention was measured by assuming that SSD reaches the maximum rated endurance at 40C in power-off state.

[•]The endurance of SSD in enterprise application is defined as the maximum number of drive writes per day that can meet the requirements specified in the JESD218 document of JEDEC standard.

[5]Relational formula between DWPD and PBW is below: PBW = DWPD x 365 x 5 x User capacity

[6]Random performance was measured by using FIO in Ubuntu with queue depth 32 by 16 workers. Measurements were performed on a full Logical Block Address (LBA) span of the drive in sustained state. Actual performance may vary depending on use conditions and environment.

[7]Sequential performance was measured by using FIO in Ubuntu with queue depth 32 by 16 worker. Actual performance may vary depending on use conditions and environment.

[8]Typical values.

[9]The random read/write latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a random workload of sustained state.

[10]The sequential read/write latency is measured by using FIO in Ubuntu and 4KB transfer size with queue depth 1 on a sequential workload of sustained state.

[11]The maximum taking time to be ready for receiving commands after power-up (CSTS.Ready=1). It is expected that I/O commands may not be completed at this point.

[12]QoS is measured using FIO (99/99.99 %) with queue depth 1 and 128 on 4 KB random and write.

[13]QoS is measured as the maximum round-trip time taken for 99 % of commands to host.

[14]QoS is measured as the maximum round-trip time taken for 99.99 % of commands to host.

[15]IOPS consistency measured using FIO with queue depth 128.

IOPS Consistency (%) = (IOPS in the 99.9% slowest 1-second interval)/(average IOPS during the test).

Related Information

-
-

Physical Dimensions

The following diagram shows Oracle Flash Accelerator F320 PCIe Card physical dimensions:
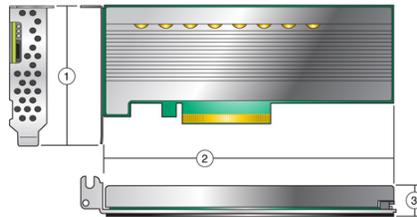
Specification	Dimension
(1) Length	167.55 mm maximum (6.59 in.)
(2) Width	56.15 +/- 0.25 mm (2.21 +/- 0.0098 in.)
(3) Height	118.74 mm (4.67 in.)
Weight	195 g maximum (6.87 oz)

Related Information

- "Product Overview" on page 9

Preparing the Oracle F320 Flash Card for Installation

These topics contain information about preparing an Oracle Flash Accelerator F320 PCIe Card for installation:

Description	Links
Prepare for installation (task).	"Prepare for Installation" on page 23
Gather the required tools.	"Required Tools" on page 24
Unpack the shipping kit.	"Ship Kit Contents" on page 24
Review safety information.	"Observing Safety Precautions" on page 25
Review electrostatic discharge (ESD) safety measures.	"ESD Safety Measures" on page 26
Review Oracle F320 Flash Card optimization Guidelines.	"Oracle Flash Accelerator F320 PCIe Card Optimization Guidelines" on page 27
Update your system to the latest software release.	"Update Your System to the Latest Software Release" on page 28

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 24.

2. **Unpack the shipping kit that includes the card.**

   a. **Unpack the card in a static free environment.**
      See "Ship Kit Contents" on page 24.

   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 26.

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 need the following tools for most service operations:

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

Related Information

- "Preparing the Oracle F320 Flash Card for Installation" on page 23
- "ESD Safety Measures" on page 26

Ship Kit Contents

The Oracle Flash Accelerator F320 PCIe Card ship kit contains the components shown in the following illustration:
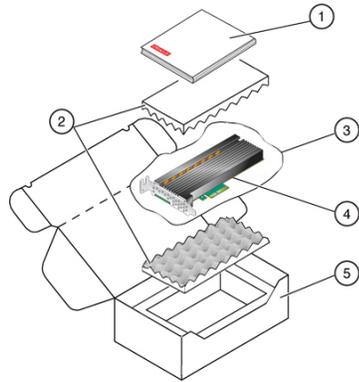
1. Documentation
2. Foam
3. Antistatic bag
4. Oracle Flash Accelerator F320 PCIe Card with low profile PCIe mounting bracket
5. Packaging

Related Information

- "Preparing the Oracle F320 Flash Card for Installation" on page 23
- "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 25
- "Safety Symbols" on page 26
- "ESD Safety Measures" on page 26
- "Perform ESD Prevention Measures" on page 27

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 servers 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 27

▼ 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 26

Oracle Flash Accelerator F320 PCIe Card Optimization Guidelines

To optimize preformance, observe the following guidelines when setting up Oracle Flash Accelerator F320 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 F320 PCIe Card is designed to provide the 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 F320 PCIe Card has a maximum transfer size of 128k. IO requests for larger transfer sizes are 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 F320 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 F320 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 F320 Flash Card for Installation" on page 23
- 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 3.2 TB domains into a single 12.8 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 F320 PCIe Card component firmware updates. When system firmware updates, as described in the server documentation, the Oracle Flash Accelerator F320 PCIe Card firmware automatically updates.

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1. **Check the "Minimum Supported Card Firmware Version" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes* for the latest firmware requirements, available at:**

   `http://www.oracle.com/goto/oracleflashf320/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 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 F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*
   - "Update the NVMe Storage Drive Firmware" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*
   - "Verify Oracle Oracle Flash Accelerator F320 PCIe Card Operation" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*
   - "Product Overview" on page 9
   - "Technical Support" on page 49

Installing the Oracle F320 Flash Card

These topics contain information about installing the Oracle Flash Accelerator F320 PCIe Card into a server PCIe slot.

Description	Links
Review installation tasks and performance tuning information before installing card.	"Installation Overview" on page 31
Install a new card into a server when the card is cold plug inserted into a PCIe slot.	"Install a New Oracle F320 Flash Card (Server Power-Off)" on page 32
Install a new card into a server when the card is hot plug inserted into a PCIe carrier.	"Install a New Oracle F320 Flash Card (Server Power-On)" on page 35

Installation Overview

Read this overview information section before installing the Oracle Flash Accelerator F320 PCIe Card into a server.

- "Oracle F320 Flash Card Installation Overview" on page 32

For detailed information on how to install your Oracle F320 Flash Card, refer to your system documentation.

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 F320 Flash Card Installation Overview

To install your Oracle 3.2 TB NVMe PCIe 3.0 Flash Card into a system, refer to the following table:

Steps	Task	See
1.	Prepare the Oracle F320 Flash Card for installation. Carefully unpack the Oracle F320 Flash Card. Inspect the card for damage. Follow ESD precautions.	"Preparing the Oracle F320 Flash Card for Installation" on page 23
2.	Insert the Oracle F320 Flash Card in an available PCIe slot with server power in the off state.	"Install a New Oracle F320 Flash Card (Server Power-Off)" on page 32
	or	or
	Insert the Oracle F320 Flash Card in an available PCIe carrier with server power in the on state.	"Install a New Oracle F320 Flash Card (Server Power-On)" on page 35

Refer to the servers service manual for additional information.

Related Information

- "Oracle F320 Flash Card Service Overview" on page 39
- "Replace Oracle F320 Flash Card (Server Power-Off)" on page 41
- "Replace Oracle F320 Flash Card (Server Power-On)" on page 46

▼ Install a New Oracle F320 Flash Card (Server Power-Off)

To install a new Oracle Flash Accelerator F320 PCIe Card into a supported server:

Note - Refer to the servers service manual for PCIe card installation instructions.

1. Prepare the Oracle F320 Flash Card for installation.

See "Preparing the Oracle F320 Flash Card for Installation" on page 23.

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 servers service manual for PCIe slot locations in the server.

Refer to "Supported Hardware and Software" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.

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 F320 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the servers service manual for PCIe card installation instructions.

a. **Ensure that you have already taken antistatic measures.**

See "ESD Safety Measures" on page 26.

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 F320 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 F320 Flash Cards from the console.

Refer to the servers service manual.

6. **Insert the Oracle F320 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 F320 Flash Card in a PCI Express slot:
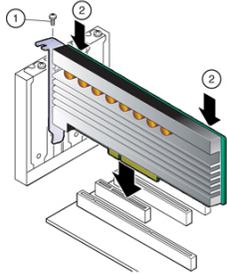
> **Note -** Your server chassis might contain a card carrier or other configuration. Refer to the servers service manual for PCIe card installation instructions.

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.**

   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 F320 Flash Card.**

   a. **If applicable, perform any required commands for your system to install the device driver for the new Oracle F320 Flash Card.**

   b. **If applicable, perform any required commands for your system to recognize the new Oracle F320 Flash Card.**

    c. Verify successful installation of the Oracle F320 Flash Card through your systems OS.

Upon completed installation, the Oracle Flash Accelerator F320 PCIe Card is visible to your server operating system.

    d. Configure the system to maximize flash technology.

Refer to the servers administration guide.

Related Information

- "Product Overview" on page 9
- "Installation Overview" on page 31
- "Oracle F320 Flash Card Service Overview" on page 39

▼ Install a New Oracle F320 Flash Card (Server Power-On)

To install a new Oracle Flash Accelerator F320 PCIe Card into a supported server when the card is hot plug inserted into an empty PCIe carrier:

Note - Refer to the servers service manual for PCIe card installation instructions.

---

1. Prepare the Oracle F320 Flash Card for installation.

See "Preparing the Oracle F320 Flash Card for Installation" on page 23.

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 servers service manual for PCIe carrier and slot locations in the server.

Refer to "Supported Hardware and Software" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.

4. Prepare the server for service.

    a. Refer to the servers 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 26.

5. **Remove the carrier from the server slot.**

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F320 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the servers service manual for PCIe card installation instructions.

---

6. **Record the serial number of the Oracle F320 Flash Card, and the PCIe slot number where the card will be installed.**

This server slot information can be used later to identify Oracle F320 Flash Cards from the console.

Refer to the servers service manual.

7. **Install the Oracle F320 Flash Card in the carrier.**
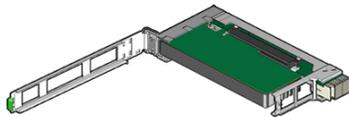
    a. **Unlatch and swing open the arm of the PCIe card carrier, and insert the new Oracle F320 Flash Card until the bottom connector is firmly seated in the carriers connector.**

    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 cards connector must be fully seated in the carriers 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 servers service manual.

10. **Configure the server for the new Oracle F320 Flash Card.**

   a. **If applicable, perform any required commands for your system to install the device driver for the new Oracle F320 Flash Card.**

   b. **If applicable, perform any required commands for your system to recognize the new Oracle F320 Flash Card.**

   c. **Verify successful installation of the Oracle F320 Flash Card through your systems OS.**

   Upon completed installation, the Oracle Flash Accelerator F320 PCIe Card is visible to your server operating system.

   d. **Configure the system to maximize flash technology.**

Refer to the servers administration guide.

Related Information

- "Product Overview" on page 9
- "Installation Overview" on page 31
- "Oracle F320 Flash Card Service Overview" on page 39

Servicing the Oracle F320 Flash Card

These topics provide service information and procedures for the Oracle Flash Accelerator F320 PCIe Card.

Description	Links
Review service task and troubleshooting information.	"Oracle F320 Flash Card Service Overview" on page 39
Review NVMe drive component serviceability information.	"Component Serviceability" on page 40
Remove and replace Oracle F320 Flash Cards.	"Replace Oracle F320 Flash Card (Server Power-Off)" on page 41
	"Replace Oracle F320 Flash Card (Server Power-On)" on page 46
Contact My Oracle Support (MOS).	"Technical Support" on page 49
Troubleshoot Oracle F320 Flash Card thermal issues.	"Troubleshooting Oracle F320 Flash Card Cooling" on page 50
Use Oracle Hardware Management Pack utilities command line interface (CLI) tools to service the Oracle F320 Flash Card.	"Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52

Oracle F320 Flash Card Service Overview

For service, the Oracle Flash Accelerator F320 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 F320 Flash Card. You can also use Oracle Hardware Management Pack for troubleshooting. See "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52.

In addition, you can monitor Oracle Flash Accelerator F320 PCIe Card health and flash media drive life through card bracket status indicators. The Oracle F320 Flash Card has three status indicators on the card bracket to indicate transfer speed, status, and activity. See "Status Indicators" on page 12.

The Oracle Flash Accelerator F320 PCIe Card requires no periodic maintenance. For data protection, the Oracle F320 Flash Card is equipped with energy storage components that allow it 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 F320 Flash Card and do not require periodic maintenance.

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

Note - Refer to the server documentation for additional Oracle F320 Flash Card service and firmware download information.

Component Serviceability

The following service actions can be performed on an Oracle F320 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 after a device orderly shutdown. The Oracle Flash Accelerator F320 PCIe Card supports PCIe presence detect and link-up detect. 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 F320 PCIe Card	Cold for servers with motherboard PCIe connections or Hot for servers with PCIe carriers. CRU	**Note -** Your server chassis might contain a card carrier or other configuration. For instructions on safe installation and removal of Oracle F320 Flash Cards, refer to the servers service manual PCIe card removal and replacement instructions. ■ "Installing the Oracle F320 Flash Card" on page 31 ■ "Replace Oracle F320 Flash Card (Server Power-Off)" on page 41 ■ "Replace Oracle F320 Flash Card (Server Power-On)" on page 46 This procedure can be performed by a customer while the server is running.

See Also:

- "Product Overview" on page 9
- "Technical Support" on page 49

▼ Replace Oracle F320 Flash Card (Server Power-Off)

Replace an existing Oracle Flash Accelerator F320 PCIe Card if the drive fails or the usable drive life has been exceeded.

⚠ **Caution -** Possible data loss. Exceeding the maximum number of Oracle 3.2 TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in host platform error reports 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 26.

⚠ **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 F320 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the servers service manual for PCIe card removal and replacement instructions.

The following task describes an example procedure. Follow the servers service manual detailed instructions.

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

   - Secure Erase the drive. For Oracle Solaris systems, use the `nvmeadm` tool to erase all namespace media for the specified controller. See "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52.

     For example:

     ```
     # nvmeadm erase --help
     erase:. Usage:  nvmeadm erase [OPTIONS] [Controller Name ...]
     OPTIONS:
          -a, --all  : Selects all namespaces on the specified controller.
          -n, --namespace=namespace_id : Selects a namespace on the specified controller.
     ```

   - Unmount the Oracle F320 Flash Cards using the specific procedure before removal. Refer to the servers service manual for instructions.
   - Follow the servers service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions.

2. **Observe the status indicators (LEDs) on the rear panel of the server to verify which Oracle F320 Flash Card in the server requires replacement.**

   - See "Status Indicators" on page 12. Green (Transfer Speed), Amber (Fail, disk status), Green (Activity).
   - If necessary, make a note of where the PCIe cards are installed.

3. **Prepare the server for service.**
   Refer to the servers 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 3.2 TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in host platform error reports 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 servers service manual for instructions.

4. Identify the physical location of the Oracle F320 Flash Card that you want to remove.

Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F320 PCIe Card to facilitate air flow. Refer to the servers service manual for instructions.

Refer to "Supported Hardware and Software" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.
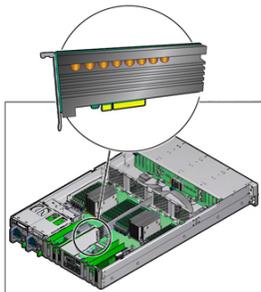
5. Remove the bracket from the server chassis [1].

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.

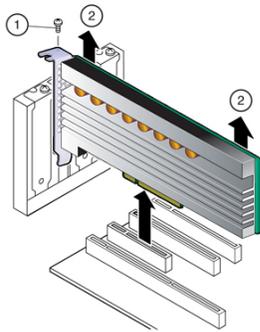Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F320 PCIe Card to facilitate air flow. Your server chassis might contain a card riser or other configuration. Refer to the servers service manual for card installation instructions.

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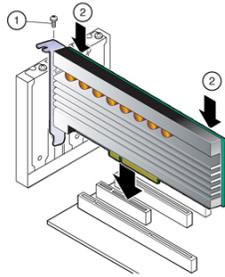
Your server chassis might contain a card riser or other configuration. Refer to the servers service manual for card installation instructions.

10. **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.

11. **Return the server to service.**

Refer to the servers service manual.

   a. **Replace the cover.**

   Your server chassis might use another configuration. Refer to the servers 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 F320 Flash Card and verify drive availability.**

   - Follow the servers service manual instructions for Oracle F320 Flash Card NVMe storage drive configuration and identification.
   - Use appropriate software commands to return the system to an operational state:
     - Power on the Oracle F320 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 Amber Fail LED is not lit and that the green LEDs are lit on the card that you installed.**

    Green (Transfer Speed), Amber (Fail, disk status), Green (Activity) See "Status Indicators" on page 12.

    ### Related Information

    - "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52
    - "Product Overview" on page 9

▼ Replace Oracle F320 Flash Card (Server Power-On)

Replace an existing Oracle Flash Accelerator F320 PCIe Card if the drive fails or the usable drive life has been exceeded. This procedure can be performed by a customer while the server is running.

⚠ **Caution -** Possible data loss. Exceeding the maximum number of Oracle 3.2 TB 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 26.

⚠ **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 F320 PCIe Card to facilitate air flow. Your server chassis might contain a card carrier or other configuration. Refer to the servers service manual for PCIe card removal and replacement instructions.

The following task describes an example procedure. Follow the servers service manual detailed instructions.

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

   See "ESD Safety Measures" on page 26.

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

   - Secure Erase the drive. For Oracle Solaris systems, use the nvmeadm tool to erase all namespace media for the specified controller. See "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52

     For example:

     ```
     # nvmeadm erase --help
     erase:. Usage:  nvmeadm erase [OPTIONS] [Controller Name ...]
     OPTIONS:
         -a, --all  : Selects all namespaces on the specified controller.
         -n, --namespace=namespace_id : Selects a namespace on the specified controller.
     ```

   - Unmount the Oracle F320 Flash Cards. Refer to the servers service manual for instructions.
   - Follow the servers service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions. Some Oracle F320 Flash Cards are hot-service components that can be replaced at any time if the card is not currently in use.

3. **Identify the physical location of the carrier and Oracle F320 Flash Card that you want to remove.**

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

   Refer to "Supported Hardware and Software" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.

4. **Observe the status indicators (LEDs) on the server to verify which Oracle F320 Flash Card in the server requires replacement.**

   - See "Status Indicators" on page 12.

     Green (Transfer Speed), Amber (Fail, disk status), Green (Activity)

- 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 F320 Flash Card from the carrier.
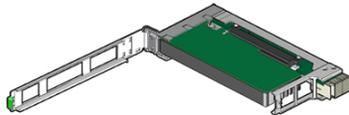
a. Press the green tab to unlock the carrier latch and open the top of the PCIe carrier.

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 26

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 F320 Flash Card and verify drive availability.

- Follow the servers service manual instructions for Oracle F320 Flash Card NVMe storage drive configuration and identification.
- Use appropriate software commands to return the system to an operational state:
  - Power on the Oracle F320 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.

Green (Transfer Speed), Amber (Fail, disk status), Green (Activity) See "Status Indicators" on page 12.

Related Information

- "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52
- "Product Overview" on page 9

Technical Support

For assistance installing, configuring, or running the Oracle Flash Accelerator F320 PCIe Card, contact My Oracle Support (MOS).

Related Information

-
- "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*

▼ Contacting Technical Support

For assistance installing, configuring, or running the Oracle Flash Accelerator F320 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/index.html`

Related Information

-
- "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*

Troubleshooting Oracle F320 Flash Card Cooling

Maintaining the proper internal operating temperature of the server is crucial to a 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. Refer to the server documentation for additional service information.

The Oracle F320 Flash Card is designed to provide continuous full bandwidth performance with temperatures up to 70° C. Qualified host platforms with required software updates operate with sufficient margin to the maximum temperature under worst case environments.

> ⚠️ **Caution -** Sustained critical temperatures might cause data loss.

Should the system maximum operating temperature be exceeded, or a system fault occur which causes internal temperatures of the flash memory modules to rise above this limit, the Oracle F320 Flash Card responds as follows:

- 55° C - Operating temperature ambient.
    - 0 to 55° C at 300 LFM minimum airflow
    - Ta is ambient temperature measured above the hottest point on the heatsink with the airflow condition of more than 2.5 CFM at 25° C of ambient temperature.
- 70° C - Operating temperature limit.
    - The card independently operates and provides continuous full bandwidth performance with temperatures up to 70° C.
- 78° C - Drive write throttling is engaged to reduce Oracle F320 Flash Card power.
    - SSD amber status indicator is lit, Service Action Required. See "Status Indicators" on page 12
    - First threshold for Dynamic Thermal Throttling (DTT). Critical temperature status displays in utility output: `Critical warning 1 ‐ Temperature exceeded critical threshold.`

        Use the Oracle Hardware Management Pack CLI commands to determine the temperature and status of the Oracle 3.2 TB NVMe SSD. See "Verify Oracle Oracle Flash Accelerator F320 PCIe Card Operation" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.
- 85° C - SSD I/O stop overtemp critical limit.
    - SSD component shuts down.
    - Critical temperature status displays in utility output: `Critical warning 1 ‐ Temperature exceeded critical threshold.`

        Use the Oracle Hardware Management Pack CLI commands to determine the temperature and status of the Oracle 3.2 TB NVMe SSD. See "Verify Oracle Oracle Flash Accelerator F320 PCIe Card Operation" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes*.

The following image shows the Oracle F320 Flash Card temperature sensor location:
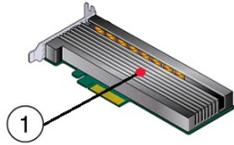
(1): Oracle F320 Flash Card temperature sensor location

Related Information

- "Status Indicators" on page 12
- "Product Overview" on page 9
- "Technical Support" on page 49

Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack

The Oracle Hardware Management Pack utilities supports command line interface (CLI) tools to service the Oracle Flash Accelerator F320 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 52
- "Access Command Line Interface (CLI) in Oracle Hardware Management Pack Utility" on page 53

Oracle Hardware Management Pack Documentation

Documentation for Oracle Hardware Management Pack can be found on the web 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 servers at the operating system level.

Related Information

- "Access Command Line Interface (CLI) in Oracle Hardware Management Pack Utility" on page 53
- "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52
- "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`.

Refer to the "Oracle Flash Accelerator F320 PCIe Card Product Notes" in *Oracle Flash Accelerator F320 PCIe Card and Oracle 3.2 TB NVMe SSD Product Notes* for additional download information.

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 servers service manual.

- Connect an Ethernet cable to the Gigabit Ethernet (NET) connectors as needed for OS support.

- Connect to the service processors 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 52.

Refer to the server documentation.

Related Information

- "Oracle Hardware Management Pack Documentation" on page 52
- "Servicing the Oracle F320 Flash Card Using Oracle Hardware Management Pack" on page 52
- "Product Overview" on page 9

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