

**Oracle® ZFS Storage ZS5-ES Service  
Manual, Release OS8.7.x**



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# About Oracle ZFS Storage ZS5-ES

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These sections describe the controls, connectors, status indicators, system components, and replaceable components of Oracle ZFS Storage ZS5-ES.

Description	Links
Review the product description	<a href="#">“Product Description” on page 11</a>
Learn about controller controls and connectors	<a href="#">“About Controls and Connectors” on page 12</a>
Learn about system components	<a href="#">“About Controller Components” on page 15</a>
Cabling between Oracle disk shelves and controllers	<a href="#">“Cabling the Appliance” in <i>Oracle ZFS Storage ZS5-ES Installation Guide, Release OS8.7.x</i></a>

Refer to the following documents for the appropriate software release at <http://docs.oracle.com/en/storage/>.

**TABLE 1**      Related Documentation

Topic	Title
Learn about Oracle DE3-24 disk shelves	<i>Oracle ZFS Storage Appliance Installation Guide</i>
Servicing Oracle disk shelf components	<i>Oracle ZFS Storage Appliance Customer Service Manual</i>
Appliance alerts, faults, active problems, and logs	<i>Oracle ZFS Storage Appliance Customer Service Manual</i>
Phone Home registration and Oracle remote support service	<i>Oracle ZFS Storage Appliance Administration Guide</i>
Appliance software updates	<i>Oracle ZFS Storage Appliance Customer Service Manual</i>

## Product Description

The Oracle ZFS Storage ZS5-ES consists of two enterprise-class, one rack unit (RU) controllers. Each controller has the following components:

- Two Intel 2.3 GHz, 18-core, 145W processors.

- 384 GB of memory using 24 16-GB DIMMs (12 DIMMs per CPU).
- Four 10 Gb BASE-T Ethernet (RJ-45) ports with integrated link/speed LEDs.
- Two 2.5" (SFF) SAS-3 system hard disk drives (HDDs).
- Two read-optimized cache solid state drives (SSDs). If read cache devices are installed in disk shelves, filler panels are installed.

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**Note** - For more information about external read cache device configurations, see *Oracle ZFS Storage Appliance Customer Service Manual* for the appropriate software release located at <http://docs.oracle.com/en/storage/>.

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- Four PCIe Gen3 slots containing an InfiniBand HCA card, a SAS-3 4-port (4x4) HBA for disk shelf connectivity, a cluster interface card, and an internal SAS-3 HBA for boot drive connectivity.
- Two hot-pluggable, redundant power supplies.
- An on-board Oracle Integrated Lights Out Manager (Oracle ILOM 3.2.x) service processor (SP).

Oracle ZFS Storage ZS5-ES supports one of the following configurations:

- One Oracle Storage Drive Enclosure DE3-24C connected to a SAS-3 HBA
- Two Oracle Storage Drive Enclosures DE3-24P connected to a SAS-3 HBA

For updated Oracle ZFS Storage Appliance software information, see <https://support.oracle.com/epmos/faces/DocumentDisplay?id=2021771.1>.

## About Controls and Connectors

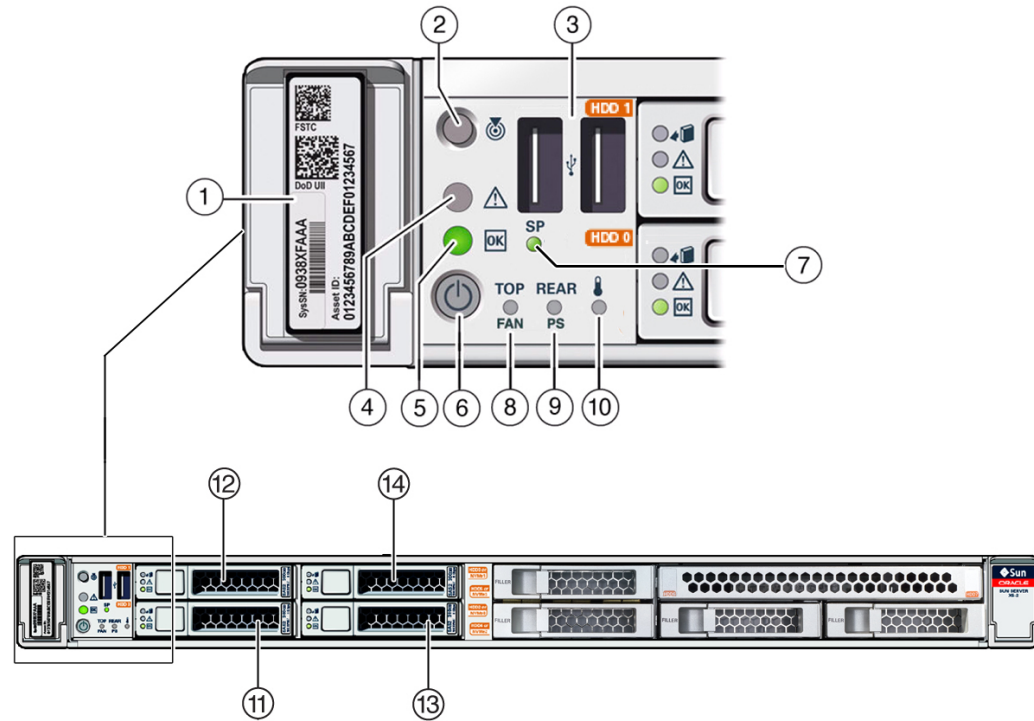
The following sections describe the controls, indicators, connectors, and drives located on the front and rear panels.

- [“Front Panel Controls and Indicators” on page 12](#)
- [“Controller Back Panel View” on page 14](#)

## Front Panel Controls and Indicators

The following figure shows the controls, status indicators (LEDs), connectors, and drives on the front panel of the Oracle ZFS Storage ZS5-ES.



**FIGURE 1** Oracle ZFS Storage ZS5-ES Controller Front Panel

Callout	Description	Callout	Description
1	Product Serial Number (PSN) label and Radio Frequency Identification (RFID) tag	8	Top Fan Fault LED: amber
2	Locator LED/button: white	9	Rear Power Supply (PS) Fault LED: amber
3	USB 2.0 connectors (2)	10	System Over Temperature Warning LED: amber
4	Service Required LED: amber	11	System disk 0 (HDD slot 0)
5	Power/OK LED: green	12	System disk 1 (HDD slot 1)
6	Power button	13	Read cache device (or filler panel)
7	SP OK LED: green	14	Read cache device (or filler panel)

Remaining disk slots have permanent filler panels.

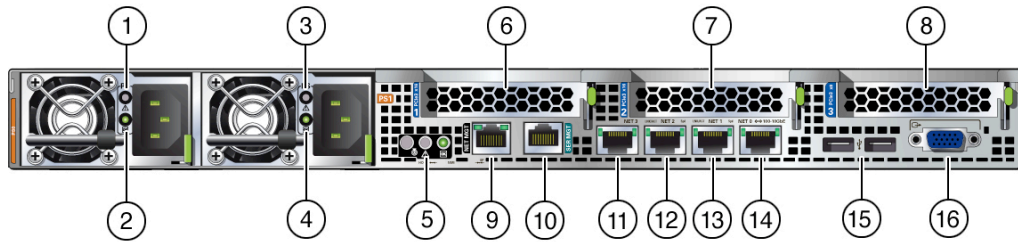
## Related Information

- [“Controller Back Panel View” on page 14](#)
- [“About Controller Components” on page 15](#)

## Controller Back Panel View

The following figure shows the Oracle ZFS Storage ZS5-ES back panel and the location of power supplies, status indicators (LEDs), connectors, and PCIe slots.

**FIGURE 2** Oracle ZFS Storage ZS5-ES Controller Back Panel View



Callout	Description	Callout	Description
1	Power Supply (PS) 0	9	NET MGT port is deactivated on ZS5-ES. Use Ethernet NET 0 port to access Oracle Integrated Lights Out Manager (ILOM) service processor (SP).
2	Power Supply (PS) 0 status indicators: Service Required LED: amber AC OK LED: green	10	Serial management (SER MGT)/RJ-45 serial port
3	Power Supply (PS) 1	11	Network (NET) 10 GbE port: NET 3
4	Power Supply (PS) 1 status indicators: Service Required LED: amber AC OK LED: green	12	Network (NET) 10 GbE port: NET 2

Callout	Description	Callout	Description
5	System status indicators: Locator LED: white; Service Required LED: amber; Power/OK LED: green	13	Network (NET) 10 GbE port: NET 1
6	PCIe InfiniBand HCA for client connectivity (slot 1)	14	Network (NET) 10 GbE port: NET 0 (provides access to Oracle ILOM service processor)
7	PCIe external-facing SAS-3 HBA for disk shelf connectivity (slot 2)	15	USB 2.0 connectors (2)
8	PCIe cluster interface card Version 3 (slot 3)	16	DB-15 video connector

### Related Information

- [“Front Panel Controls and Indicators” on page 12](#)
- [“About Controller Components” on page 15](#)

## About Controller Components

These sections describe the components of the controller:

- [“Illustrated Parts Breakdown” on page 15](#)
- [“Field-Replaceable Units” on page 18](#)
- [“Controller Internal Cables” on page 18](#)

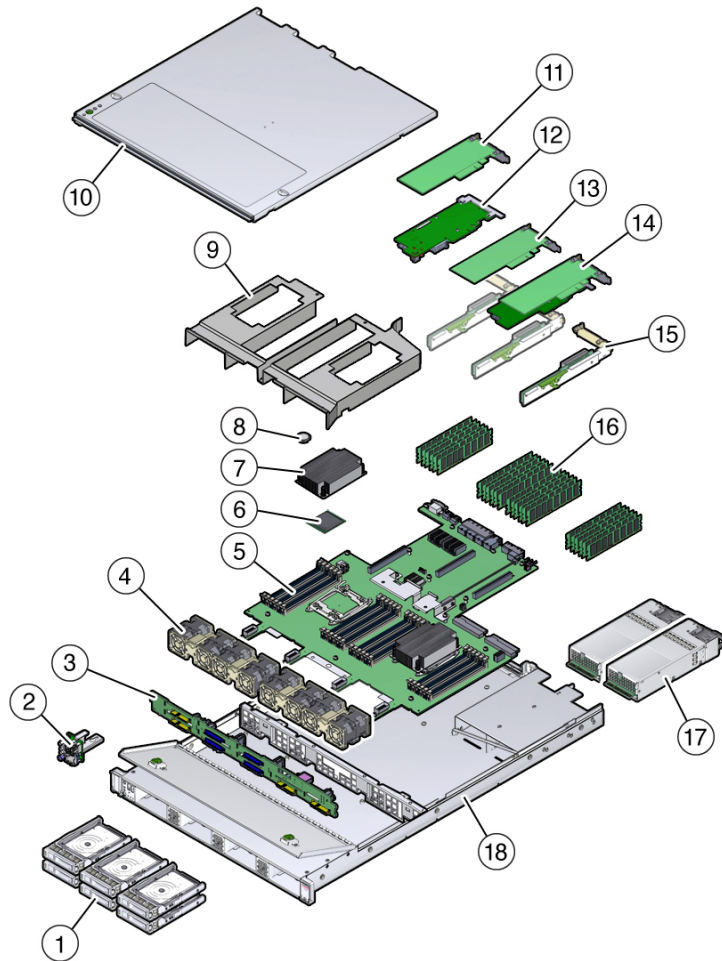
### Related Information

- [“Servicing CRUs That Do Not Require Controller Power-Off” on page 33](#)
- [“Servicing CRUs That Require Controller Power-Off” on page 47](#)
- [“Servicing FRUs” on page 75](#)

## Illustrated Parts Breakdown

The following figure identifies the major components of the controller.

**FIGURE 3** Controller Illustrated Parts Breakdown



Callout	Description	Callout	Description
1	Two system drives and two optional read cache SSDs	10	Top cover
2	Front indicator module (FIM)	11	Cluster interface card Version 3 (PCIe slot 3)
3	Disk backplane	12	Internal SAS-3 HBA card (PCIe slot 4)

Callout	Description	Callout	Description
4	Fan modules	13	External SAS-3 4-port (4x4) HBA (PCIe slot 2)
5	Motherboard	14	InfiniBand HCA (PCIe slot 1)
6	Processors	15	PCIe risers (3)
7	Heatsinks	16	DIMMs
8	Battery	17	Power supplies
9	Air baffle	18	Controller chassis

## Customer-Replaceable Units

The following table lists the customer-replaceable units (CRUs) in the controller and directs you to the replacement instructions.

CRU	Description	Replacement Instructions
Battery	Lithium coin-cell battery that powers the CMOS BIOS and real-time clock.	<a href="#">“Servicing the Battery (CRU)” on page 71</a>
DIMMs	Replace memory modules in the controller.	<a href="#">“Servicing the DIMMs (CRU)” on page 47</a>
Storage drives	Supports SAS-3 hard-disk drives (HDDs) and SATA solid-state drives (SSDs)	<a href="#">“Servicing Storage Drives (CRU)” on page 33</a>
Fan modules	Four fan modules for cooling the motherboard assembly and installed components.	<a href="#">“Servicing Fan Modules (CRU)” on page 38</a>
PCIe cards	PCIe cards for client, disk shelf, and cluster I/O connectivity. <b>Note</b> - The internal SAS-3 PCIe HBA card is a field-replaceable unit (FRU) and should only be serviced by authorized Oracle Services personnel. See <a href="#">“Servicing the Internal HBA Card (FRU)” on page 91</a> .	<a href="#">“Servicing PCIe Cards (CRU)” on page 67</a>
PCIe risers	Houses and connects the PCIe cards.	<a href="#">“Servicing PCIe Risers (CRU)” on page 55</a>
Power supplies	Two fully redundant AC power supplies.	<a href="#">“Servicing Power Supplies (CRU)” on page 42</a>

## Related Information

- [“Field-Replaceable Units” on page 18](#)
- [“Illustrated Parts Breakdown” on page 15](#)
- [“Servicing CRUs That Do Not Require Controller Power-Off” on page 33](#)
- [“Servicing CRUs That Require Controller Power-Off” on page 47](#)
- [“Controller Internal Cables” on page 18](#)

## Field-Replaceable Units

The following table lists the field-replaceable units (FRUs) in the controller and directs you to the replacement instructions.

FRU	Description	Replacement Instructions
Processor and heat sink	Carries out the instructions of the system.	<a href="#">“Servicing Processors (FRU)” on page 75</a>
Internal SAS-3 PCIe HBA card	Provides boot drive and SSD connectivity.	<a href="#">“Servicing the Internal HBA Card (FRU)” on page 91</a>
Disk backplane	Serves as the interface between storage drives and the internal host bus adapter (HBA) card.	<a href="#">“Servicing the Disk Backplane (FRU)” on page 100</a>
Front indicator module (FIM)	Contains the front panel controls, indicators, and USB ports.	<a href="#">“Remove the Front Indicator Module” on page 106</a>
Motherboard assembly	Provides connectors for the fans, DIMMs, processors, PCIe risers, internal USB ports, and power supplies.	<a href="#">“Servicing the Motherboard (FRU)” on page 109</a>
SAS cables	Provide signals between the disk backplane and internal SAS PCIe RAID HBA.	<a href="#">“Servicing the Internal HBA SAS Cable Assembly” on page 132</a>
Internal controller cables		<a href="#">“Controller Internal Cables” on page 18</a>

### Related Information

- [“Illustrated Parts Breakdown” on page 15](#)
- [“Servicing FRUs” on page 75](#)
- [“Controller Internal Cables” on page 18](#)

## Controller Internal Cables

The following table lists the cables used in the controller and directs you to the replacement instructions.

Cable Name	Description	Removal/Replacement Instructions
Internal HBA SAS cable assembly	Disk cable assembly that connects the internal host bus adapter (HBA) card to the disk backplane.	See <a href="#">“Servicing the Internal HBA SAS Cable Assembly” on page 132</a>
Power cable	Connects the disk backplane to the motherboard. Provides power from the motherboard to the disk backplane.	See <a href="#">“Servicing the Power, FIM, and Disk Backplane Data Cables” on page 136</a>

Cable Name	Description	Removal/Replacement Instructions
FIM cable	Ribbon cable that provides a signal and power connection between the motherboard to the Front Module Indicator (FIM).	See <a href="#">“Servicing the Power, FIM, and Disk Backplane Data Cables”</a> on page 136
Disk backplane data cable	Ribbon cable that connects the disk backplane to the motherboard. Provides a data connection between the two components.	See <a href="#">“Servicing the Power, FIM, and Disk Backplane Data Cables”</a> on page 136

### Related Information

- [“Illustrated Parts Breakdown”](#) on page 15
- [“Servicing FRUs”](#) on page 75





## Preparing for Service

---

These sections describe safety considerations and provide prerequisite procedures and information to replace components within the controller.

Description	Links
Understand the safety precautions, understand the safety symbols, and take ESD precautions prior to removing or installing parts in the controller.	<a href="#">“Safety Precautions” on page 21</a> <a href="#">“Safety Symbols” on page 22</a> <a href="#">“Electrostatic Discharge Safety” on page 22</a>
Understand the key identity properties auto-update feature.	<a href="#">“FRU Key Identity Properties Automated Update” on page 23</a>
Assemble the required tools.	<a href="#">“Required Tools” on page 24</a>
Before working with components within the controller, power down the controller and prepare for servicing.	<a href="#">“Preparing the Controller for Component Replacement” on page 24</a>

## Safety Precautions

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

- Follow all standard cautions, warnings, and instructions marked on the equipment and described in the online *Oracle Server X5-2 Safety and Compliance Guide* and in the printed *Important Safety Information for Oracle's Hardware Systems*.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Follow the electrostatic discharge safety practices as described in [“Electrostatic Discharge Safety” on page 22](#).
- Disconnect both power supply cords before servicing components.

### Related Information

- [“Safety Symbols” on page 22](#)

- [“Electrostatic Discharge Safety” on page 22](#)

## Safety Symbols

The following symbols might appear in this document. Note their meanings.



---

**Caution - Risk of personal injury or equipment damage.** To avoid personal injury or 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.

---

### Related Information

- [“Safety Precautions” on page 21](#)
- [“Electrostatic Discharge Safety” on page 22](#)

## Electrostatic Discharge Safety

Devices that are sensitive to electrostatic discharge (ESD), such as the motherboard, PCIe cards, drives, processors, and memory cards require special handling.



---

**Caution** - The 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 components. Do not touch the components along their connector edges.

---

Do the following when handling ESD-sensitive components:

- Use an antistatic wrist strap.  
Wear an antistatic wrist strap and use an antistatic mat when handling components such as drive assemblies, boards, or cards. When servicing or removing controller components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then

disconnect the power cords from the controller. Following this practice equalizes the electrical potentials between you and the controller.

---

**Note** - An antistatic wrist strap is not included in the Ship Kit for the controller. However, antistatic wrist straps are included with options and components.

---

- Use an antistatic mat.  
Place ESD-sensitive components such as the motherboard, memory DIMMs, and other printed circuit boards on an antistatic mat. The following items can be used as an antistatic mat:
  - An antistatic bag used to wrap an Oracle replacement part
  - An Oracle ESD mat (orderable item)
  - A disposable ESD mat (shipped with some replacement parts or optional system components)

### Related Information

- [“Safety Precautions” on page 21](#)
- [“Safety Symbols” on page 22](#)
- [“Preparing the Controller for Component Replacement” on page 24](#)
- [“Returning the Controller to Operation” on page 143](#)

## FRU Key Identity Properties Automated Update

Oracle ILOM includes a key identity properties (KIP) auto-update feature that ensures product information that is used for service entitlement and warranty coverage is accurately maintained by the controller at all times, including during hardware replacement activities.

The KIP includes the controller product name, product part number (PPN), and product serial number (PSN). The KIP are stored in the FRUID (field-replaceable unit identifiers) container of the three controller FRUs that are designated quorum members.

The quorum members include:

- Disk backplane (DBP), designated as a primary quorum member.
- Motherboard (MB), designated as a backup quorum member.
- Power supply (PS), designated as a backup quorum member.

When a controller FRU that contains the KIP is removed and a replacement component is installed, the KIP of the replacement component is programmed by Oracle ILOM to contain the same KIP as the other two components.

---

**Note** - Only one of the quorum members can be replaced at a time. Automated updates can only be completed when two of the three quorum members contain matching key identity properties.

---

## Related Information

- [“Servicing Power Supplies \(CRU\)” on page 42](#)
- [“Servicing the Disk Backplane \(FRU\)” on page 100](#)
- [“Servicing the Motherboard \(FRU\)” on page 109](#)

## Required Tools

The controller can be serviced with the following tools:

- Antistatic wrist strap
- Antistatic mat
- No. 2 Phillips screwdriver

## Related Information

- [“Preparing for Service” on page 21](#)
- [“Servicing CRUs That Do Not Require Controller Power-Off” on page 33](#)
- [“Servicing CRUs That Require Controller Power-Off” on page 47](#)
- [“Servicing FRUs” on page 75](#)

## Preparing the Controller for Component Replacement

Before you can remove and install components that are inside the controller, you must perform the procedures in the following tasks:

---

**Note** - When replacing the storage drives or power supplies, not all of these procedures are necessary. See the replacement tasks for those components for more information.


---

- “Powering Off the Controller” on page 25
- “Disconnect Cables From the Controller” on page 26
- “Extend the Controller to the Maintenance Position” on page 26
- “Remove the Controller From the Rack” on page 28
- “Take Antistatic Measures” on page 29
- “Remove the Controller Top Cover” on page 30

## Powering Off the Controller

Some replacement tasks require you to power off the controller. Because Oracle ZFS Storage ZS5-ES has clustered controllers, there is no loss of access to storage when one controller is powered down for service. The recommended methods for powering off a controller depend on whether you have completed initial configuration. Use a power off method from one of the following two situations.

If you have completed initial configuration, power off a controller using one of the following methods:

- Log in to the BUI and click the power icon  on the left side under the masthead.
- SSH in to the appliance and enter the `maintenance system poweroff` command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.

If you have not completed the initial configuration steps, power off a controller using one of the following methods:

- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- SSH or use a serial connection to log in to the service processor (SP), and then issue the command `stop /SYS`.
- To initiate an emergency shutdown during which all applications and files will be closed abruptly without saving, press and hold the Power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode. To completely remove power, disconnect the AC power cords from the rear panel of the storage controller.

### Related Information

- For information about servicing Oracle disk shelf components, see *Oracle ZFS Storage Appliance Customer Service Manual* for OS8.6.x or later at <http://docs.oracle.com/en/storage/>

## ▼ Disconnect Cables From the Controller



**Caution** - The controller supplies standby power to the circuit boards when the power cords are connected even when the controller is powered off.

---

1. **Label all cables connected to the controller.**
2. **Ensure the controller is powered down.**  
See [“Powering Off the Controller” on page 25](#).
3. **Disconnect the power cords from the rear of the controller.**
4. **Disconnect all data cables and cluster cables from the rear of the controller.**

### Related Information

- [“Controller Back Panel View” on page 14](#)
- [“Powering Off the Controller” on page 25](#)
- [“Remove the Controller From the Rack” on page 28](#)
- [“Reconnect Data Cables and Power Cords” on page 149](#)

## ▼ Extend the Controller to the Maintenance Position

The following components can be serviced with the controller in the maintenance position:

- Storage drives
- Fan modules
- Power supplies
- PCIe risers
- PCIe cards and cables
- SAS cables
- DIMMs
- Motherboard battery
- Processors
- Disk backplane
- FIM (front indicator module)
- Motherboard

Use this procedure to extend the controller to the maintenance position.

1. **To prevent the rack from tipping forward when the controller is extended, extend all rack anti-tilt devices.**



**Caution** - To reduce the risk of personal injury, stabilize the expansion rack cabinet and extend all anti-tilt devices before extending the controller from the rack.

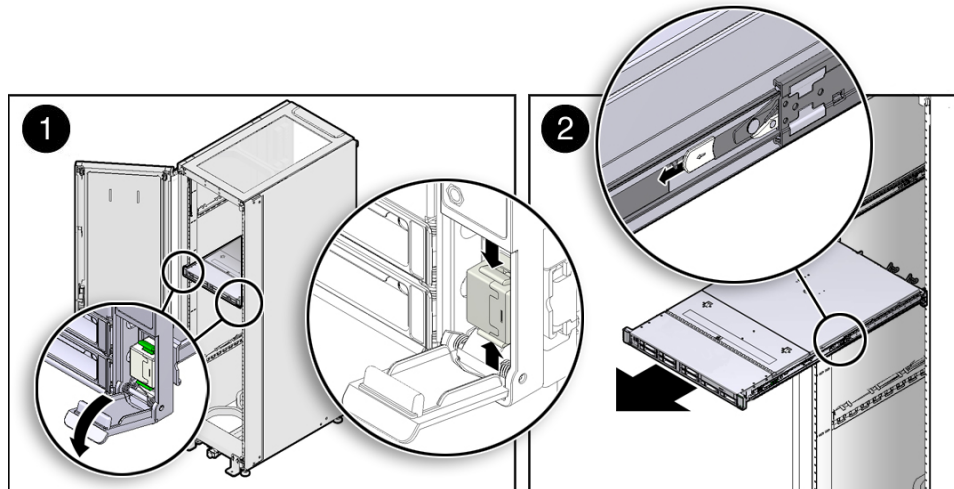
For instructions for stabilizing the rack, see [“Stabilize the Rack for Installation” in Oracle ZFS Storage ZS5-ES Installation Guide, Release OS8.7.x.](#)

2. **Verify that no cables will be damaged or will interfere when the controller is extended.**

Although the cable management arm (CMA) that is supplied with the controller is hinged to accommodate extending the controller, you should ensure that all cables and cords are capable of extending.

3. **From the front of the controller, open and hold the left and right release latch covers in the open position (see [“Extend the Controller to the Maintenance Position” on page 26](#) ).**

When in an open position, the release latch covers engage the slide-rail release latches [1].



4. **While the release latch covers are in the open position, slowly pull the controller forward until the slide-rails latch into a locked position [2].**

The controller is now in the extended maintenance position.

### Related Information

- [“Disconnect Cables From the Controller” on page 26](#)
- [“Remove the Controller From the Rack” on page 28](#)
- [“Reinstall the Controller Into the Rack” on page 145](#)

## ▼ Remove the Controller From the Rack



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**Caution** - The controller weighs approximately 18.1 kg (40.0 lbs). Two people are required to dismount and carry the chassis.

---

1. **Disconnect all the cables and power cords from the controller.**
2. **Remove the cable management arm (CMA).**  
For instructions for removing the CMA, see [“Remove the Cable Management Arm” in Oracle ZFS Storage ZS5-ES Installation Guide, Release OS8.7.x.](#)
3. **Extend the controller to the maintenance position.**  
For instructions, see [“Extend the Controller to the Maintenance Position” on page 26.](#)
4. **From the front of the controller, pull the green slide-rail release tabs toward the front of the controller, and pull the controller out of the rack until it is free of the rack rails.**

A slide-rail release tab is located on each slide-rail (see [“Extend the Controller to the Maintenance Position” on page 26 \[2\].](#)

---

**Note** - To pull the green slide-rail release tab, place your finger in the center of the tab, not on the end, and apply pressure as you pull the tab toward the front of the controller.

---

5. **Set the controller on a sturdy work surface.**

### Related Information

- [“Disconnect Cables From the Controller” on page 26](#)



- [“Take Antistatic Measures” on page 29](#)
- [“Extend the Controller to the Maintenance Position” on page 26](#)
- [“Reinstall the Controller Into the Rack” on page 145](#)

## ▼ Take Antistatic Measures

### 1. Prepare an antistatic surface on which to set parts during removal and installation.

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

- An antistatic bag used to wrap a replacement part
- An Oracle ESD mat (orderable item)
- A disposable ESD mat (shipped with some replacement parts or optional system components)

### 2. Attach an antistatic wrist strap.

When servicing or removing controller components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Then disconnect the power cords from the controller.

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**Note** - An antistatic wrist strap is not included in the Ship Kit for the controller. However, antistatic wrist straps are still included with options and components.

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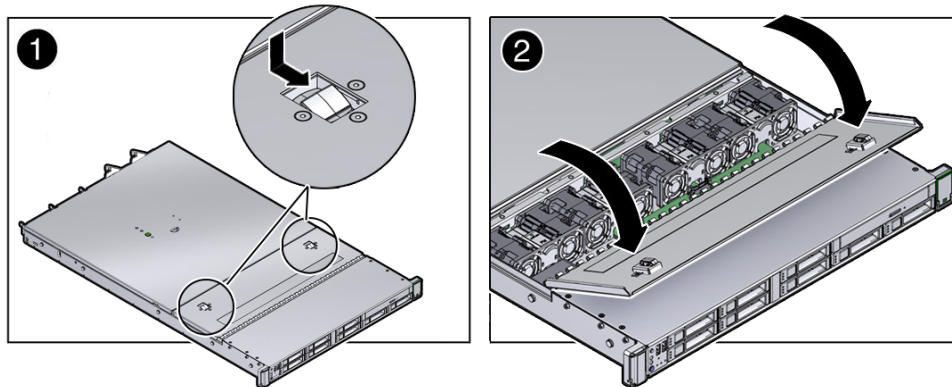
### Related Information

- [“Remove Antistatic Measures” on page 145](#)

## ▼ Open the Controller Fan Door

Servicing the controller fan modules and other components located in the front of the controller, such as the front indication module and disk backplanes, requires that the fan door be opened. It is also easier to remove the controller top cover if you open the fan door first.

- To open the controller fan door, slide the fan door latches to the front of the controller and swing the door up to the open position.



### Related Information

- [“Take Antistatic Measures” on page 29](#)
- [“Remove the Controller Top Cover” on page 30](#)

## ▼ Remove the Controller Top Cover

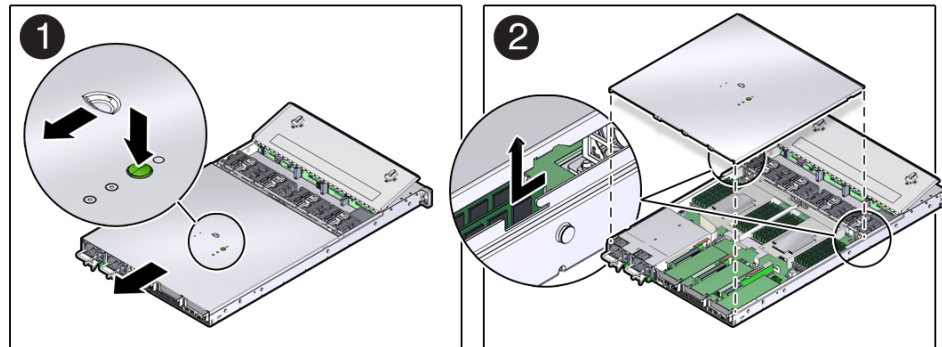
Servicing most of the controller components requires that the top cover be removed.



**Caution** - If the top cover is removed without first removing the AC power cords, the controller host shuts down immediately and an event is logged to indicate that the chassis top cover has been removed.

1. **Ensure that the AC power cords are disconnected from the controller power supplies.**
2. **Open the controller fan door.**  
See [“Open the Controller Fan Door” on page 29](#).

3. To open the controller top cover, press and hold down the top cover release button and use the recessed area to slide the top cover toward the rear of the controller about 0.5 inches (12.7 mm) [1].



4. Lift the cover off the chassis and set it aside [2].

#### Related Information

- [“Take Antistatic Measures” on page 29](#)
- [“Install the Controller Top Cover” on page 144](#)



# Servicing CRUs That Do Not Require Controller Power-Off

---

These sections describe how to service customer-replaceable units (CRUs) that do not require you to power off the controller. For more information about CRUs, see [“Illustrated Parts Breakdown” on page 15](#) and [“Customer-Replaceable Units” on page 17](#).

Description	Links
Service the storage drives	<a href="#">“Servicing Storage Drives (CRU)” on page 33</a>
Service the fan modules	<a href="#">“Servicing Fan Modules (CRU)” on page 38</a>
Service the power supplies	<a href="#">“Servicing Power Supplies (CRU)” on page 42</a>

## Related Information

- [“Servicing CRUs That Require Controller Power-Off” on page 47](#)
- [“Servicing FRUs” on page 75](#)

## Servicing Storage Drives (CRU)

These sections describe how to remove and replace storage drives:

- [“Storage Drives Hot-Plug Conditions” on page 33](#)
- [“Storage Drive Locations and Numbering” on page 34](#)
- [“Storage Drive Status Indicators” on page 35](#)
- [“Removing and Replacing a HDD or SSD Storage Drive” on page 35](#)

## Storage Drives Hot-Plug Conditions

The hard-disk drives (HDDs), and solid-state drives (SSDs) installed in the controller are hot-pluggable, but this capability depends on how the drives are configured. To hot-plug a drive you

must be able to take the drive offline before you can remove it. When you take the drive offline, you prevent any application from accessing the drive and remove the logical software links to the drive.

The following conditions inhibit the ability to perform hot-plugging of a drive:

- The drive provides the operating system, and the operating system is not mirrored on another drive.
- The drive cannot be logically isolated from the online operations of the controller.

If either of the above drive restrictions is true, then you must shut down the system before you replace the drive. See [“Powering Off the Controller” on page 25](#).

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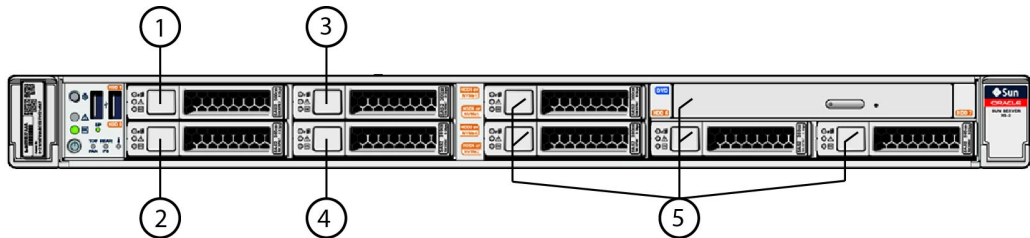
**Note** - Replacing a storage drive does not require removing the controller from a rack.

---

## Storage Drive Locations and Numbering

The following illustration and table show the locations of the HDD and SSD drives.

**FIGURE 4** Controller Storage Drives



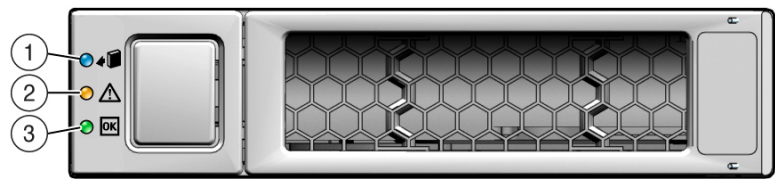
**TABLE 2** Controller Storage Drive Locations and Numbering

Legend		Legend	
1	System boot drive 1 (HDD)	4	Read cache SSD
2	System boot drive 0 (HDD)	5	Permanent filler panels
3	Read cache SSD		

## Storage Drive Status Indicators

The following figure and table describe the storage drive status indicators (LEDs).

**FIGURE 5** Storage Drive Status Indicators



**TABLE 3** Storage Drive Status Indicators

Legend	LED	Color	State and Meaning
1	OK to Remove	Blue	<ul style="list-style-type: none"><li>■ STEADY ON – The storage drive can be removed safely during a hot-plug operation.</li><li>■ OFF – The storage drive has not been prepared for removal.</li></ul>
2	Service Required	Amber	<ul style="list-style-type: none"><li>■ OFF – The storage drive is operating normally.</li><li>■ STEADY ON – The system has detected a fault with the storage drive.</li></ul>
3	OK/Activity	Green	<ul style="list-style-type: none"><li>■ OFF – Power is off or the installed drive is not recognized by the system.</li><li>■ STEADY ON – The drive is engaged and is receiving power.</li><li>■ STEADY BLINK – There is disk activity. The LED blinks on and off to show activity.</li></ul>

## Removing and Replacing a HDD or SSD Storage Drive

This section describes how to remove and replace HDD and SSD drives.

### ▼ Remove a HDD or SSD Storage Drive

1. **Prepare the system for the drive removal.**  
See [“Take Antistatic Measures” on page 29](#).

**2. Identify the location of the drive that you want to remove.**

For storage drive locations, see [“Storage Drive Locations and Numbering” on page 34.](#)

**3. If you are removing a HDD or SSD storage drive, type the operating system commands required to stop the controller from using the drive; otherwise, proceed to the next step.**

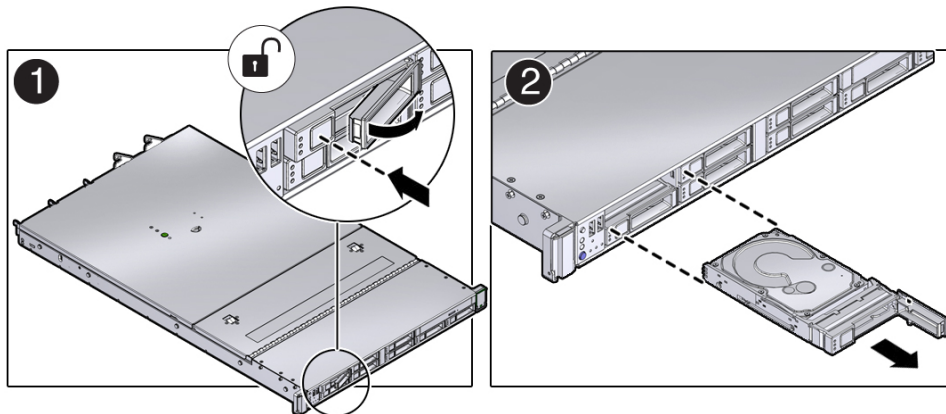
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**Note** - The blue OK to Remove LED on the storage drive might not light, as support for this varies depending on the operating system in use.

---

The exact commands required depend on the configuration of your drives. Unmount file systems or issue RAID commands as needed.

**4. On the drive you plan to remove, push the latch release button to open the drive latch.**



---

**Caution** - The latch is not an ejector. Do not open the latch too far to the right. Doing so can damage the latch.

---

**5. Grasp the latch and pull the drive out of the drive slot.**

**6. Consider your next steps:**

- If you are replacing the drive, continue to [“Install a HDD or SSD Storage Drive” on page 37.](#)



- If you are not replacing the drive, install a filler panel in the empty drive slot to maintain proper airflow and perform administrative tasks to configure the controller to operate without the drive.

For information on how to install a storage drive filler panel, see [“Installing Controller Filler Panels” on page 143](#).

### Related Information

- [“Storage Drive Status Indicators” on page 35](#)
- [“Storage Drives Hot-Plug Conditions” on page 33](#)
- [“Install a HDD or SSD Storage Drive” on page 37](#)

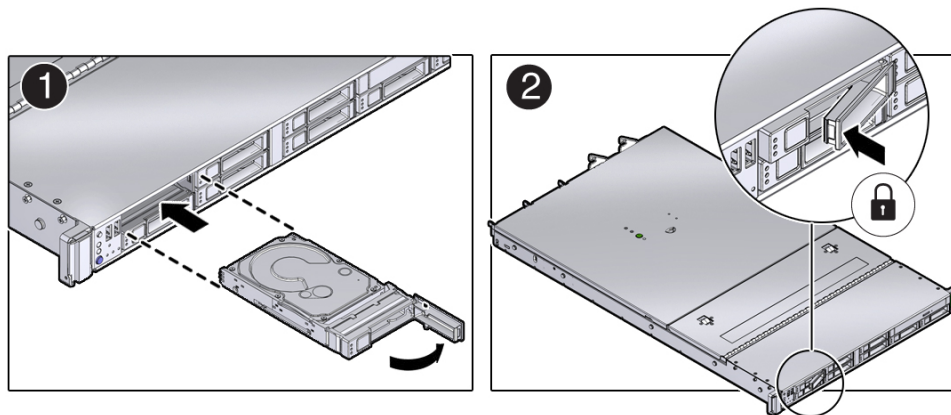
## ▼ Install a HDD or SSD Storage Drive

1. **Remove the replacement drive from its packaging and place the drive on an antistatic mat.**
2. **If necessary, remove the drive filler panel.**

3. **Align the replacement drive with the drive slot.**

The drive is physically addressed according to the slot in which it is installed. It is important to install a replacement drive in the same slot as the drive that was removed.

4. **Slide the drive into the slot until the drive is fully seated [1].**



**5. Close the drive latch to lock the drive in place [2].**

**6. Perform administrative tasks to reconfigure the drive.**

The procedures that you perform at this point depend on how your data is configured. You might need to partition the drive, create file systems, load data from backups, or have the drive updated from a RAID configuration.

**Related Information**

- [“Storage Drive Status Indicators” on page 35](#)
- [“Storage Drives Hot-Plug Conditions” on page 33](#)
- [“Remove a HDD or SSD Storage Drive” on page 35](#)

## Servicing Fan Modules (CRU)

The fan modules are located in the front of the controller. See the following procedures:

- [“Remove a Fan Module” on page 38](#)
- [“Install a Fan Module” on page 41](#)

### ▼ Remove a Fan Module

You do not have to power off the controller to service the fan modules.

You should not begin this procedure unless you have a replacement fan and you are ready to install it right away.

**1. Extend the controller to the maintenance position.**

See [“Extend the Controller to the Maintenance Position” on page 26](#).

**2. To access the fan modules, open the controller fan door.**

See [“Open the Controller Fan Door” on page 29](#).



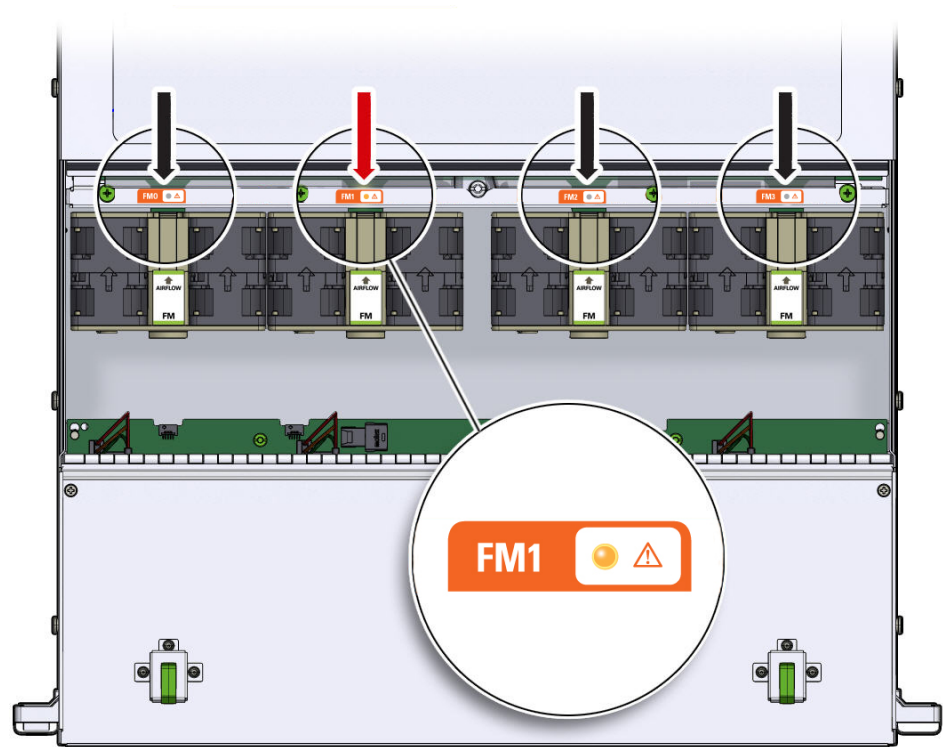

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**Caution** - Close the controller fan door within 20 seconds to maintain adequate airflow to properly cool the controller. Leaving the door open for more than 20 seconds, while the controller is running, might cause the controller to overheat and shut down.

---

3. Identify the faulty fan module.

Each fan module has a status indicator (LED). If the LED is off, the fan is good. If the LED is lit amber, the fan has failed. The LEDs are located on the chassis mid-wall adjacent to and aligned with the fan modules, as shown in the following figure.



Status Indicator Name	Color	State Meaning
Fan Module Status	Off/Amber	<ul style="list-style-type: none"><li>■ Off – The fan module is correctly installed and operating within specification.</li><li>■ Amber – The fan module is faulty. The front TOP FAN LED and the front and rear panel Service Required LEDs are also lit if the system detects a fan module fault.</li></ul>

4. Remove the faulty fan module.

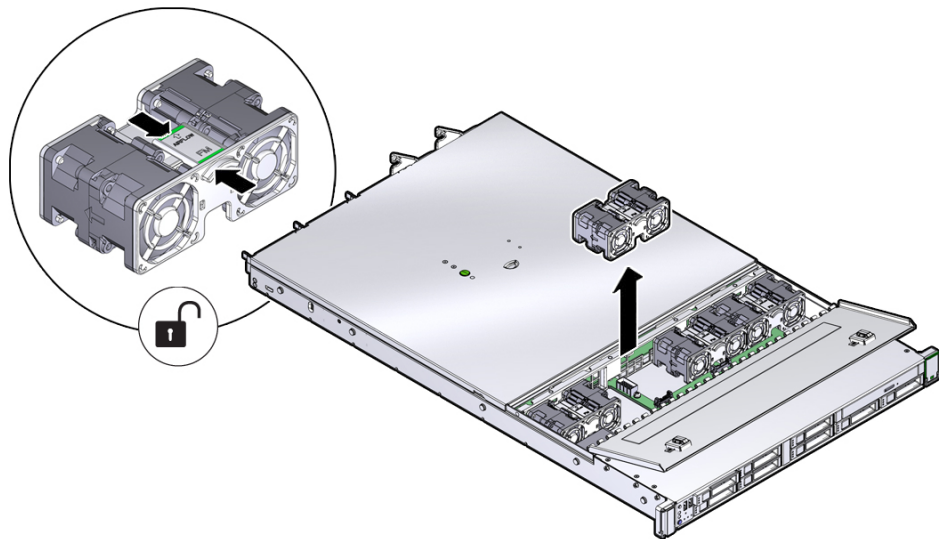
- a. Using your thumb and forefinger, grasp the fan module in the finger recesses located in the plastic between the fans.
- b. Lift the fan module straight up and out of the chassis.



---

**Caution** - When removing a fan module, do not rock it back and forth. Rocking a fan module can cause damage to the motherboard connectors.

---



5. Set the fan module aside.



---

**Caution** - Do not service any other components in the fan compartment unless the system is shut down and the power cords are removed.

---

6. Consider your next step:

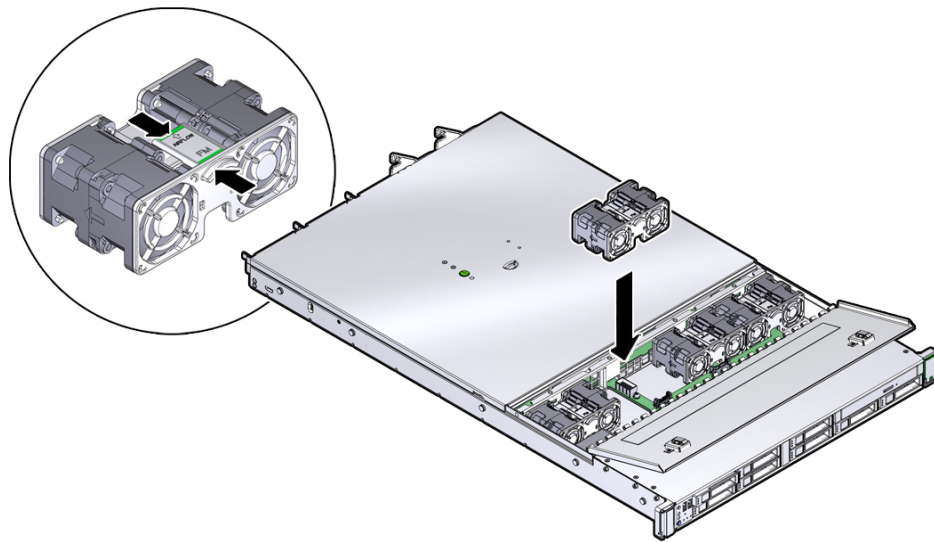
- If you removed the fan assembly as part of another procedure, return to that procedure.
- Otherwise, continue to [“Install a Fan Module” on page 41](#).

## Related Information

- [“Install a Fan Module” on page 41](#)

## ▼ Install a Fan Module

1. Remove the replacement fan module from its packaging and place it on an antistatic mat.
2. With the fan door open, position the replacement fan module into the controller.  
The fan modules are keyed to ensure that they are installed in the correct orientation.



3. Press down on the fan module and apply firm pressure to fully seat the fan module.
4. Verify that the fan module status indicator (LED) that aligns with the replaced fan module is extinguished.
5. Close the fan door.

6. **Verify that the Top Fan Fault LED on the front of the controller and the Service Required LEDs on the front and rear of the controller are extinguished.**
7. **Consider your next step:**
  - If you installed the fan module as part of another procedure, return to that procedure.
  - Otherwise, return the controller to operation. See [“Returning the Controller to Operation” on page 143](#).

#### **Related Information**

- [“Remove a Fan Module” on page 38](#)

## **Servicing Power Supplies (CRU)**

The redundant power supplies on the controller support concurrent maintenance, which enables you to remove and replace a power supply without shutting down the controller, provided that the other power supply is online and working.

The controller supports model A256 (600 watt) power supplies. The A256 power supply unit (PSU) provides conversion from the AC lines to the system, accepting ranges from 100-240 volts AC (VAC). These PSUs are designed to be hot-swappable, and will provide fully redundant “1+1” power, allowing the system to suffer the loss of a PSU or an AC feed with no loss to system availability.

The following indicators (LEDs) are lit when a power supply fault is detected:

- Front and rear Service Required LEDs
- Amber Service Required LED on the faulty power supply
- Rear Power Supply Fault LED located on the controller front panel (see [“Front Panel Controls and Indicators” on page 12](#))

If a power supply fails and you do not have a replacement available, leave the failed power supply installed to ensure proper airflow in the controller.

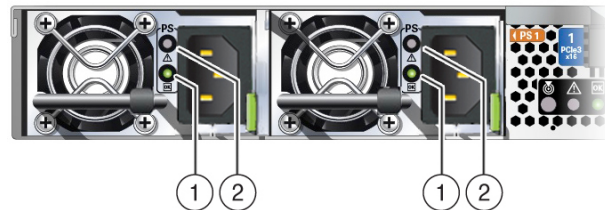
For more information, refer to the following topic and procedures:

- [“Power Supply Status Indicators” on page 43](#)
- [“Remove a Power Supply” on page 43](#)
- [“Install a Power Supply” on page 45](#)



## Power Supply Status Indicators

Each power supply contains two status indicators (LEDs) on the back panel. The following figure and table provide a description of the power supply status indicators.

**FIGURE 6** Power Supply Status Indicators



**TABLE 4** Controller Power Supply Indicators

Legend	Status Indicator Name	Icon	Color	State Meaning
1	AC OK/DC OK		Green	<ul style="list-style-type: none"> <li>■ OFF – No AC power is present.</li> <li>■ SLOW BLINK – Normal operating. Input power is within specification. DC output voltage is not enabled.</li> <li>■ STEADY ON – Normal operation. Input AC power and DC output voltage are within specification.</li> </ul>
2	Service Required		Amber	<ul style="list-style-type: none"> <li>■ OFF – Normal operation; no service required.</li> <li>■ STEADY ON – The power supply (PS) has detected a PS fan failure, PS overtemperature, PS over current, or PS over/under voltage.</li> </ul>

## ▼ Remove a Power Supply

### 1. Identify which power supply requires replacement.

A lit amber Service Required LED on a power supply indicates that a failure was detected. You can also use the Oracle ILOM `show faulty` command at the Oracle ILOM command line prompt (`->`) to identify a power supply failure.

Alternatively, to list all known faults in the controller, log in to Oracle Solaris OS and issue the `fmadm faulty` command, or log in to the Oracle ILOM service processor from the Oracle

ILOM Fault Management Shell and issue the `fmadm faulty` command. For more information about how to use the Oracle ILOM Fault Management Shell and supported commands, see the *Oracle ILOM User's Guide for System Monitoring and Diagnostics Firmware Release 3.2.x* in the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

---

**Note** - The fans of a failed power supply might still be spinning when the system is powered on. You can remove a power supply while the fans are still spinning.

---

2. **Gain access to the rear of the controller where the faulty power supply is located.**
3. **If the cable management arm (CMA) is installed, disconnect both CMA left-side connectors and move the CMA out of the way.**

For instructions for disconnecting the CMA left-side connectors, refer to *Oracle ZFS Storage ZS5-ES Installation Guide*.

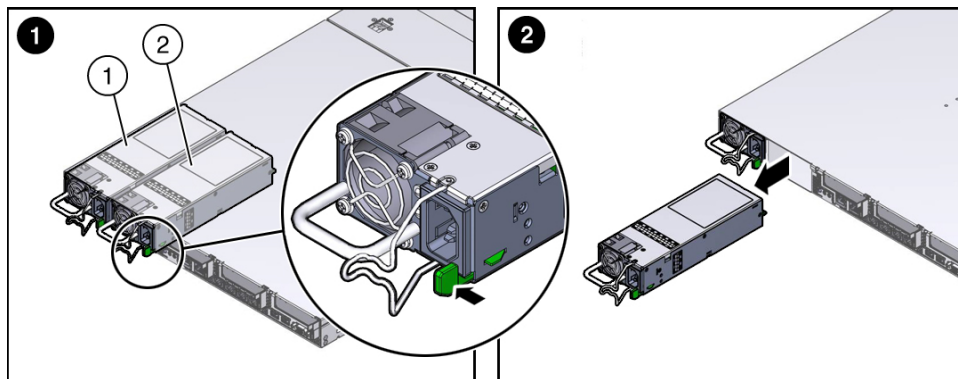


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**Caution** - When disconnecting the CMA left-side connectors, use your arm to support the CMA so that it does not hang down under its own weight and stress the right-side connectors; otherwise, the CMA might be damaged. You must continue to support the CMA until you have reconnected both of the left-side connectors.

---

4. **Disconnect the power cord from the faulty power supply.**
5. **Grasp the power supply handle and push the power supply latch to the left [1].**





Legend	
1	Power Supply 0 (PS0)
2	Power Supply 1 (PS1)

**6. Pull the power supply out of the chassis [2].**



---

**Caution** - Whenever you remove a power supply, you should replace it with another power supply; otherwise, the controller might overheat due to improper airflow.

---

**7. Continue to [“Install a Power Supply” on page 45](#).**

**Related Information**

- [“Controller Back Panel View” on page 14](#)
- [“Power Supply Status Indicators” on page 43](#)
- [“Install a Power Supply” on page 45](#)

## ▼ Install a Power Supply



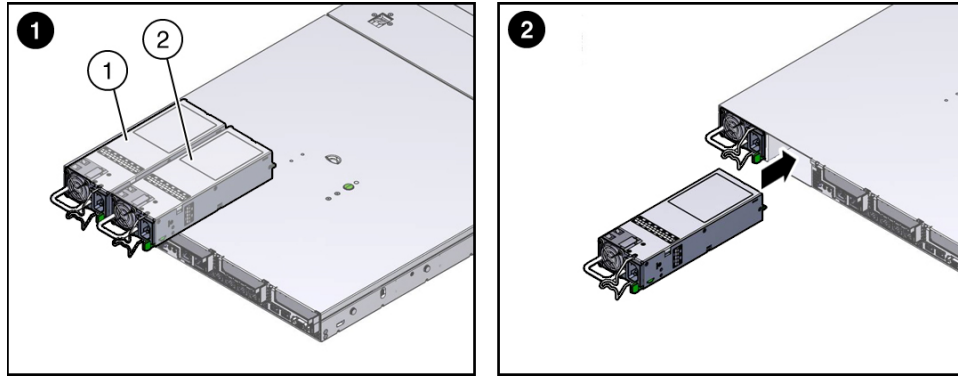
---

**Caution** - Always replace a faulty power supply with a power supply of the same type (model).

---

- 1. Remove the replacement power supply from its packaging and place it on an antistatic mat.**
- 2. Align the replacement power supply with the empty power supply slot [1].**
- 3. Slide the power supply into the bay until it is fully seated [2].**

You will hear an audible click when the power supply fully seats.



4. **Reconnect the power cord to the power supply.**
5. **Verify that the amber LED on the replaced power supply and the Service Required LEDs on the front and rear panels of the controller are not lit.**

---

**Note** - After you have replaced Power Supply 0, you must reset the Oracle ILOM service processor (SP) to propagate the key identity properties (KIP) data to the new power supply. For instructions on resetting the SP, see the *Oracle Integrated Lights Out Manager (ILOM) 3.2 Configuration and Maintenance Guide* at <http://www.oracle.com/goto/ilom/docs>. Power Supply 1 does not contain KIP data, and therefore does not require an SP reset after replacement.

---

6. **If you disconnected the two CMA left-side connectors, reconnect the connectors.**

For instructions for reconnecting the CMA left-side connectors, refer to *Oracle ZFS Storage ZS5-ES Installation Guide*.

### Related Information

- [“Controller Back Panel View” on page 14](#)
- [“Power Supply Status Indicators” on page 43](#)
- [“Remove a Power Supply” on page 43](#)

# Servicing CRUs That Require Controller Power-Off

---

These sections describe how to service customer-replaceable units (CRUs) that require you to power off the controller. For more information about CRUs, see [“Illustrated Parts Breakdown” on page 15](#) and [“Customer-Replaceable Units” on page 17](#).

Description	Use
Service the DIMMs	<a href="#">“Servicing the DIMMs (CRU)” on page 47</a>
Service the PCIe Risers	<a href="#">“Servicing PCIe Risers (CRU)” on page 55</a>
Service the PCIe cards	<a href="#">“Servicing PCIe Cards (CRU)” on page 67</a>
Service the battery	<a href="#">“Servicing the Battery (CRU)” on page 71</a>

## Related Information

- [“Servicing CRUs That Do Not Require Controller Power-Off” on page 33](#)
- [“Servicing FRUs” on page 75](#)

## Servicing the DIMMs (CRU)

Oracle ZFS Storage ZS5-ES base configuration supports 384GB DDR4 (16GB DIMMs).



**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).



**Caution** - Ensure that all power is removed from the controller before removing or installing DDR4 DIMMs, or damage to the DDR4 DIMMs might occur. You must disconnect all power cables from the system before performing these procedures.

The following topics and procedures provide information to assist you when replacing a DIMM:

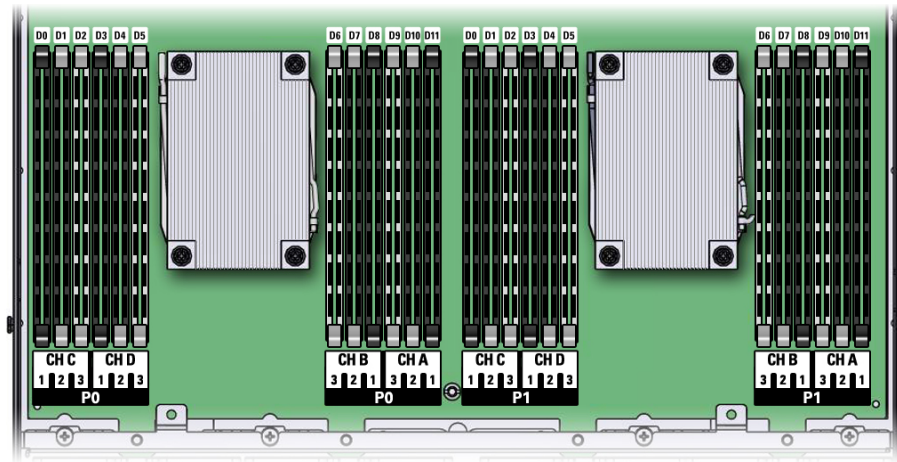
- [“DIMM and Processor Physical Layout” on page 48](#)
- [“Inconsistencies Between DIMM Fault Indicators and the BIOS Isolation of Failed DIMMs” on page 49](#)
- [“Using the Controller Fault Remind Button” on page 50](#)
- [“Identify and Remove the Failed DIMM” on page 51](#)
- [“Install a DIMM” on page 54](#)

### **Related Information**

- [“Servicing CRUs That Do Not Require Controller Power-Off” on page 33](#)
- [“Servicing FRUs” on page 75](#)

## **DIMM and Processor Physical Layout**

The physical layout of the DIMMs and processors is shown in the following figure. When viewing the controller from the front, processor 0 (P0) is on the left. Notice that each processor, P0 and P1, has four memory channels that are labeled, from left to right, Ch C, Ch D, Ch B, and Ch A.

**FIGURE 7** DIMM and Processor Physical Layout

### Related Information

- [“Inconsistencies Between DIMM Fault Indicators and the BIOS Isolation of Failed DIMMs” on page 49](#)

## Inconsistencies Between DIMM Fault Indicators and the BIOS Isolation of Failed DIMMs

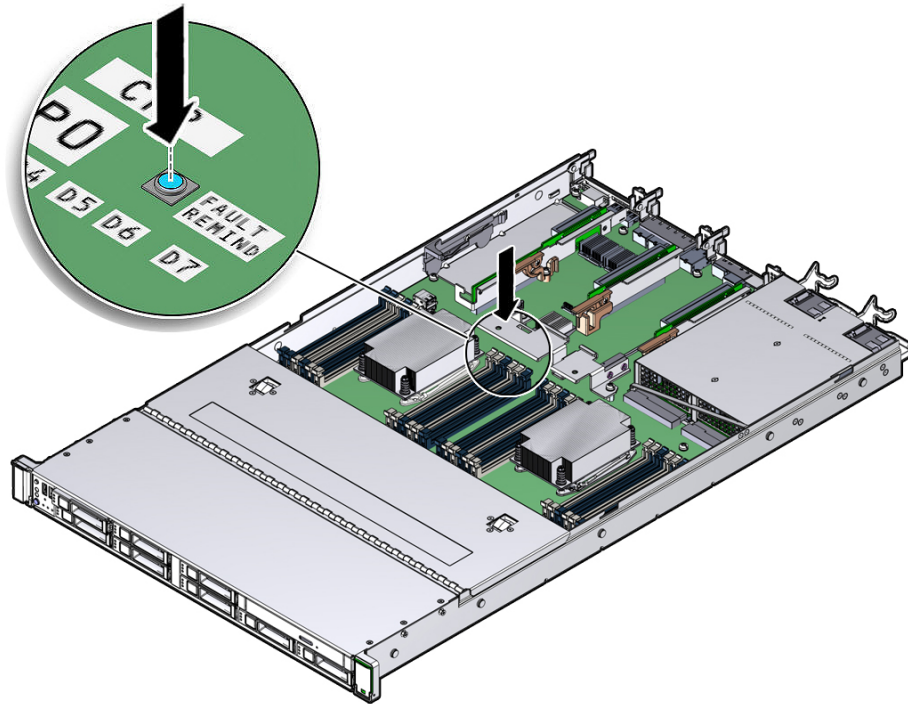
When a single DIMM is marked as failed by Oracle ILOM (for example, `fault.memory.intel.dimm.training-failed` is listed in the service processor Event Log), BIOS might disable the entire memory channel that contains the failed DIMM, up to three DIMMs. As a result, none of the memory installed in the disabled channel will be available to the operating system. However, when the Fault Remind button is pressed, only the fault status indicator (LED) associated with the failed DIMM lights. The fault LEDs for the other DIMMs in the memory channel remain off. Therefore, you can correctly identify the failed DIMM using the lit LED.

## Using the Controller Fault Remind Button

When the Fault Remind button is pressed, an LED located next to the Fault Remind button lights green to indicate that there is sufficient voltage present in the fault remind circuit to light any fault LEDs that were lit due to a component failure. If this LED does not light when you press the Fault Remind button, it is likely that the capacitor powering the fault remind circuit has lost its charge. This can happen if the Fault Remind button is pressed for several minutes with fault LEDs lit or if power has been removed from the controller for more than 15 minutes.

The following figure shows the location of the Fault Remind button.

**FIGURE 8** Fault Remind Button Location



## ▼ Identify and Remove the Failed DIMM

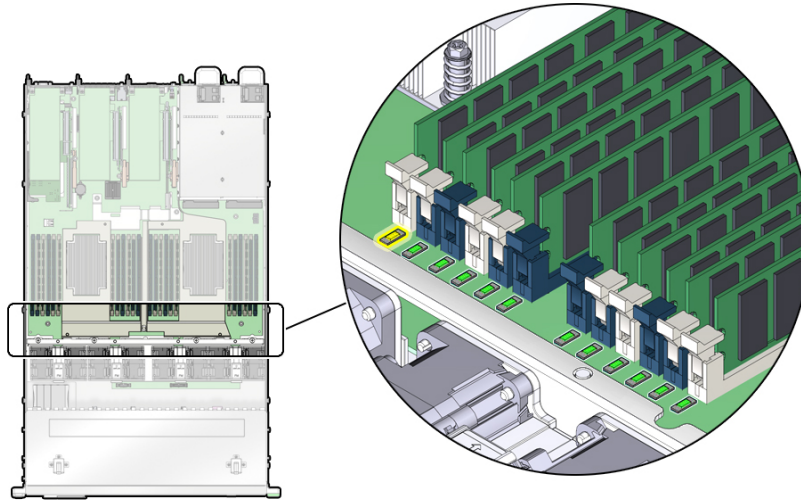
**Before You Begin** Use the Maintenance > Hardware screen of the BUI, or maintenance hardware CLI context, to identify the faulted memory module.

1. **Prepare the controller for service.**
  - a. **Power off the controller, and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25](#)
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26](#).
  - c. **Attach an antistatic wrist strap to your wrist and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
  - d. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30](#).
2. **Identify and note the location of the failed DDR4 DIMM by pressing the Fault Remind button on the motherboard (see [“Using the Controller Fault Remind Button” on page 50](#)).**

Failed DDR4 DIMMs are identified with a corresponding amber LED on the motherboard.

  - If the DIMM fault LED is off, the DIMM is operating properly.

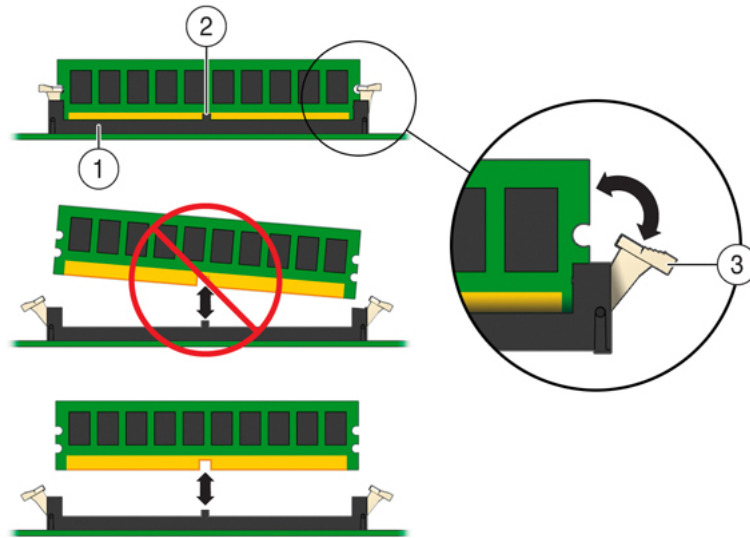
- If the DIMM fault LED is on (amber), then the DIMM has failed and should be replaced.



3. To remove the failed DIMM do the following:
  - a. Rotate both DIMM socket ejectors outward as far as they will go (see the following figure).



The DIMM is partially ejected from the socket.



Legend	
1	DIMM connector socket
2	DIMM connector key
3	DIMM connector key

- b. Carefully lift the DIMM straight up to remove it from the socket.
4. Replace each failed DIMM with either another DIMM of the same rank size (quad rank, dual rank, or single rank) or leave the socket empty.

For DIMM replacement instructions, see [“Install a DIMM” on page 54](#).

### Related Information

- [“DIMM and Processor Physical Layout” on page 48](#)
- [“Install a DIMM” on page 54](#)

## ▼ Install a DIMM

1. **Unpack the replacement DDR4 DIMM and place it on an antistatic mat.**
2. **Ensure that the replacement DDR4 DIMM matches the size of the DIMM it is replacing.**
3. **Install a DIMM.**
  - a. **Ensure that the ejector tabs are in the open position.**
  - b. **Align the notch in the replacement DIMM with the connector key in the connector socket.**

The notch ensures that the DIMM is oriented correctly.
  - c. **Push the DDR4 DIMM into the connector until the ejector tabs lock the DIMM in place.**

If the DIMM does not easily seat into the connector socket, verify that the notch in the DIMM is aligned with the connector key in the connector socket. If the notch is not aligned, damage to the DIMM might occur.

---

**Note** - If you want to move a faulty DDR4 DIMM to a new DIMM socket or re-seat a DIMM for troubleshooting, you must first manually clear the associated DIMM fault. Otherwise, the DIMM fault might follow the DIMM to the new socket location or reoccur on the current socket location, possibly causing a false DIMM fault condition.

---

4. **Repeat Step 3. until all replacement DDR4 DIMMs are installed.**
5. **Return the controller to operation.**
  - a. **Install the controller top cover.**

See [“Install the Controller Top Cover”](#) on page 144.
  - b. **Close the fan door.**
  - c. **Return the controller to the normal rack position.**

See [“Return the Controller to the Normal Rack Position”](#) on page 147.
  - d. **Reconnect the power cords to the controller power supplies and reconnect the data cables.**

See [“Reconnect Data Cables and Power Cords”](#) on page 149.

**e. Power on the controller.**

See [“Power On the Controller”](#) on page 150.

Verify that the Power/OK status indicator is steady on.

- 6. Go to the Maintenance > Hardware screen of the BUI. Click the right-arrow icon for the controller, click DIMM, and verify that the status icon is green for the newly installed DIMM. To view details about the new DIMM, click its information icon.**

- 7. (Optional) Use Oracle ILOM to clear controller DDR4 DIMM faults.**

DDR4 DIMM faults are automatically cleared after a new DIMM has been installed. If you need to manually clear DDR4 DIMM faults, refer to the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

### Related Information

- [“DIMM and Processor Physical Layout”](#) on page 48
- [“Identify and Remove the Failed DIMM”](#) on page 51

## Servicing PCIe Risers (CRU)

PCIe cards in all slots are installed on vertical risers. You must remove the relevant riser to remove and replace a PCIe card. You must remove all three PCIe risers when replacing the motherboard.



---

**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures”](#) on page 29.

---



---

**Caution** - Ensure that all power is removed from the controller before removing or installing PCIe risers, or damage to the PCIe cards installed in the risers might occur. You must disconnect all power cables from the system before performing these procedures.

---

The following sections provide information to assist you in servicing PCIe risers:

- [“PCIe Riser Location and Differences”](#) on page 56

- [“Remove a PCIe Riser From PCIe Slot 1 or 2” on page 58](#)
- [“Install a PCIe Riser Into PCIe Slot 1 or 2” on page 60](#)
- [“Remove the PCIe Riser From PCIe Slots 3 and 4” on page 62](#)
- [“Install the PCIe Riser Into PCIe Slots 3 and 4” on page 64](#)

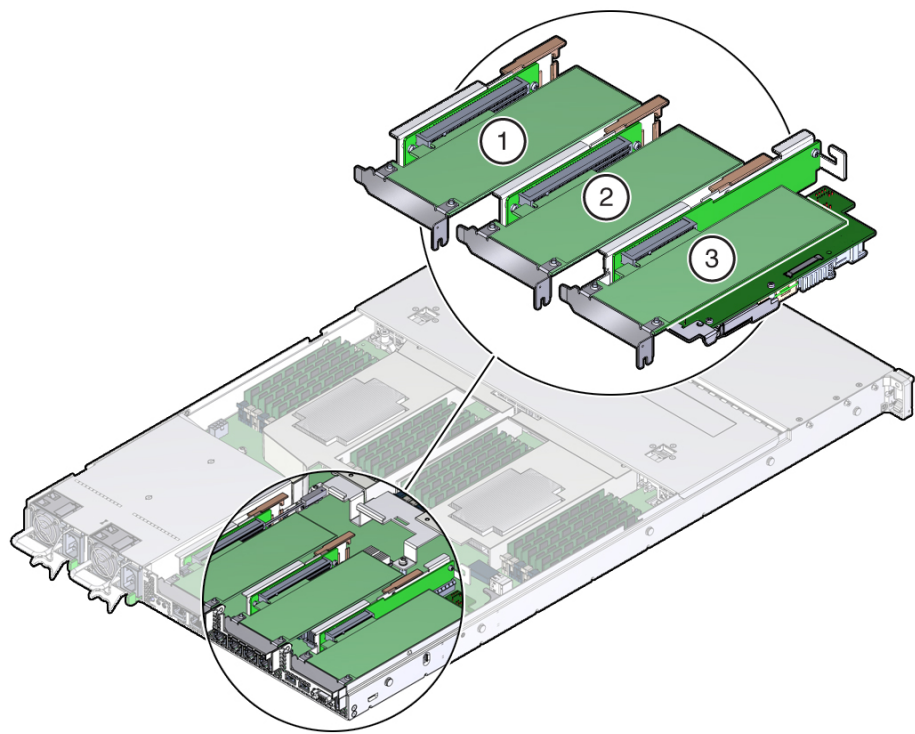
### **Related Information**

- [“Servicing PCIe Cards \(CRU\)” on page 67](#)

## **PCIe Riser Location and Differences**

The PCIe riser that installs in PCIe slots 3 and 4 is different than the risers in PCIe slots 1 and 2. The riser for slots 3 and 4 supports two cards: a standard PCIe card and the internal HBA card. Do not attempt to install the PCIe riser for PCIe slots 3 and 4 in slots 1 or 2, and vice versa.

FIGURE 9 PCIe Riser Locations



Legend	
1	PCIe riser and installed PCIe InfiniBand card (slot 1)
2	PCIe riser and installed PCIe HBA card (slot 2)
3	PCIe riser and installed cluster interface card (slot 3) and the internal HBA card (slot 4) of this riser. <b>Note</b> - This riser is different from the risers in slots 1 and 2.

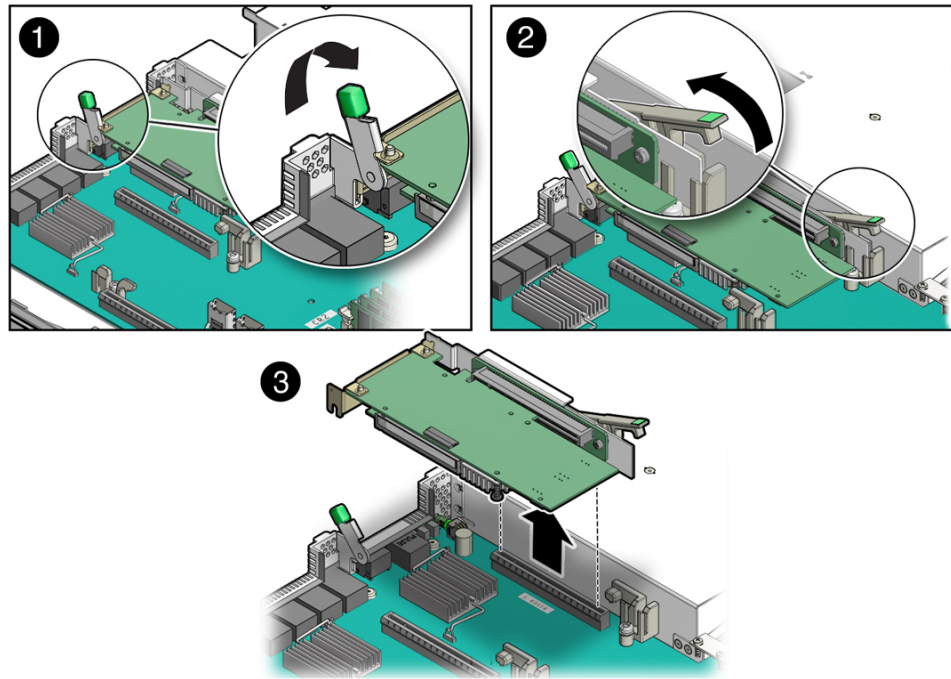
Related Information

- [“PCIe Slot Characteristics” on page 67](#)

## ▼ Remove a PCIe Riser From PCIe Slot 1 or 2

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25.](#)
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26.](#)
  - c. **Attach an antistatic wrist strap to your wrist and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29.](#)
  - d. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30.](#)
2. **Select the PCIe riser that you want to remove.**  
See [“PCIe Slot Characteristics” on page 67.](#)
3. **If a PCIe card is installed in the riser, disconnect any external cables from the card.**

4. Lift the green-tabbed latch on the rear of the controller chassis next to the applicable PCIe slot to release the rear bracket on the PCIe card [1].



---

**Note** - If the riser does not have a PCIe card installed, then lift the latch to release the PCIe slot filler panel.

---

5. Lift the green-tabbed riser release lever on the PCIe riser with one hand and use your other hand to remove the riser from the motherboard connector [2, 3].
6. If there is a PCIe card installed in the riser, place the riser on an antistatic mat and note the slot in which the PCIe riser was originally installed; otherwise, set the PCIe riser aside.

### Related Information

- [“Install a PCIe Riser Into PCIe Slot 1 or 2” on page 60](#)

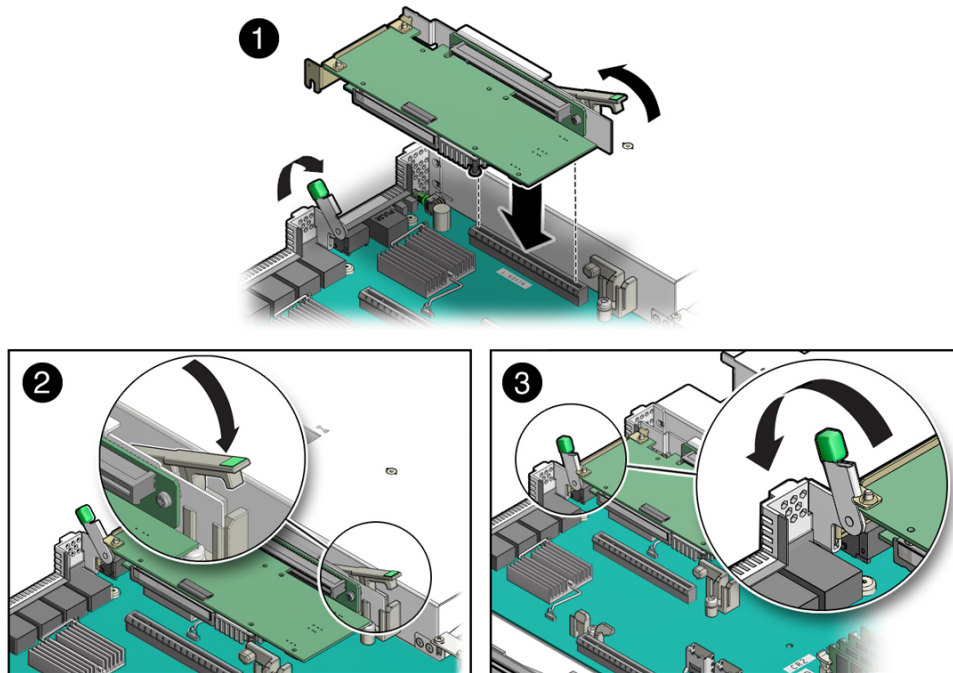
## ▼ Install a PCIe Riser Into PCIe Slot 1 or 2

---

**Note** - The PCIe riser in slots 3 and 4 is different than the PCIe risers in slots 1 and 2. Do not attempt to install a PCIe riser from slot 1 or 2 into PCIe slots 3 and 4 and vice versa.

---

1. Determine into which slot you will install the PCIe riser.
2. Retrieve the PCIe riser and any PCIe cards attached to it.
3. Raise the green-tabbed release lever on the PCIe riser to the open (up) position [1].
4. Gently press the riser into the motherboard connector until it is seated, and then press the green-tabbed release lever on the PCIe riser to the closed (down) position [2].





5. **Close the green-tabbed latch on the rear of the controller chassis next to the applicable PCIe slot to secure the rear bracket on the PCIe card to the controller chassis [3].**

---

**Note** - If the riser does not have a PCIe card installed, install a PCIe slot filler panel and close the green-tabbed latch to secure the filler panel.

---

6. **If there were any external cables connected to the PCIe card, reconnect them.**
7. **Return the controller to operation.**
  - a. **Install the controller top cover.**  
See [“Install the Controller Top Cover” on page 144.](#)
  - b. **Return the controller to the normal rack position.**  
See [“Return the Controller to the Normal Rack Position” on page 147.](#)
  - c. **Reconnect the power cords to the controller power supplies and reconnect the data cables.**  
See [“Reconnect Data Cables and Power Cords” on page 149.](#)
  - d. **Power on the controller.**  
See [“Power On the Controller” on page 150.](#)  
Verify that the Power/OK status indicator is steady on.
8. **Go to the Maintenance > Hardware screen of the BUI. Click the right-arrow icon for the controller, click Slot, and verify that the status icon is green for the newly installed card. To view details about the new card, click its information icon.**
9. **(Optional) Use Oracle ILOM to clear the controller PCIe riser fault.**  
If the PCIe riser fault message in Oracle ILOM is not cleared under Open Problems, you must manually clear the fault in Oracle ILOM. For instructions for manually clearing a PCIe riser fault, see the procedure "Clear Faults for Undetected Replaced or Repaired Hardware Components" in the *Oracle ILOM User's Guide for System Monitoring and Diagnostics Firmware Release 3.2.x* in the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

## Related Information

- [“Remove a PCIe Riser From PCIe Slot 1 or 2” on page 58](#)

## ▼ Remove the PCIe Riser From PCIe Slots 3 and 4

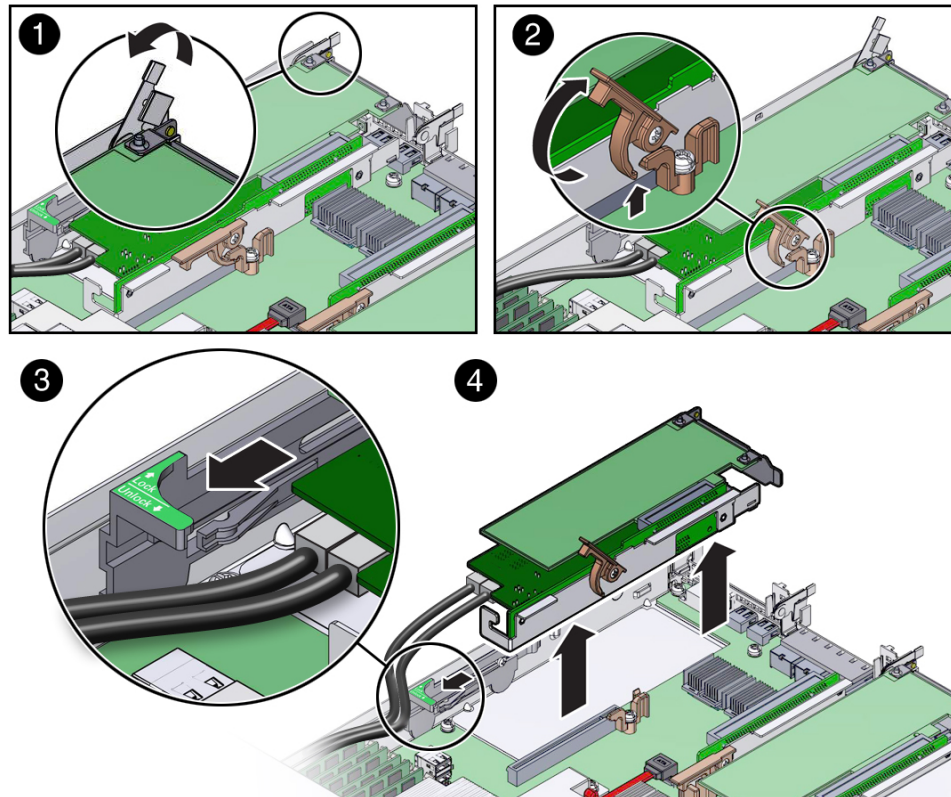
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**Note** - This PCIe riser is actually installed in PCIe slot 3, but it supports up to two PCIe cards. The upper slot, referred to as slot 3, can be used for any supported PCIe card, and, therefore, is optionally populated. The lower slot, referred to as slot 4, is dedicated to the internal HBA card, and, therefore is always populated. The internal HBA card is a field-replaceable unit (FRU). For instructions for servicing the internal HBA card, see [“Servicing the Internal HBA Card \(FRU\)” on page 91](#).

---

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25](#)
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26](#).
  - c. **Attach an antistatic wrist strap to your wrist and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
  - d. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30](#).

2. Open the green-tabbed latch located on the rear of the controller chassis next to PCIe slot 3 to release the rear bracket on the PCIe card [1].



**Note** - If the riser does not have a PCIe card installed in slot 3, then lift the latch to release the PCIe slot 3 filler panel.

3. To release the riser from the motherboard connector, lift the green-tabbed release lever on the PCIe riser to the open position [2].
4. Slide the plastic PCIe card retainer, which is mounted on the side of the chassis, toward the front of the controller to release the card(s) installed in the riser [3].
5. Grasp the riser with both hands and remove it from the controller [4].

6. **Disconnect the SAS system boot drive (HDD) cables from the internal HBA card installed in PCIe slot 4.**
7. **Place the riser on an antistatic mat.**

#### **Related Information**

- [“Install the PCIe Riser Into PCIe Slots 3 and 4” on page 64](#)

## **▼ Install the PCIe Riser Into PCIe Slots 3 and 4**

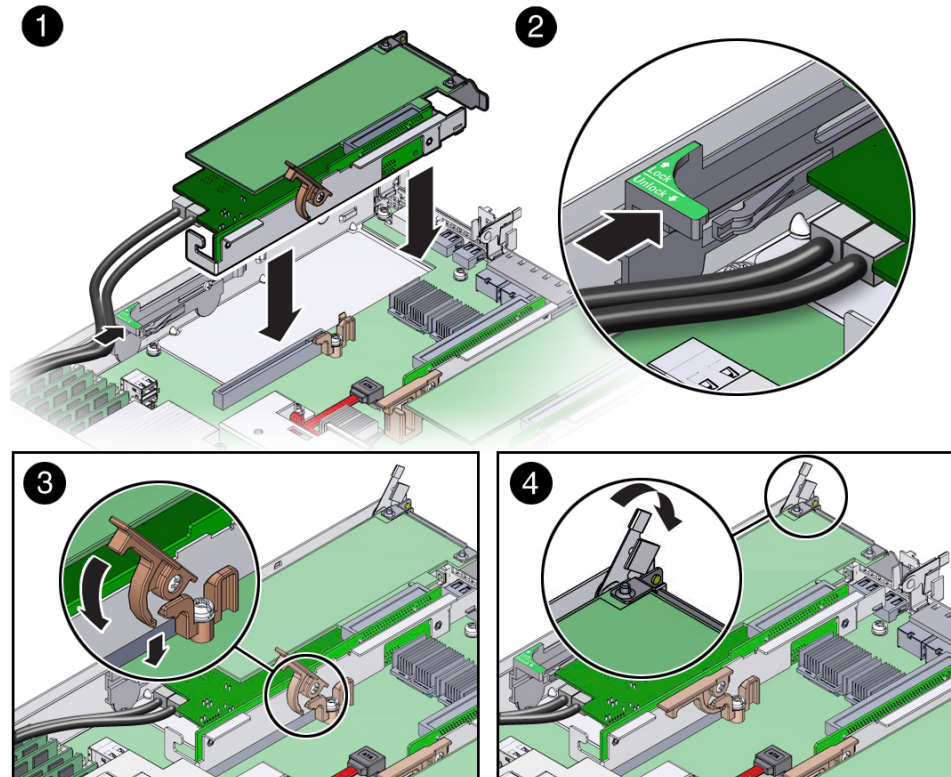
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**Note** - The PCIe riser in slots 3 and 4 is different than the PCIe risers in slots 1 and 2. Do not attempt to install a PCIe riser from slot 1 or 2 into PCIe slots 3 and 4 and vice versa.

---

1. **Retrieve the PCIe riser and any PCIe cards attached to it.**
2. **Reconnect the SAS cables to the internal host bus adapter card.**

Be sure to connect the SAS cable for storage drives 0 through 3 (HDDs 0-3) to the connector that is farthest from the riser in which the HBA card is installed; otherwise, the controller will incorrectly identify the storage drives when it is powered on.



3. **Raise the green-tabbed release lever on the PCIe riser to the open (up) position, and then gently press the riser into the motherboard connector until it is seated [1].**
4. **Ensure that the rear bracket on the internal HBA card in PCIe slot 4 is connected to the slot in the controller chassis side wall.**  
If the bracket is not connected, remove the riser and reposition it so that the rear bracket connects to the side wall, and then gently press the riser into the motherboard connector.
5. **Slide the plastic PCIe card retainer, which is mounted on the side of the chassis, toward the back of the controller to secure the card(s) installed in the riser [2].**

6. **Press the green-tabbed release lever on the PCIe riser to the closed (down) position [3].**
7. **To secure the rear bracket on the PCIe card to the controller, close the green-tabbed latch on the rear of the controller chassis [4].**

---

**Note** - If the riser does not have a PCIe card installed in slot 3, install a PCIe slot filler panel and close the green-tabbed latch to secure the PCIe slot filler panel.

---

8. **If there is a PCIe card installed in slot 3 of the riser, reconnect any external or internal cables to the card.**
9. **Return the controller to operation.**
  - a. **Install the controller top cover.**  
See [“Install the Controller Top Cover” on page 144.](#)
  - b. **Return the controller to the normal rack position.**  
See [“Return the Controller to the Normal Rack Position” on page 147.](#)
  - c. **Reconnect the power cord to the controller power supply and the data cables.**  
See [“Reconnect Data Cables and Power Cords” on page 149.](#)
  - d. **Power on the controller.**  
See [“Power On the Controller” on page 150.](#)  
Verify that the Power/OK status indicator is steady on.
10. **Use Oracle ILOM to clear the controller PCIe riser fault.**

If the PCIe riser fault message in Oracle ILOM is not cleared under Active Problems, you must manually clear the fault in Oracle ILOM. For instructions for manually clearing a PCIe riser fault, see the procedure "Clear Faults for Undetected Replaced or Repaired Hardware Components" in the *Oracle ILOM User's Guide for System Monitoring and Diagnostics Firmware Release 3.2.x* in the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

## **Related Information**

- [“Remove the PCIe Riser From PCIe Slots 3 and 4” on page 62](#)

## Servicing PCIe Cards (CRU)

These sections describe how to service PCIe cards. Refer to your PCIe card documentation for complete software and cabling information about your card.



**Caution** - The procedures in this section should not be used to service the internal HBA card that is located in PCIe slot 4. The internal HBA card is a field-replaceable unit (FRU) and should be serviced only by qualified Oracle Services personnel. See [“Servicing the Internal HBA Card \(FRU\)” on page 91](#).



**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).



**Caution** - Ensure that all power is removed from the controller before removing or installing PCIe cards. You must disconnect all power cables from the system before performing these procedures.

This section the following topics and procedures:

- [“PCIe Slot Characteristics” on page 67](#)
- [“Remove a PCIe Card From PCIe Slot 1 or 2” on page 68](#)
- [“Install a PCIe Card in PCIe Slot 1 or 2” on page 69](#)
- [“Remove a PCIe Card From PCIe Slot 3” on page 70](#)
- [“Install a PCIe Card in PCIe Slot 3” on page 70](#)

### Related Information

- [“Servicing PCIe Risers \(CRU\)” on page 55](#)

## PCIe Slot Characteristics

There are three external and one internal PCIe slots available in the Oracle ZFS Storage ZS5-ES. The external slots support optional, standard PCIe cards and are numbered 1, 2, and 3 from left to right when you view the controller from the rear. The internal slot, which installs on the riser in PCIe slots 3 and 4, supports a required internal SAS controller HBA card. For a view of the rear panel that shows PCIe slot numbering, see [“Controller Back Panel View” on page 14](#).

---

**Note** - All of the PCIe slots comply with the PCI Express 3.0 specification and can accommodate 25 watt PCIe cards.

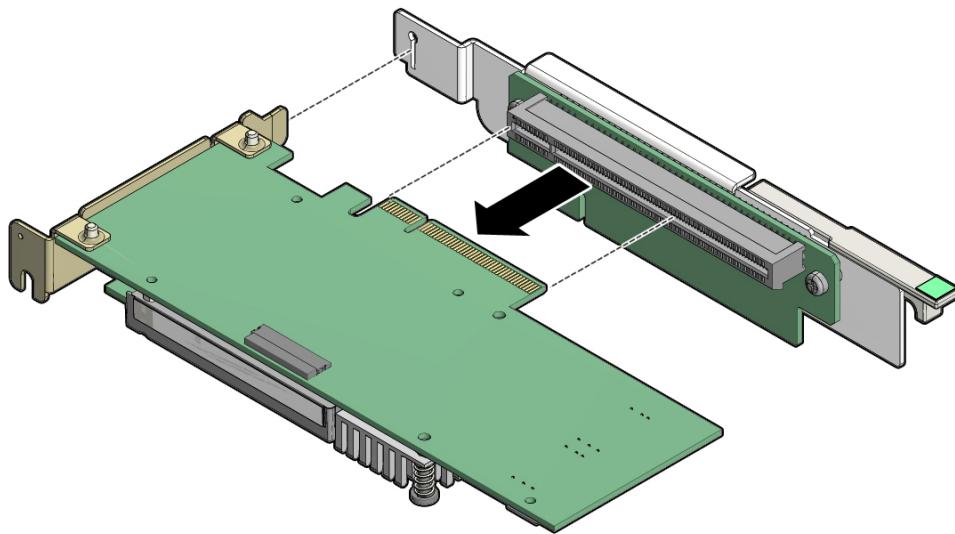
---

### Related Information

- [“Controller Back Panel View” on page 14](#)

## ▼ Remove a PCIe Card From PCIe Slot 1 or 2

1. **Remove the PCIe riser from the controller.**  
For instructions, see [“Remove a PCIe Riser From PCIe Slot 1 or 2” on page 58](#).
2. **Remove the PCIe card from the PCIe riser.**
  - a. Hold the riser in one hand and use your other hand to carefully pull the PCIe card connector out of the riser.
  - b. Disconnect the rear bracket that is attached to the PCIe card from the rear of the PCIe riser.





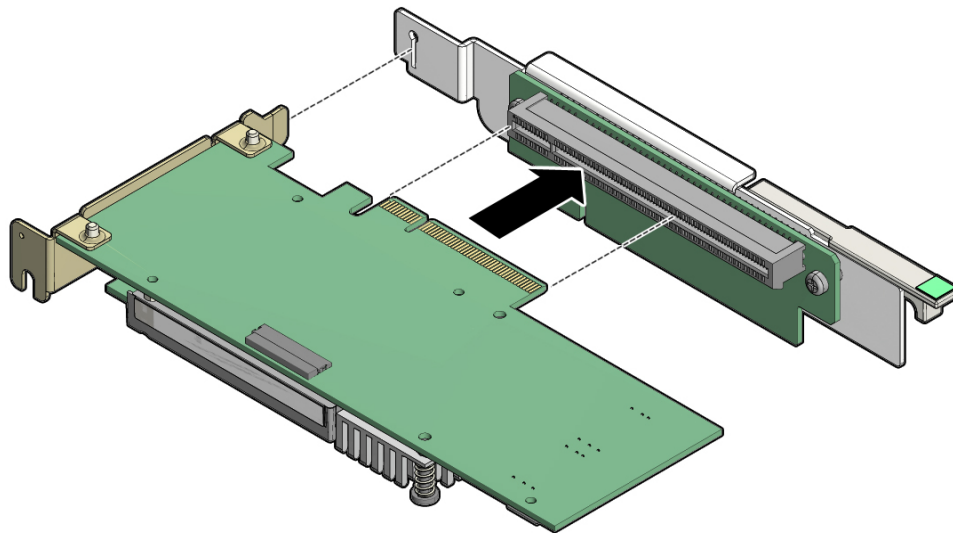
3. Place the PCIe card on an antistatic mat.



**Caution** - Whenever you remove a PCIe card, replace it with the same PCIe type and model card.

## ▼ Install a PCIe Card in PCIe Slot 1 or 2

1. Retrieve the PCIe card and riser you want to install.
2. Insert the rear bracket that is attached to the PCIe card into the PCIe riser.
3. Hold the riser in one hand and use your other hand to carefully insert the PCIe card connector into the Riser.



4. Install the PCIe riser into the controller.

For instructions, see [“Install a PCIe Riser Into PCIe Slot 1 or 2” on page 60](#).

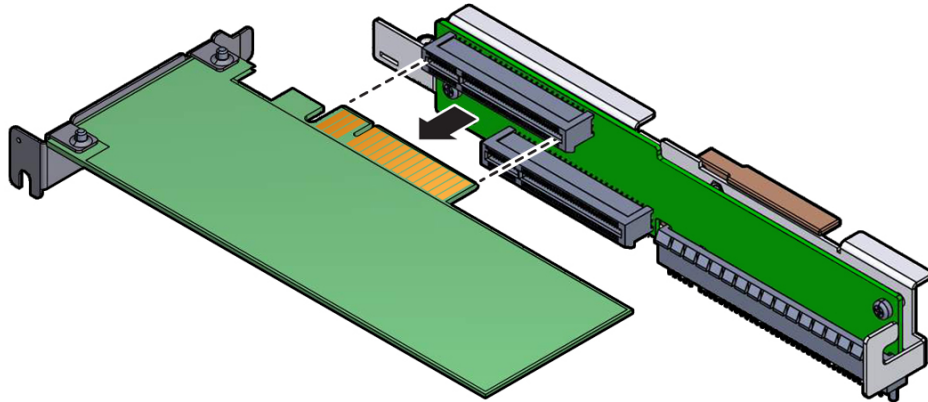
## ▼ Remove a PCIe Card From PCIe Slot 3

1. Remove the PCIe riser from the controller.

For instructions, see [“Remove the PCIe Riser From PCIe Slots 3 and 4”](#) on page 62.

2. Remove the PCIe card from the riser.

- a. Hold the riser in one hand and use your other hand to carefully remove the PCIe card connector from the riser.
- b. Disconnect the rear bracket attached to the PCIe card from the rear of the PCIe riser.



3. Place the PCIe card on an antistatic mat.



---

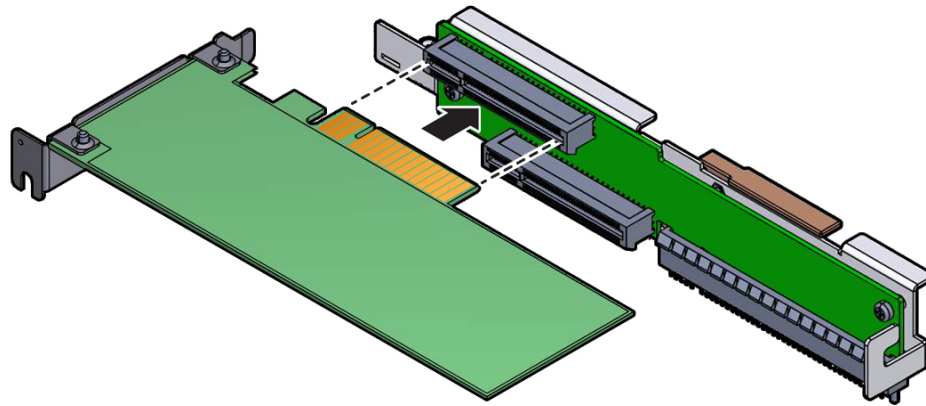
**Caution** - Whenever you remove a PCIe card, replace it with the same PCIe type and model card.

---

## ▼ Install a PCIe Card in PCIe Slot 3

1. Retrieve the PCIe card and riser you want to install.

2. Insert the rear bracket that is attached to the PCIe card into the PCIe riser.
3. Hold the riser in one hand and use your other hand to carefully insert the PCIe card connector into the riser.



4. Install the PCIe riser.

For instructions, see [“Install the PCIe Riser Into PCIe Slots 3 and 4” on page 64.](#)

## Servicing the Battery (CRU)

The battery maintains system time when the controller is powered off and a time controller is unavailable. If the controller fails to maintain the proper time when the controller is powered off and not connected to a network, replace the battery.



**Caution** - Ensure that all power is removed from the controller before removing or installing the battery. You must disconnect the power cables from the system before performing these procedures.

This section covers the following procedures:

- [“Remove the Battery” on page 72](#)
- [“Install the Battery” on page 73](#)

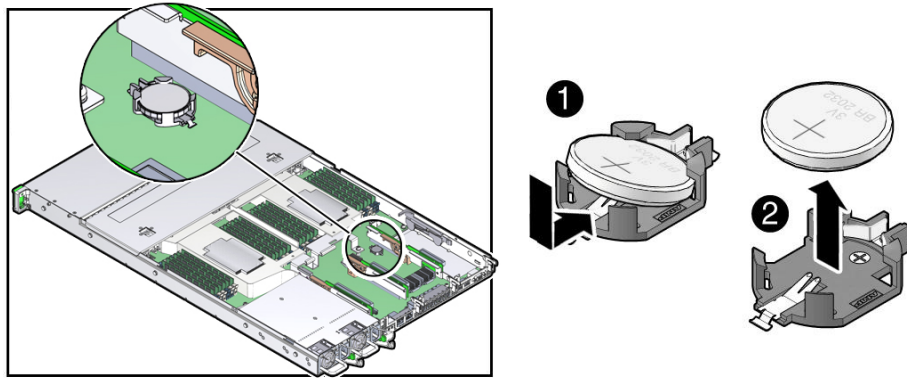
### Related Information

- [“Extend the Controller to the Maintenance Position” on page 26](#)
- [“Remove the Controller Top Cover” on page 30](#)

## ▼ Remove the Battery

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25](#).
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26](#).
  - c. **Attach an antistatic wrist strap to your wrist and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
  - d. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30](#).
2. **If there is a PCIe card installed in the PCIe riser slot 2, remove the riser and card to gain access to the battery.**  
See [“Remove a PCIe Riser From PCIe Slot 1 or 2” on page 58](#).

3. To dislodge the battery from the retainer, place your finger under the side of the battery nearest the rear of the controller [1] and gently lift the battery up and out of the retainer [2].



## ▼ Install the Battery

1. **Unpack the replacement battery.**
2. **Press the new battery into the battery retainer with the positive side (+) facing up** (see [“Remove the Battery” on page 72](#)[1]).
3. **If there was a PCIe card installed in the PCIe riser slot 2, reinstall it.**  
See [“Install a PCIe Riser Into PCIe Slot 1 or 2” on page 60](#).
4. **Return the controller to operation.**
  - a. **Install the controller top cover.**  
See [“Install the Controller Top Cover” on page 144](#).
  - b. **Close the fan door.**
  - c. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143](#).

- d. **Reconnect the power cords to the controller power supplies and reconnect the data cables.**

See “Reconnect Data Cables and Power Cords” on page 149.

- e. **Power on the controller.**

See “Power On the Controller” on page 150.

Verify that the Power/OK status indicator is steady on.

---

**Note** - If the service processor is configured to synchronize with a network time controller using the Network Time Protocol (NTP), the Oracle ILOM clock will be reset as soon as the controller is powered on and connected to the network; otherwise, proceed to the next step.

---

**5. If the service processor is not configured to use NTP, do one of the following:**

- Reset the Oracle ILOM clock using the Oracle ILOM CLI or the web interface.

For instructions, refer to the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

- Use the BIOS Setup Utility to reprogram the host clock.

For the BIOS Main menu screen that supports this procedure, refer to the *Oracle X5 Series Servers Administration Guide* at <http://www.oracle.com/goto/x86adminddiag/docs>.

## Servicing FRUs

---

The following sections describe how to service field-replaceable units (FRUs). For more information about FRUs, see [“Illustrated Parts Breakdown” on page 15](#) and [“Field-Replaceable Units” on page 18](#).

You must power down the system and disconnect the AC power cords from the controller before servicing any of these components.

---

**Note** - Only authorized Oracle Services personnel should service FRUs.

---

Description	Link
Service the processors	<a href="#">“Servicing Processors (FRU)” on page 75</a>
Service the internal host bus adapter (HBA)	<a href="#">“Servicing the Internal HBA Card (FRU)” on page 91</a>
Service the disk backplane	<a href="#">“Servicing the Disk Backplane (FRU)” on page 100</a>
Service the front indicator module	<a href="#">“Remove the Front Indicator Module” on page 106</a>
Service the motherboard	<a href="#">“Servicing the Motherboard (FRU)” on page 109</a>
Service the internal HBA cable assembly.	<a href="#">“Servicing the Internal HBA SAS Cable Assembly” on page 132</a>
Service the power, FIM, and disk backplane data cables	<a href="#">“Servicing the Power, FIM, and Disk Backplane Data Cables” on page 136</a>

## Servicing Processors (FRU)

---

**Note** - Processors should be removed and replaced only by authorized Oracle Services personnel.

---



---

**Caution** - Ensure that all power is removed from the controller before removing or installing a processor. You must disconnect the power cables from the controller before performing these procedures.

---



**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).

**Note** - On single-processor systems, neither a heatsink nor a processor filler cover are installed in the processor socket 1 (P1). To protect the delicate processor socket pins, the cover that comes on the motherboard from manufacturing is left in place.

These procedure are provided in this section:

- [“Remove a Processor” on page 78](#)
- [“Install a Processor” on page 85](#)

## Selecting the Correct Processor Removal and Replacement Tool



**Caution** - The correct color-coded processor removal and replacement tool must be used to remove and replace a processor; otherwise, the processor or the processor socket might be damaged. Additionally, do not use a tool that is designed for earlier generations of Intel processors (CPUs). If you use an earlier generation tool, the processor will only be partially held by the tool and it could fall from the tool, which could damage the processor socket.

Selecting the correct processor removal and replacement tool is a two-step process. First you determine the size of the processor that is being replaced, then you select the removal and replacement tool that fits that size.

- Use Oracle Integrated Lights Out Manager (Oracle ILOM) 3.2.x to display processor information.

For instructions, refer to the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs>.

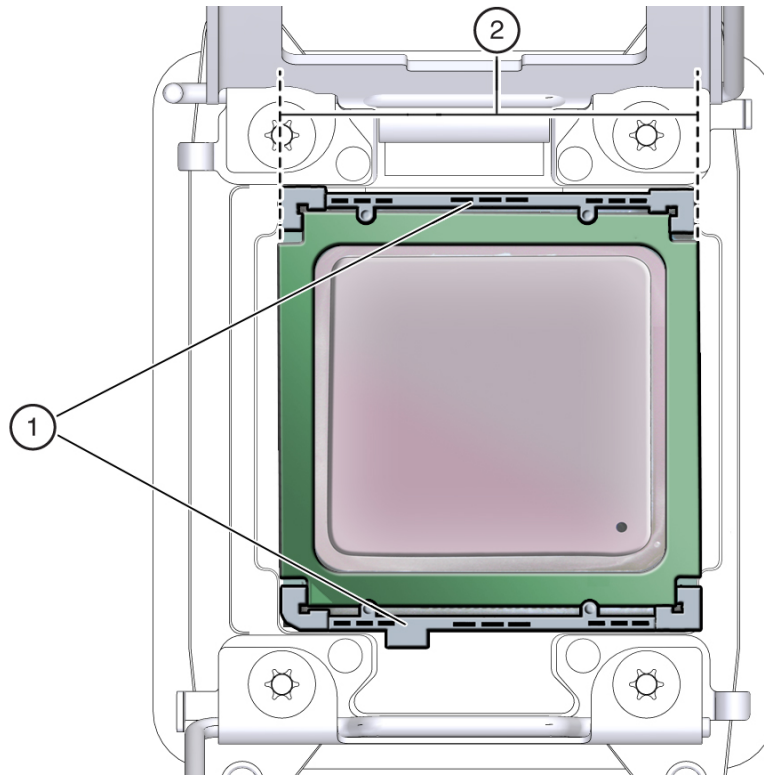
Or

- Visually check the size of the processor installed in the controller.

This requires that you remove the processor heatsink and open the independent loading mechanism (ILM) assembly that holds the processor in the socket. For instructions, see [“Remove a Processor” on page 78](#). This is the same procedure that you will use when you remove the processor.

The following figure shows an 18-core processor installed. Notice that the right and left edges of the processor extend beyond the boundaries of the processor alignment brackets.

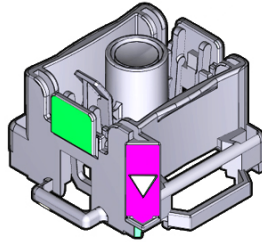


**FIGURE 10** 18-Core Processor Installed in a Motherboard Processor Socket

Legend	
1	Processor alignment brackets
2	Processor left and right edges extend beyond alignment bracket boundaries

The tool for the 18-core processors is color-coded pink, as shown in the following figure.

**FIGURE 11** Color-Coded Processor Removal and Replacement Tool



---

**Caution** - The pink color-coded processor removal and replacement tool must be used only for 18-core processors; otherwise, the processor or the processor socket might be damaged.

---

---

**Note** - The correct processor removal and replacement tool is included in the box with the replacement processor. Additionally, both removal and replacement tools ship with replacement motherboards.

---

## ▼ Remove a Processor



---

**Caution** - Processors should be removed only by authorized Oracle Services personnel.

---



---

**Caution** - Processor removal and replacement must be done using the removal and replacement tool that is included with the replacement processor for the controller (see [“Remove a Processor” on page 78](#)). Using a tool with a different color code might result in damage to the processor and processor socket.

---

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**

See [“Powering Off the Controller”](#) on page 25.

**b. Extend the controller to the maintenance position.**

See [“Extend the Controller to the Maintenance Position”](#) on page 26.

**c. Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**

See [“Take Antistatic Measures”](#) on page 29.

**d. Remove the controller top cover.**

[“Remove the Controller Top Cover”](#) on page 30.

**2. Lift the air baffle up and out of the controller and put it aside.**

**3. Identify the location of the failed processor by pressing the Fault Remind button on the motherboard.**

---

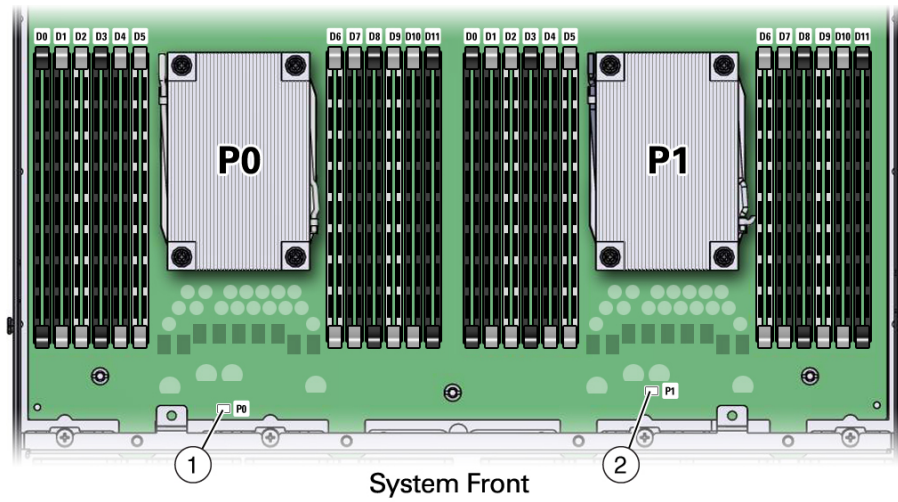
**Note** - When the Fault Remind button is pressed, a LED located next to the Fault Remind button lights green to indicate that there is sufficient voltage present in the fault remind circuit to light any fault LEDs that were lit due to a failure. If this LED fails to light when you press the Fault Remind button, it is likely that the capacitor powering the fault remind circuit has lost its charge. This can happen if the Fault Remind button is pressed for a long time with fault LEDs lit or if power has been removed from the controller for more than 15 minutes.

---

The processor fault LEDs are located next to the processor(s).

- If the processor fault LED is off, then the processor is operating properly.

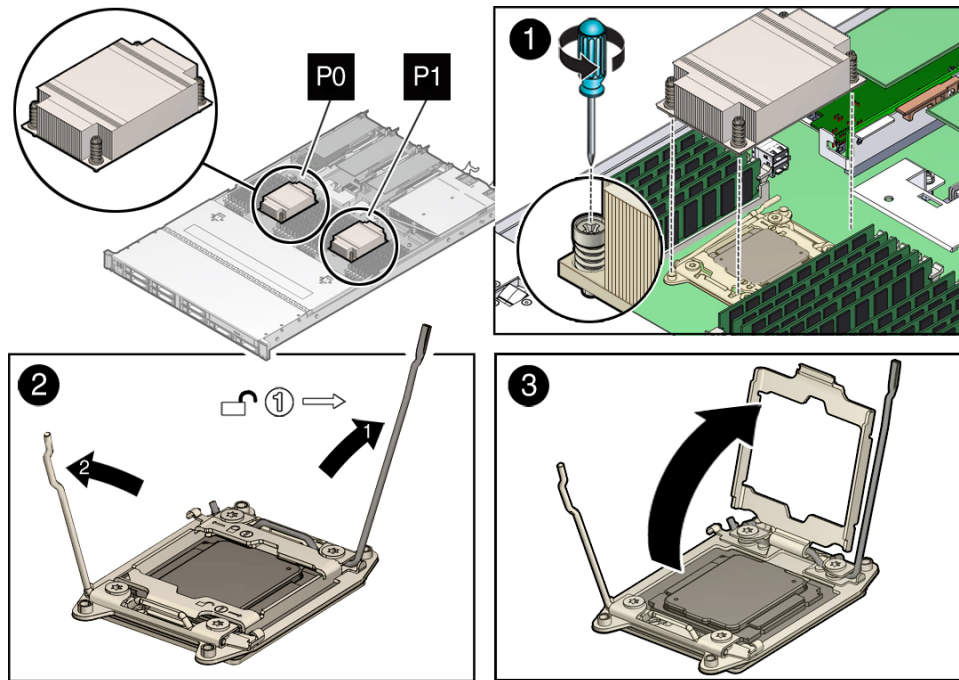
- If the processor fault LED is on (amber), then the processor is failed and should be replaced.



Legend	
1	Processor 0 (P0) fault LED
2	Processor 1 (P1) fault LED

4. Gently press down on the top of the heatsink to counteract the pressure of the captive spring-loaded screws that secure the heatsink to the motherboard and

loosen the four Phillips captive screws in the heatsink for the failed processor [1].



Using a No. 2 Phillips screwdriver, turn the screws counterclockwise alternately one and one half turns until they are fully removed.

5. **To separate the heatsink from the top of the processor, gently twist the heatsink left and right, while pulling upward, and then lift off the heatsink and place it upside down on a flat surface [1].**

A thin layer of thermal grease separates the heatsink and the processor. This grease acts as an adhesive.

---

**Note** - Do not allow the thermal grease to contaminate the work space or other components.

---

6. **Use an alcohol pad to clean the thermal grease from the underside of the heatsink.**

Be very careful not to get the thermal grease on your fingers.



---

**Caution** - Failure to clean the heatsink prior to removing the processor could result in the accidental contamination of the processor socket or other components. Also, be careful not to get the grease on your fingers as this could result in contamination of components.

---

7. **Disengage the processor release lever on the right side of the processor socket (viewing the controller from the front) by pushing down on the lever and moving it to the side away from the processor, and then rotating the lever upward [2].**
8. **Disengage the processor release lever on the left side of the processor socket (viewing the controller from the front) by pushing down on the lever and moving it to the side away from the processor, and then rotating the lever upward [2].**
9. **To lift the ILM assembly load plate off of the processor socket, rotate the processor release lever on the right side of the processor toward the closed position (the ILM assembly load plate is lifted up as the release lever is lowered toward the closed position) and carefully swing the ILM load plate to the fully open position [3].**



---

**Caution** - Whenever you remove a processor, you should replace it with another processor and reinstall the processor heatsink; otherwise, the controller might overheat due to improper airflow. For instructions for installing a processor, see [“Install a Processor” on page 85](#).

---

10. **To remove the processor from the processor socket, acquire the processor removal and replacement tool and perform the following steps:**



---

**Caution** - Before removing the processor, ensure that you are using the correct color-coded processor removal and replacement tool. For information on how to select the correct processor removal and replacement tool, see [“Selecting the Correct Processor Removal and Replacement Tool” on page 76](#).

---

- a. **Locate the button in the center of the top of the processor removal and replacement tool and press it to the down position [1].**
- b. **Properly position the tool over the processor socket and lower it into place over the processor socket [2].**

To properly position the tool over the processor socket, rotate the tool until the green triangle on the side of the tool is facing the front of the controller and it is over the left side of the processor socket when viewing the controller from the front.

- c. **Press the release lever on the tool to release the center button and engage the processor [3].**

An audible click indicates that the processor is engaged.

- d. **Grasp the tool by the sides and remove it from the controller [4].**
- e. **Turn the tool upside down and verify that it contains the processor [5].**
- f. **While holding the processor tool up side down, press the center button on the tool to release the processor [5].**
- g. **Carefully grasp the processor by the front and back edges, lift it out of the tool and place it with the circuit side down (the installed orientation) into an antistatic container [6].**
- h. **Carefully clean the thermal grease off the top of the processor.**



---

**Caution** - The following figure shows the green color-coded processor removal and replacement tool. If you are removing a 12-core processor, you must use the pink color-coded processor removal and replacement tool; otherwise, damage might result to the processor or the processor socket. For information on how to select the correct processor removal and replacement tool, see [“Selecting the Correct Processor Removal and Replacement Tool” on page 76](#).

---



## ▼ Install a Processor




---

**Caution** - Processors should be installed only by authorized Oracle Services personnel.

---




---

**Caution** - Processor removal and replacement must be done using the correct removal and replacement tool; otherwise, damage might result to the processor or the processor socket. For information on how to select the correct removal and replacement tool, see [“Selecting the Correct Processor Removal and Replacement Tool” on page 76.](#)

---




---

**Caution** - Be careful not to touch the processor socket pins. The processor socket pins are very fragile. A light touch can bend the processor socket pins and damage the board beyond repair. Always use the processor removal and replacement tool to remove and replace the processor.

---

1. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29.](#)
2. **Unpack the replacement processor and place it on an antistatic mat.**
3. **Ensure that the replacement processor is identical to the failed processor that was removed.**
4. **Ensure that the two processor ILM assembly levers and the ILM assembly load plate are in the fully open position.**  
For instructions for opening the processor ILM assembly levers and the load plate, see [“Remove a Processor” on page 78.](#)
5. **To install the replacement processor into the processor removal and replacement tool, acquire the tool and perform the following steps:**




---

**Caution** - Before installing the processor, ensure that you are using the correct color-coded processor removal and replacement tool. For information on how to select the correct processor removal and replacement tool, see [“Selecting the Correct Processor Removal and Replacement Tool” on page 76.](#)

---

- a. **Press the button in the center of the tool to the down position [1].**
- b. **Turn the tool upside down, grasp the processor by its front and back edges and position the processor (circuit side up) in the tool so that the triangle**

**on the corner of the processor aligns with the triangle on the side of the processor removal and replacement tool [2].**

- c. Lower the processor into the tool and press the tool release lever to release the center button and engage the processor [3].**

An audible click indicates that the processor is locked in place.

- d. Properly position the tool over the processor socket and lower it into place [4].**

To properly position the tool in the processor socket, rotate the tool until the green triangle on the side of the tool is facing the front of the controller and it is over the left side of the processor socket (when viewing the controller from the front) and lower the tool into the processor socket.

- e. Press the center button in the tool down to release the processor so that it is placed in the socket [5].**
- f. Remove the processor removal and replacement tool [6].**



---

**Caution** - The following figure shows the green color-coded processor removal and replacement tool. If you are installing a 12-core processor, you must use the pink color-coded processor removal and replacement tool; otherwise, damage might result to the processor or the processor socket. For information on how to select the correct processor removal and replacement tool, see [“Selecting the Correct Processor Removal and Replacement Tool” on page 76](#).

---

**6. Visually check the alignment of the processor in the socket.**

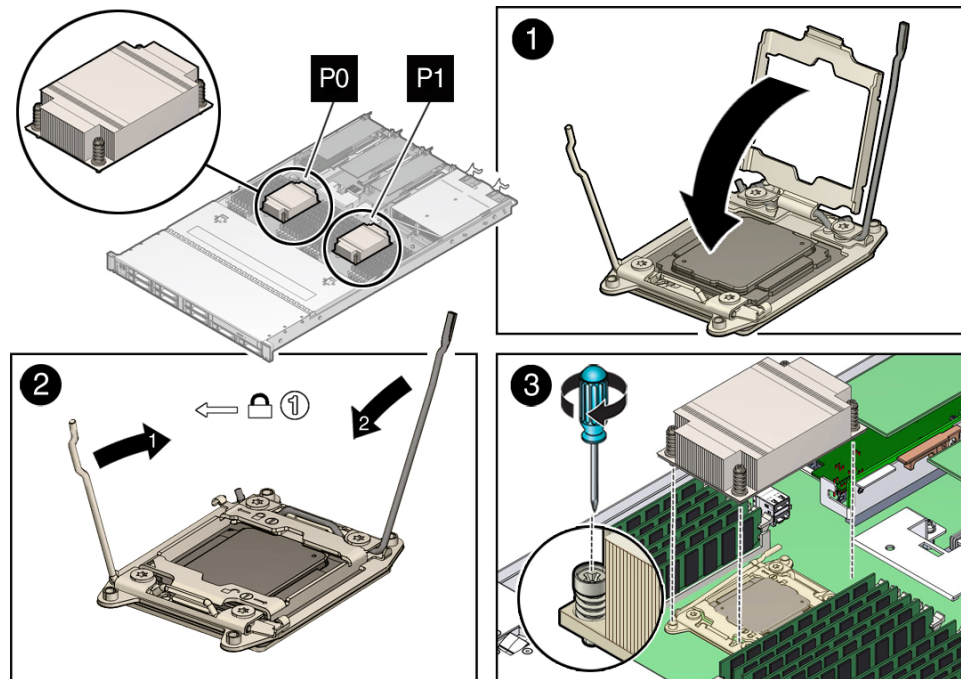
When properly aligned, the processor sits flat in the processor socket.



**Caution** - Do not press down on the processor. Irreparable damage to the processor or motherboard might occur from excessive downward pressure. Do not forcibly seat the processor into the socket. Excessive downward pressure might damage the socket pins.

**7. Swing the processor ILM assembly load plate into the closed position [1].**

Ensure that the load plate sits flat around the periphery of the processor.



**8. Engage the socket release lever on the left side of the socket (viewing the controller from the front) by rotating it downward and slipping it under the catch [2].**

**9. Engage the socket release lever on the right side of the socket (viewing the controller from the front) by rotating it downward and slipping it under the catch [2].**

10. **Use the syringe (supplied with the new or replacement processor) to apply approximately 0.1 ml of thermal grease to the center of the top of the processor.**

To measure 0.1 ml of thermal grease, use the graduated scale on the thermal grease syringe.

---

**Note** - Do not distribute the grease; the pressure of the heatsink will do so for you when you install the heatsink.

---

11. **Inspect the heatsink for dust and lint.**

Clean the heatsink if necessary.

12. **Orient the heatsink so that the screws line up with the mounting studs [3].**

---

**Note** - The processor heatsink is not symmetrical.

---

13. **Carefully position the heatsink on the processor, aligning it with the mounting posts to reduce movement after it makes initial contact with the layer of thermal grease [3].**



---

**Caution** - Avoid moving the heatsink after it has contacted the top of the processor. Too much movement could disturb the layer of thermal grease, causing voids, and leading to ineffective heat dissipation and component damage.

---

14. **Tighten the Phillips screws with a No. 2 Phillips screwdriver alternately one-half turn until fully seated.**

15. **Install the air baffle.**

16. **Return the controller to operation.**

- a. **Install the controller top cover.**

See [“Install the Controller Top Cover”](#) on page 144.

- b. **Close the controller fan door.**

- c. **Return the controller to the normal rack position.**

See [“Returning the Controller to Operation”](#) on page 143.

- d. **Reconnect the data cables and reconnect the power cords to the controller power supplies.**

See [“Reconnect Data Cables and Power Cords”](#) on page 149.

**e. Power on the controller.**

See “Power On the Controller” on page 150.

Verify that the Power/OK status indicator is steady on.

**17. Use Oracle ILOM to clear controller processor faults.**

Refer to the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at <http://www.oracle.com/goto/ilom/docs> for more information about the following steps.

**a. To show controller faults, log in to the controller as root using the Oracle ILOM CLI, and type the following command to list all known faults on the system:**

```
-> show /SP/faultmgmt
```

The controller lists all known faults, for example:

```
-> show /SP/faultmgmt
Targets:
    0 (/SYS/MB/P0)Properties:
Commands:
    cd
    show
```

Alternatively, to list all known faults in the controller, log in to the Oracle Solaris OS and issue the `fmadm faulty` command, or log in to the Oracle ILOM service processor from the Oracle ILOM Fault Management Shell and issue the `fmadm faulty` command. For more information about how to use the Oracle ILOM Fault Management Shell and supported commands, see the *Oracle ILOM User's Guide for System Monitoring and Diagnostics Firmware Release 3.2.x* in the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at: <http://www.oracle.com/goto/ilom/docs>.

**b. To clear the fault, type the following command:**

```
-> set /SYS/MB/P0 clear_fault_action=true
```

For example:

```
-> set /SYS/MB/P0 clear_fault_action=true
Are you sure you want to clear /SYS/MB/P0 (y/n)? y
Set 'clear_fault_action' to 'true'
```

Alternatively, to clear all known faults in the controller, log in to the Oracle Solaris OS and issue the `fmadm repair` command, or log in to the Oracle ILOM service processor

from the Oracle ILOM Fault Management Shell and issue the `fmadm repair` command. For more information about how to use the Oracle ILOM Fault Management Shell and supported commands, see the *Oracle ILOM User's Guide for System Monitoring and Diagnostics Firmware Release 3.2.x* in the Oracle Integrated Lights Out Manager (ILOM) 3.2 Documentation Library at: <http://www.oracle.com/goto/ilom/docs>

### Related Information

- [“Remove a Processor” on page 78](#)

## Servicing the Internal HBA Card (FRU)

The following sections provide information to assist you when servicing the internal HBA card:

---

**Note** - Only authorized Oracle Services personnel should service the internal HBA card.

---



---

**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).

---



---

**Caution** - Ensure that all power is removed from the controller before removing or installing the internal HBA. You must disconnect the power cables from the controller before performing these procedures.

---

- [“Install the Internal HBA Card in PCIe Slot 4” on page 95](#)

### Related Information

- [“Disconnect Cables From the Controller” on page 26](#)
- [“Take Antistatic Measures” on page 29](#)
- [“Extend the Controller to the Maintenance Position” on page 26](#)
- [“Open the Controller Fan Door” on page 29](#)

## ▼ Remove the Internal HBA Card From PCIe Slot 4

---

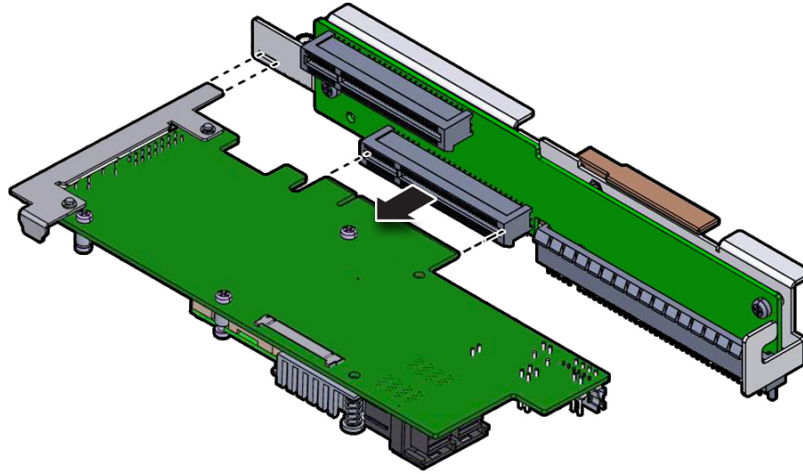
**Note** - Only authorized Oracle Services personnel should remove and replace the internal HBA card.

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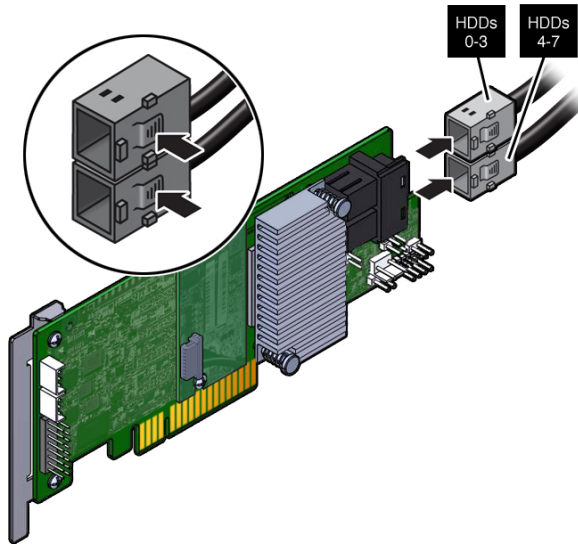
1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25.](#)
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26.](#)
  - c. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29.](#)
  - d. **Open the controller fan door to gain access to the disk backplanes.**  
See [“Open the Controller Fan Door” on page 29](#)
  - e. **Remove fan module FM0 (the left most fan viewing the controller from the front).**  
See [“Remove a Fan Module” on page 38.](#)
2. **Remove the PCIe riser from slots 3 and 4.**  
For instructions, see [“Remove the PCIe Riser From PCIe Slots 3 and 4” on page 62.](#)
3. **Remove the internal host bus adapter card from the riser.**
  - a. **Hold the riser in one hand and use your other hand to carefully remove the card from slot 4 of the riser.**



- b. Disconnect the rear bracket attached to the PCIe card from the rear of the PCIe riser.

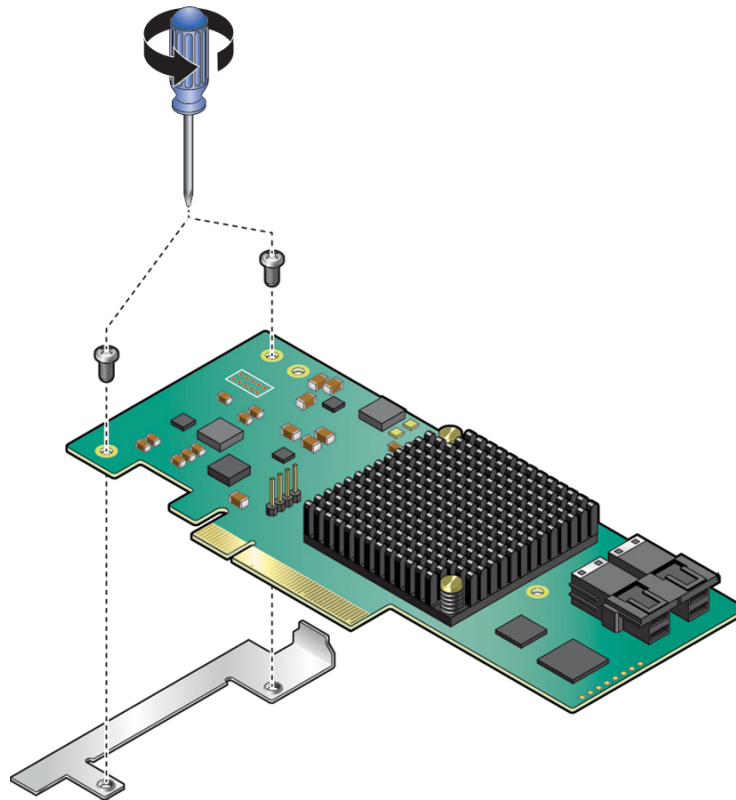


4. **Disconnect the SAS cables from the internal HBA card and place the card on an antistatic mat.**



5. **If you are replacing the internal HBA card, use a No. 2 Philips screwdriver to remove the special fitted bracket from the HBA card.**

You will need to install the special fitted bracket on the replacement HBA card. Set aside the bracket until you are ready to install the replacement HBA card.



## ▼ Install the Internal HBA Card in PCIe Slot 4

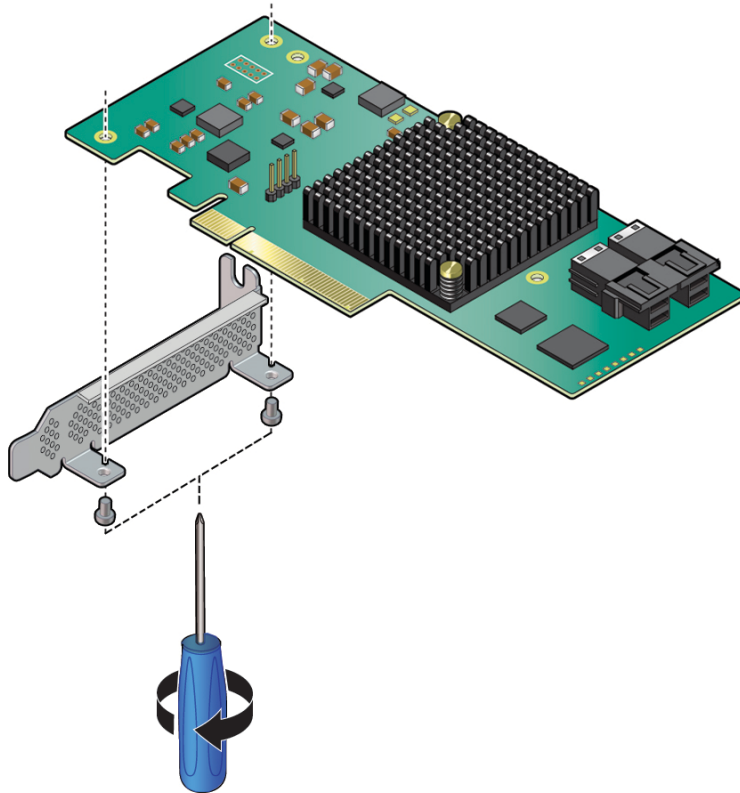
---

**Note** - Only authorized Oracle Services personnel should remove and replace the internal HBA card.

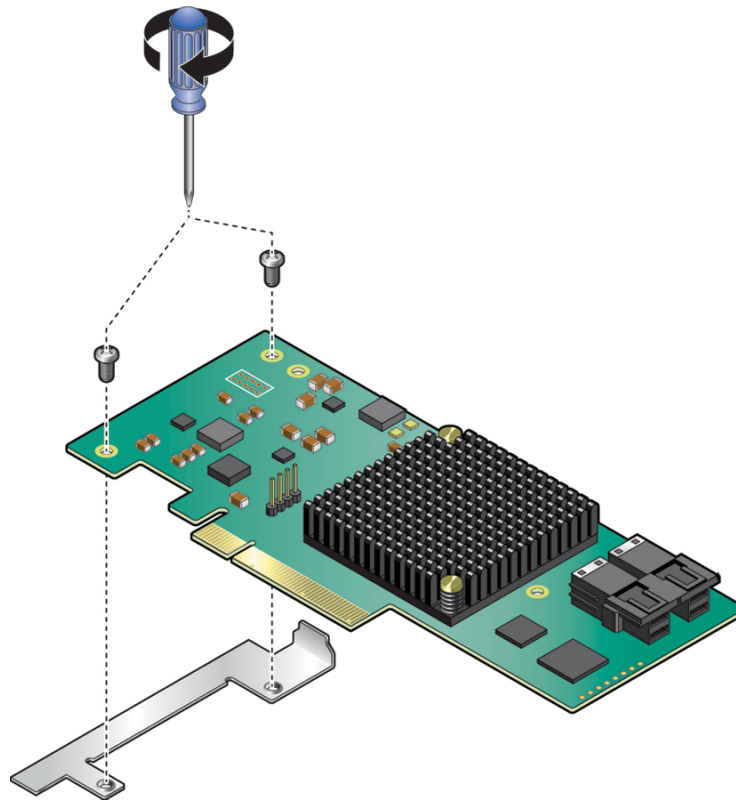
---

1. **Unpack the replacement host bus adapter (HBA) card and SAS cables, and retrieve the PCIe riser for slot 3.**

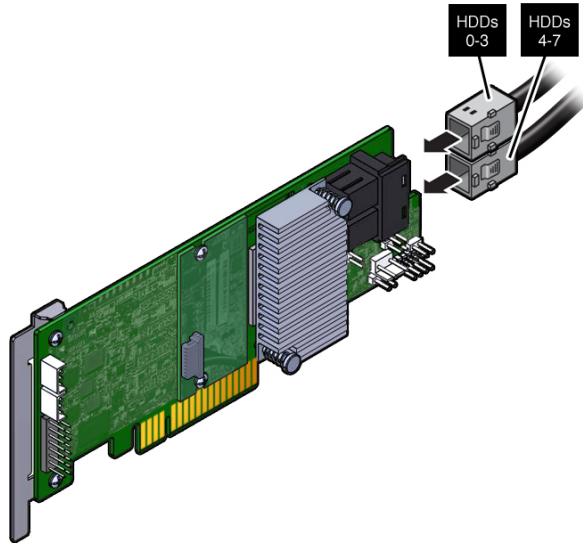
2. Using a No. 2 Philips screwdriver, remove the standard HBA bracket that shipped with the replacement HBA card.



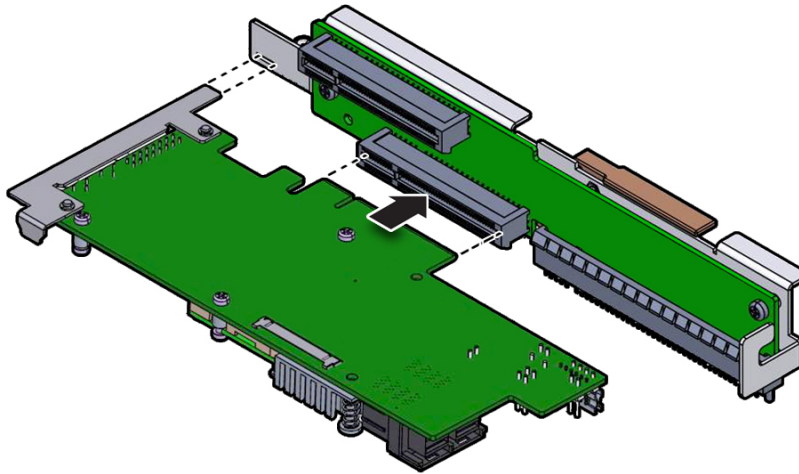
3. Install the special fitted bracket that was removed in [“Remove the Internal HBA Card From PCIe Slot 4”](#) on page 92.



4. **Connect the SAS cables to the internal HBA card.**



5. **Insert the rear bracket on the internal HBA card into the rear connector on the PCIe riser.**



6. **Insert the internal HBA card connector into the bottom connector on the riser for PCIe slot 3 and 4.**
7. **Install the PCIe riser.**  
For instructions, see [“Install the PCIe Riser Into PCIe Slots 3 and 4” on page 64.](#)
8. **Install fan module FM0.**  
See [“Install a Fan Module” on page 41.](#)
9. **Return the controller to operation.**
  - a. **Close the controller fan door.**
  - b. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143.](#)
  - c. **Reconnect the data cables to the controller and reconnect the power cords to the controller power supplies.**  
See [“Reconnect Data Cables and Power Cords” on page 149.](#)

**d. Power on the controller.**

See [“Power On the Controller” on page 150](#).

Verify that the Power/OK status indicator is steady on.

## Servicing the Disk Backplane (FRU)



---

**Caution** - The disk backplane should be serviced only by authorized Oracle Services personnel.

---

The following sections provide information to assist you when servicing the disk backplane:



---

**Caution** - Ensure that all power is removed from the controller before removing or installing a disk backplane. You must disconnect the power cables from the controller before performing these procedures.

---

- [“Remove the Disk Backplane” on page 100](#)
- [“Install the Disk Backplane” on page 103](#)

### Related Information

- [“Disconnect Cables From the Controller” on page 26](#)
- [“Take Antistatic Measures” on page 29](#)
- [“Extend the Controller to the Maintenance Position” on page 26](#)
- [“Open the Controller Fan Door” on page 29](#)

## ▼ Remove the Disk Backplane



---

**Caution** - The disk backplane should be removed only by authorized Oracle Services personnel.

---

- 1. Prepare the controller for service.**
  - a. Power off the controller and disconnect the power cords from the power supplies.**



See [“Powering Off the Controller”](#) on page 25.

**b. Extend the controller to the maintenance position.**

See [“Extend the Controller to the Maintenance Position”](#) on page 26.

**c. Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**

See [“Take Antistatic Measures”](#) on page 29.

**d. Open the controller fan door to gain access to the disk backplanes.**

See [“Open the Controller Fan Door”](#) on page 29

**e. Remove all four fan modules.**

See [“Remove a Fan Module”](#) on page 38.

**2. Pull all storage drives out far enough to disengage them from the disk backplane.**

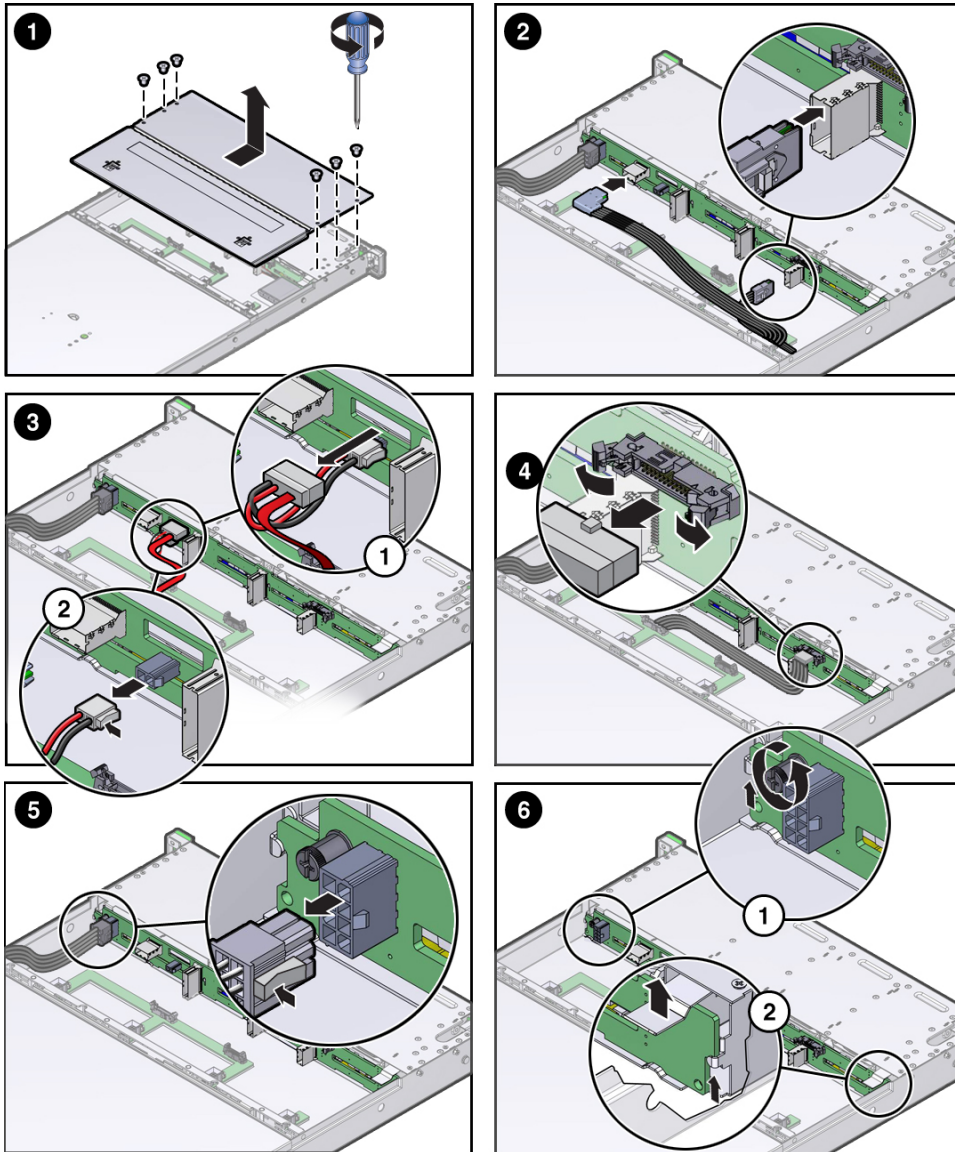
See [“Remove a HDD or SSD Storage Drive”](#) on page 35.

---

**Note** - It is not necessary to completely remove the storage drives from the controller; simply pull them out far enough to disengage them from the disk backplane. If you do remove the storage drives from the controller, record their locations so that you can reinstall them in the same locations.

---

3. Remove six Philips screws from the disk cage cover and slide toward the front of the controller and lift up to remove it [1].



4. Disconnect the SAS cables from the disk backplane [2].

5. **Disconnect the disk backplane auxiliary power and signal cable from the disk backplane [3].**
6. **Disconnect the disk backplane power cable from the disk backplane [4].**
7. **Loosen the captive screw that secures the disk backplane to the chassis [6.1].**
8. **Lift the metal spring retainer on the right side of the disk backplane, lift the disk backplane up and tilt it toward the rear of the controller to free it from the holding brackets, and lift it out of the controller [6.2].**
9. **Place the disk backplane on an antistatic mat.**

#### **Related Information**

- [“Install the Disk Backplane” on page 103](#)

## **▼ Install the Disk Backplane**



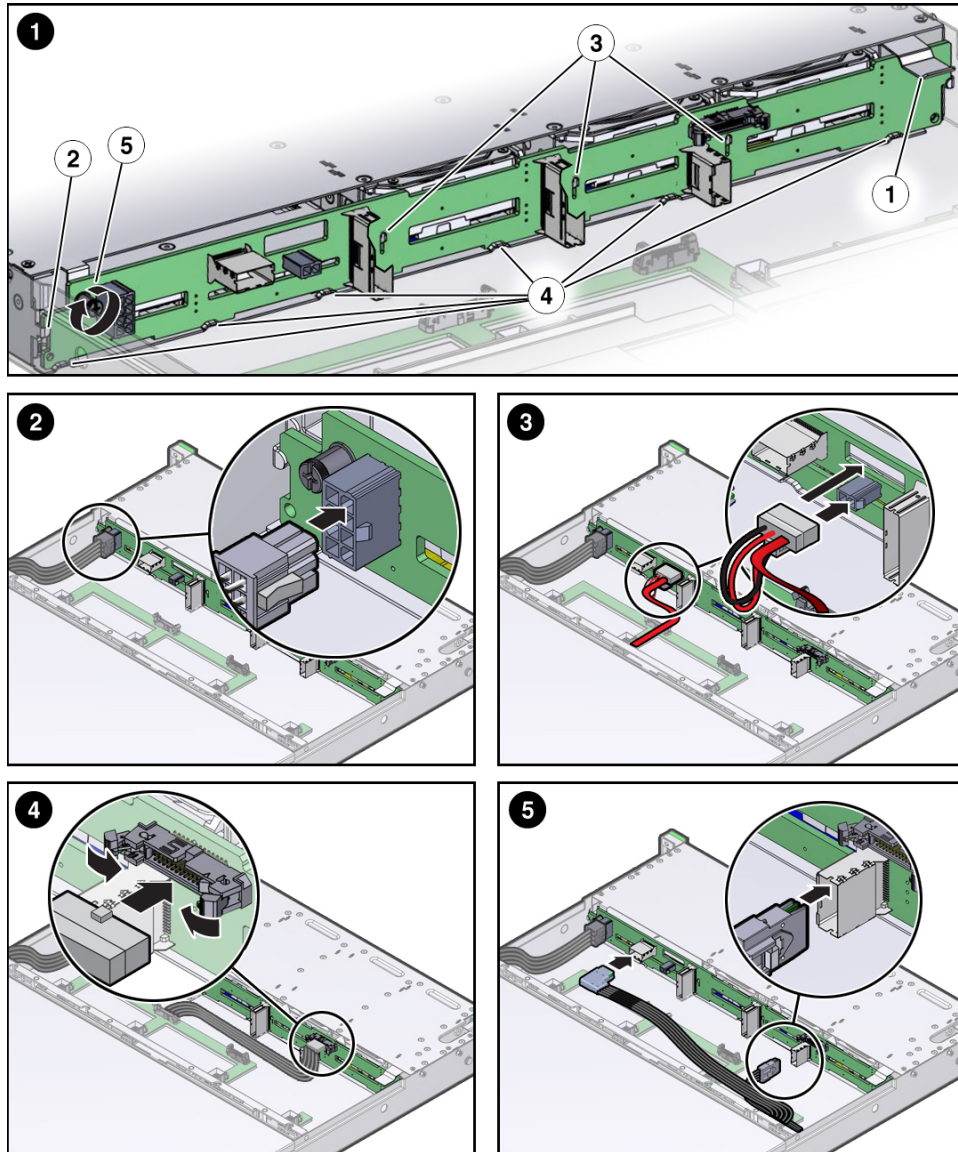
---

**Caution** - The disk backplane should be installed only by authorized Oracle Services personnel.

---

1. **To place the backplane into the disk cage, do the following:**
  - a. **Lift the metal spring retainer [frame 1, callout 1] and position the backplane so that it fits into the two metal brackets that are located on the chassis side walls [1, 2].**
  - b. **Lower the disk backplane into the disk cage so that it engages the three metal hooks in the disk cage [1, 3]**
  - c. **Continue to lower the disk backplane into the disk cage until it is positioned in all six troughs that are located at the bottom of the disk cage [1, 4] .**

- d. Turn the disk backplane captive screw clockwise until the disk backplane is secure [1, 5].



2. **Reconnect the disk backplane power cable to the disk backplane [2].**
3. **Reconnect the disk backplane auxiliary power and signal cable to the disk backplane [4].**
4. **Reconnect the SAS cables to the disk backplane [5].**
5. **Reinstall all of the storage drives into the storage drive cage.**  
See [“Install a HDD or SSD Storage Drive” on page 37.](#)
6. **Install the disk cage cover.**
7. **Install all four fan modules.**  
See [“Install a Fan Module” on page 41.](#)
8. **Return the controller to operation.**
  - a. **Close the controller fan door.**
  - b. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143.](#)
  - c. **Reconnect the data cables to the controller and reconnect the power cords to the controller power supplies.**  
See [“Reconnect Data Cables and Power Cords” on page 149.](#)
  - d. **Power on the controller.**  
See [“Power On the Controller” on page 150.](#)  
Verify that the Power/OK status indicator is steady on.

#### **Related Information**

- [“Remove the Disk Backplane” on page 100](#)

## **Servicing the Front Indicator Module (FRU)**



---

**Caution** - The front indicator module should be serviced only by authorized Oracle Services personnel.

---



---

**Caution** - Ensure that all power is removed from the controller before removing or installing a front indicator module. You must disconnect the power cables from the controller before performing these procedures.

---

Follow these procedures to remove and install the front indicator module (FIM).

- [“Remove the Front Indicator Module” on page 106](#)
- [“Install the Front Indicator Module” on page 108](#)

## ▼ Remove the Front Indicator Module



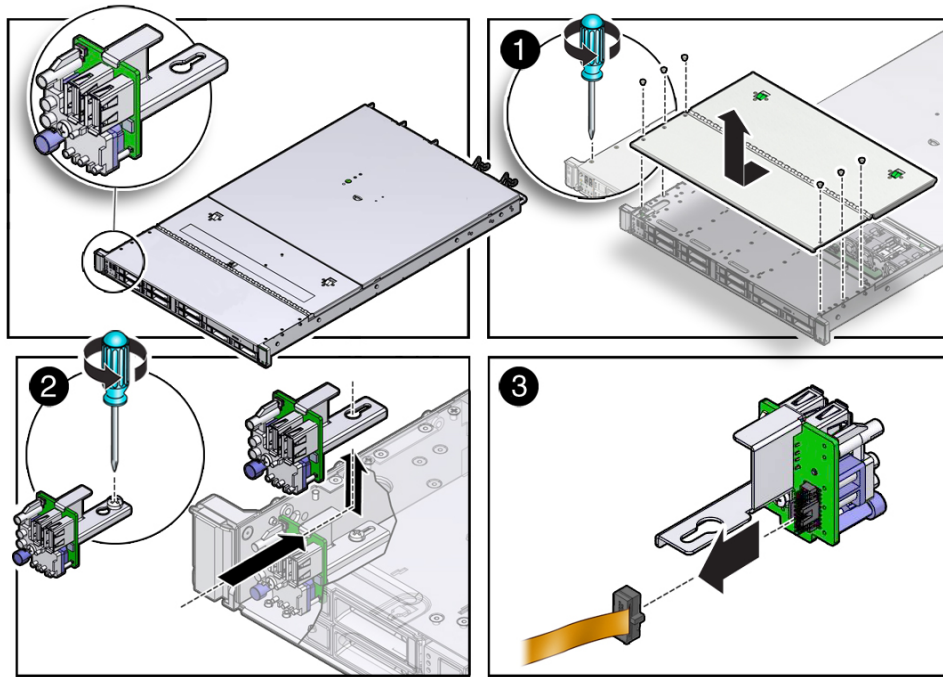
---

**Caution** - The front indicator module should be removed only by authorized Oracle Services personnel.

---

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25](#).
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26](#).
  - c. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
2. **To remove the top cover from the storage drive cage, do the following [1]:**
  - a. **Remove the six Phillips screws from the top of the storage drive cage.**  
There are three Phillips screws on each side of the storage drive cage.
  - b. **Open the controller fan door.**  
See [“Open the Controller Fan Door” on page 29](#).

- c. Slide the storage drive cage cover forward (toward the front of the controller) and lift it up.



3. Loosen the screw that secures the front indicator module (FIM) assembly to the controller chassis [2].
4. Carefully slide the FIM assembly toward the rear of the controller enough to lift it over the Phillips screw and out of the controller [2].
5. Disconnect the FIM cable from the FIM assembly and set the assembly aside [3].
6. Continue to [“Install the Front Indicator Module” on page 108](#).

#### Related Information

- [“Install the Front Indicator Module” on page 108](#)

## ▼ Install the Front Indicator Module



**Caution** - The front indicator module should be installed only by authorized Oracle Services personnel.

---

1. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
2. **Unpack the replacement FIM and place it on an antistatic mat.**
3. **Connect the FIM cable to the replacement FIM assembly (See [“Remove the Front Indicator Module” on page 106 \[3\]](#)).**
4. **Carefully lower the FIM assembly into the chassis, position it over the Phillips screw in the controller chassis, and slide it forward so all the LEDs, USB connectors, and Power On button fit into place on the controller front panel [2].**
5. **Tighten the Phillips screw to secure the FIM assembly to the controller chassis [2].**
6. **Position the storage drive cage cover over the controller storage drive cage so that it over hangs the front of the disk drive cage by about 1/4 inch.**
7. **Install the six Phillips screws to secure the cover to the controller [1].**  
There are three Phillips screws on each side of the storage drive cage.
8. **Close the controller fan door.**
9. **Return the controller to operation.**
  - a. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143](#).
  - b. **Reconnect the data cables to the controller and reconnect the power cords to the controller power supplies.**  
See [“Reconnect Data Cables and Power Cords” on page 149](#).
  - c. **Power on the controller.**  
See [“Power On the Controller” on page 150](#).  
Verify that the Power/OK status indicator is steady on.



## Servicing the Motherboard (FRU)



**Caution** - The motherboard should be serviced only by authorized Oracle Services personnel.



**Caution** - Ensure that all power is removed from the controller before removing or installing the motherboard. You must disconnect the power cables before performing these procedures.



**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).

Follow these procedures to replace a faulty motherboard and to upgrade the firmware, Oracle ILOM, and BIOS settings.

- [“Prepare the Motherboard for Service” on page 109](#)
- [“Remove the Motherboard” on page 111](#)
- [“Install the Motherboard” on page 118](#)
- [“Restore the Original SP Settings” on page 121](#)
- [“Configure the BIOS Settings” on page 122](#)

### ▼ Prepare the Motherboard for Service

The motherboard is the primary component of the ZS5-ES controller. The motherboard is located at the bottom of the controller chassis.

- Before You Begin**
- Download the latest qualified Oracle ILOM/BIOS package (for example ILOM: 3.2.x.xx.a-r111411 / BIOS: 30.08.04.00)

For details see: <https://mosemp.us.oracle.com/epmos/faces/DocumentDisplay?id=2177437.1>

- **Record the original SP configuration settings.**

- Host name
- Oracle ILOM IP address
- Controller IP address
- Gateway IP address
- Netmask IP address

---

**Note** - If the controller with the faulty motherboard cannot be powered on, contact the system administrator to obtain the above configuration settings.

---

- a. **From the controller with the faulty motherboard, log in to the SP using SSH or a serial connection. For example, to log in using SSH enter:**

```
$ssh root@zs5-es-sp.xxx.com
Password: *****
```

- b. **Enter `cd /SP` and then type `show` to list the host name and version information.**

```
-> cd /SP
-> show
Properties:
  check_physical_presence = true
  current_hostname = zs5-es-sp
  hostname = zs5-es-sp
  reset_to_defaults = none
  system_contact = (none)
  system_description = Oracle SERVER X5-2, ILOM v3.2.x.xx.x, rxx773
  system_identifier = (none)
  system_location = (none)
```

- c. **Manually copy the settings, or take a screen shot and save it for future use.**

- d. **Enter `cd /SP/network` and then type `show` to list the network configuration.**

```
-> cd /SP/network
-> show
Properties:
  commitpending = (Cannot show property)
  dhcp_clientid = none
  dhcp_server_ip = none
  ipaddress = 198.51.100.11
  ipdiscovery = static
  ipgateway = 198.51.101.11
  ipnetmask = 255.255.254.0
  macaddress = 00:10:E0:3B:E3:E6
  managementport = xxx
  outofbandmacaddress = 00:10:E0:3B:E3:E6
  pendingipaddress = 198.51.100.11
  pendingipdiscovery = static
  pendingipgateway = 198.51.101.11
  pendingipnetmask = 255.255.254.0
```

```

pendingmanagementport = nnnn
pendingvlan_ID (none)
sidebandmacaddress = 00:10:E0:3B:E3:E7
state = enabled
vlan_id = (none)

```

- e. **Manually copy the network configuration settings, or take a screen shot and save it for future use.**
- f. **Enter `cd /System` and then type `show` for the controller's Key Identity Properties. Make note of the following properties:**
  - model
  - part\_number
  - serial\_number
  - component\_model
  - component\_part\_number
  - component\_serial\_number
  - system\_identifier (if applicable)

### Next Steps

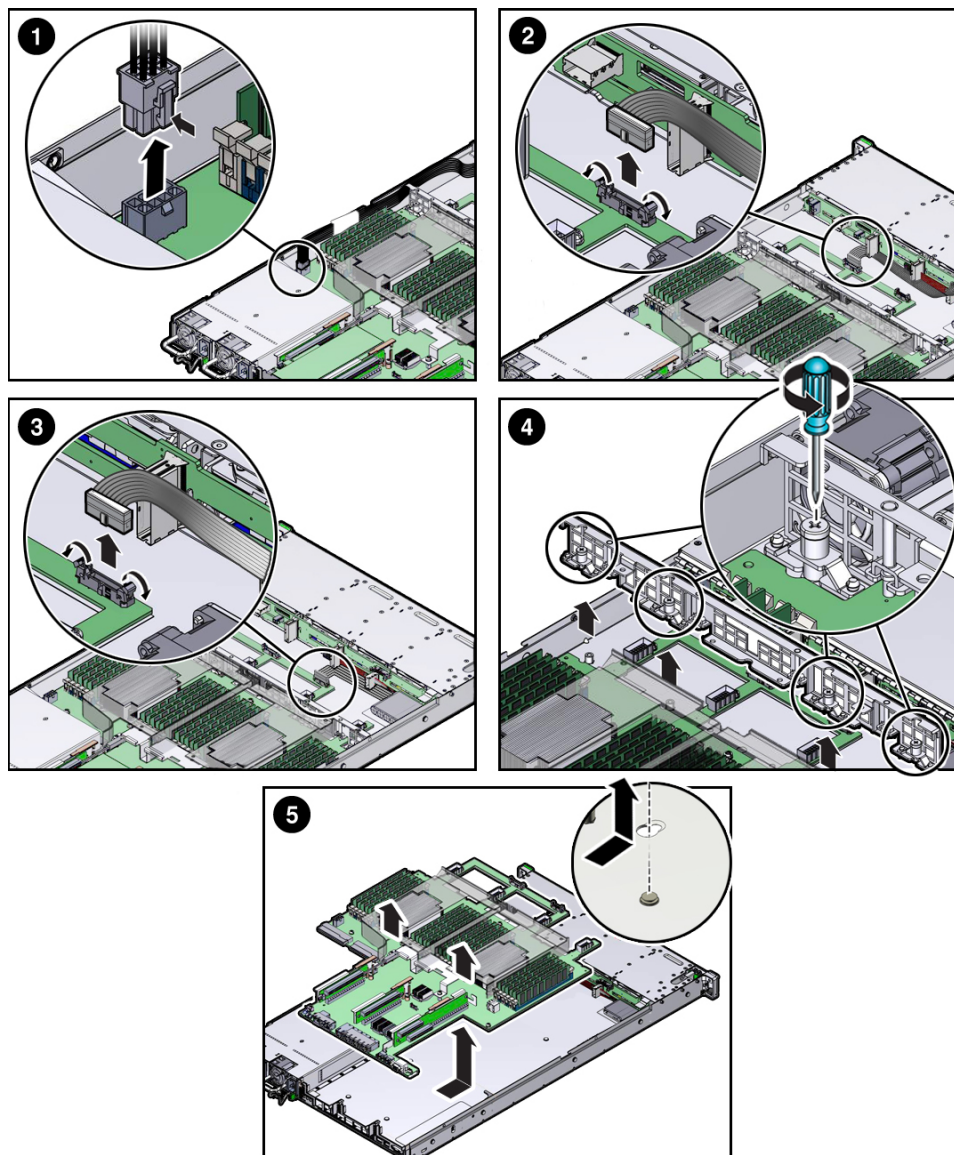
- [“Remove the Motherboard” on page 111](#)

## ▼ Remove the Motherboard

1. **Prepare the controller for service.**
  - a. **Power off the controller with the faulty motherboard.**  
See [“Powering Off the Controller” on page 25](#).  
The peer controller of the cluster configuration takes over the resources.
  - b. **Disconnect all cables.**  
See [“Disconnect Cables From the Controller” on page 26](#).
  - c. **Remove the controller from the rack.**  
See [“Remove the Controller From the Rack” on page 28](#).

- d. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29.](#)
  - e. **Open the controller fan door.**  
See [“Open the Controller Fan Door” on page 29.](#)
  - f. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30.](#)
- 2. **Remove the fan modules.**  
See [“Remove a Fan Module” on page 38.](#)
  - 3. **To disconnect the disk backplane power cable from the motherboard, press in on the connector and pull the connector out [1].**
  - 4. **To eject the signal cable connector, open both side latches [2].**

5. To eject the FIM cable connector, open both side latches. Disconnect the FIM cable [3].



6. Disconnect and remove the internal HBA SAS cable assembly.

See [“Remove the Internal HBA SAS Cable Assembly”](#) on page 132.

**7. Remove all PCIe risers and cards.**

See [“Servicing PCIe Risers \(CRU\)”](#) on page 55 and [“Servicing PCIe Cards \(CRU\)”](#) on page 67.

**8. Remove the controller mid-wall [4].**

- a. Using a screwdriver (No. 2 Phillips or flathead), loosen the four captive screws that secure the mid-wall to the controller chassis.
- b. Slightly lift up the mid-wall slightly to disengage it from the raised mushroom-shaped standoffs that are located on the controller chassis sidewall (one on each end of the mid-wall). Lift the mid-wall of the controller and set it aside.

**9. Lift the motherboard out of the controller chassis and place it on an antistatic mat, next to the replacement motherboard [5].**

**10. Remove the air baffle from the motherboard and set it aside.**

**11. Remove all DIMMs from the motherboard and install them in the corresponding DIMM sockets on the replacement motherboard.**

See [“Servicing the DIMMs \(CRU\)”](#) on page 47.

---

**Note** - Install the DIMMs only in the sockets (connectors) that correspond to the sockets from which they were removed. Performing a one-to-one replacement of the DIMMs significantly reduces the possibility that the DIMMs will be installed in the wrong slots. If you do not reinstall the DIMMs in the same sockets, controller performance might suffer and some DIMMs might not be used by the controller.

---

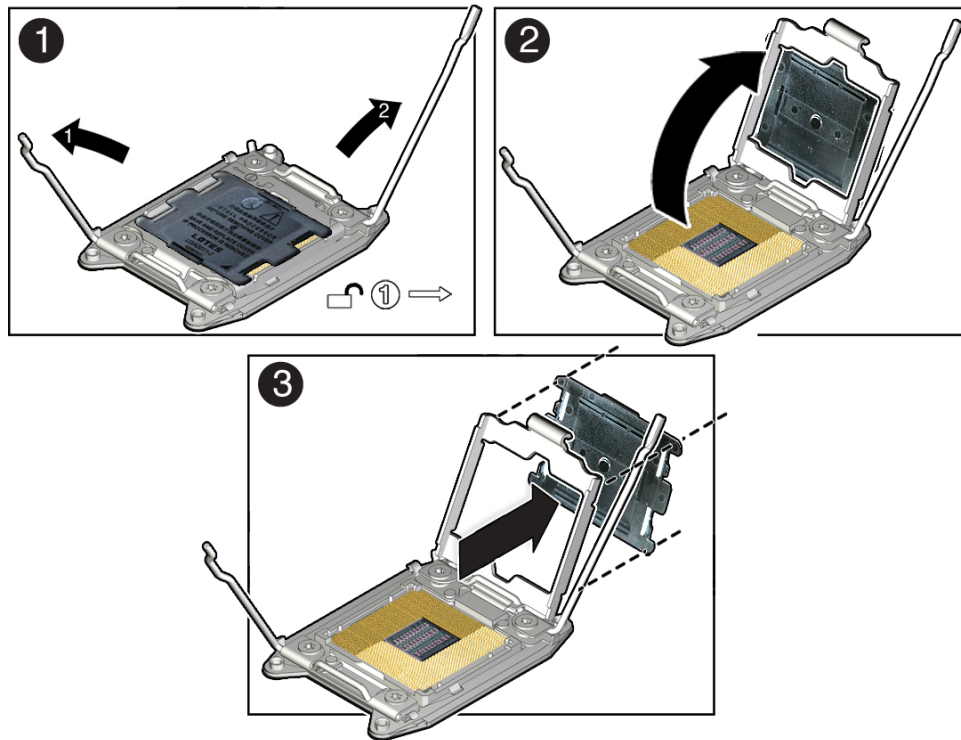
**12. Using the processor removal tool, remove the CPUs from the faulty motherboard.**

See [“Remove a Processor”](#) on page 78.

**13. Remove the processor socket covers from the replacement motherboard and install the processors.**

- a. Disengage the processor independent loading mechanism (ILM) assembly hinge lever on the right side of the processor socket (viewing the controller

from the front) by pushing down on the lever and moving it to the side away from the processor, and then rotating the lever upward [1].



- b. Disengage the processor ILM assembly load lever on the left side of the processor socket (viewing the controller from the front) by pushing down on the lever and moving it to the side away from the processor, and then rotating the lever upward [1].
- c. To lift the processor ILM assembly load plate off of the processor socket, rotate the ILM assembly hinge lever on the right side of the processor toward the closed position (the load plate is lifted up as the hinge lever is lowered) and carefully swing the load plate to the fully open position [2].



**Caution** - Be careful not to allow the processor socket cover to fall into the processor socket as this could result in damage to the socket.

d. Grasp the top and underside of the processor socket cover with one hand (place your thumb against the underside of the cover), place your other thumb against the underside of the cover, and carefully push the cover out of the processor ILM assembly load plate [3].

e. Install a processor into the socket from which you removed the processor socket cover.

See [“Install a Processor” on page 85](#).

f. Repeat steps a through e to remove the second processor socket cover from the replacement motherboard and install the second processor.

14. Install the air baffle on the replacement motherboard.

15. Install the processor socket covers on the failed motherboard.



---

**Caution** - The processor socket covers must be installed on the failed motherboard; otherwise, damage might result to the processor sockets during handling and shipping.

---



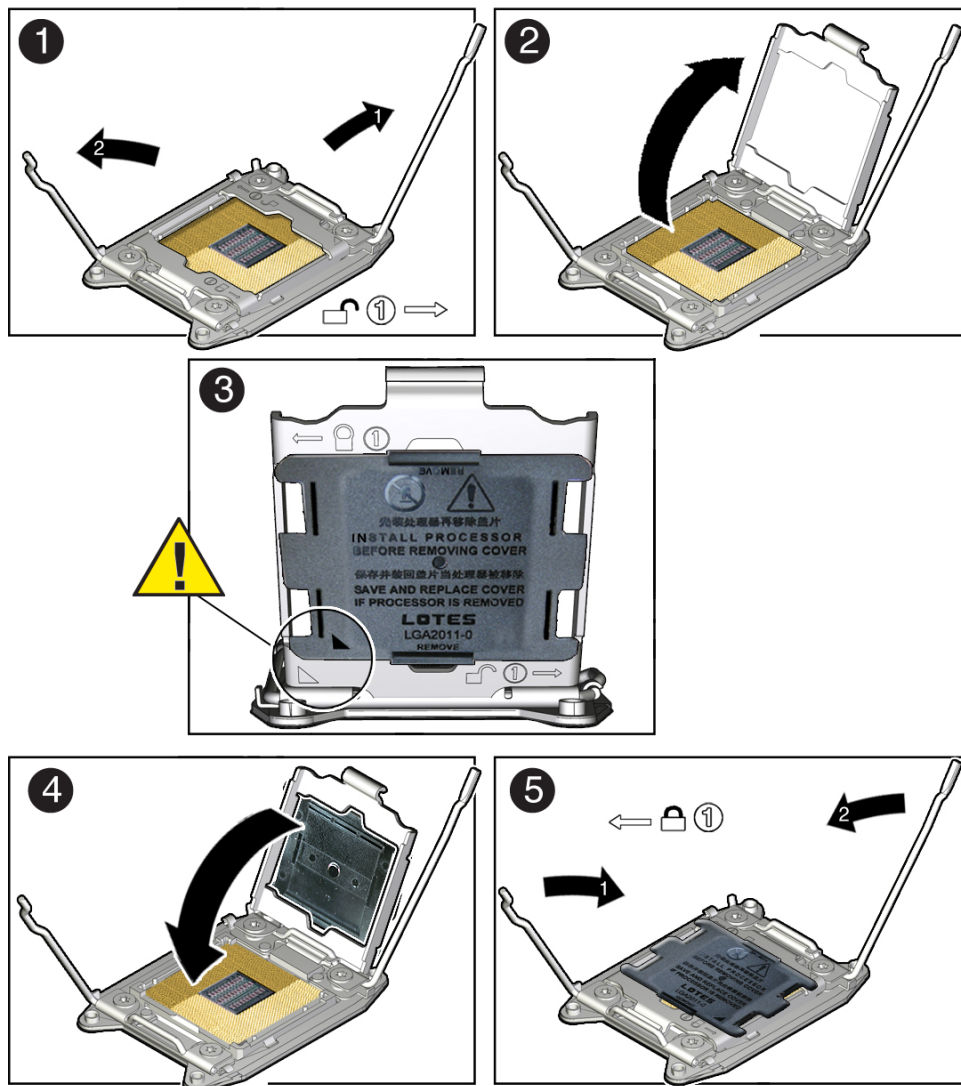
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**Caution** - Be careful not to allow the processor socket cover to fall into the processor socket as this could result in damage to the socket.

---



- a. Open one of the processor ILM assemblies on the failed motherboard [1 and 2].



- b. Hold the processor ILM assembly load plate open with one hand and position the processor socket cover over the top of the ILM assembly load plate so that 1) the arrow on the processor socket cover is aligned with the arrow on the load plate and 2) the fasteners on one side of the cover (the fasteners are located on the underside of the cover) are inside the load plate (it does not matter which side), and use your thumb to press the other side of the processor socket cover into the load plate. [3].

You will hear a clicking sound when the processor socket cover snaps into place.

- c. Close the processor ILM assembly load plate [4 and 5].
- d. Repeat steps a through c to install the second processor socket cover on the failed motherboard.

### Next Steps

- [“Install the Motherboard” on page 118](#)

## ▼ Install the Motherboard



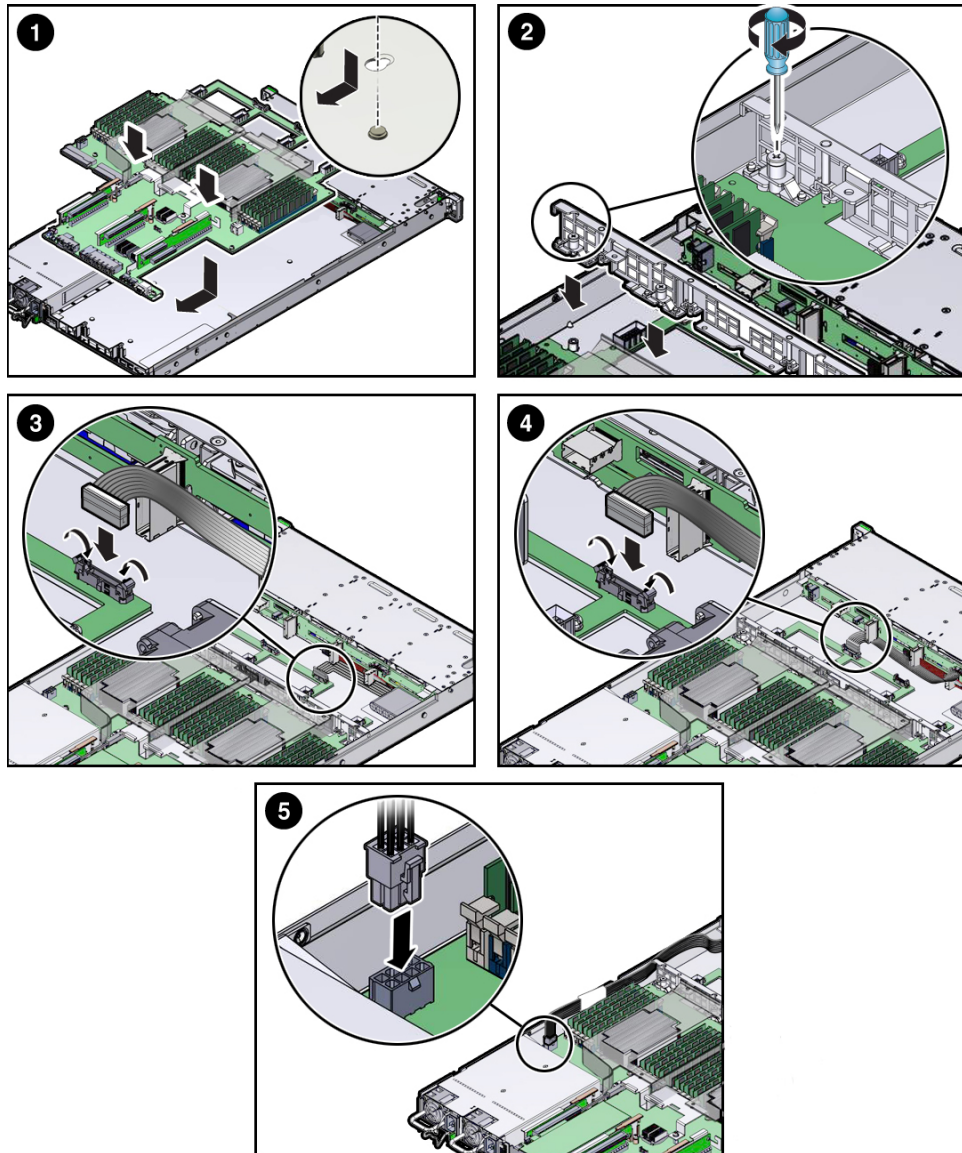
---

**Caution** - The motherboard should be installed only by authorized Oracle Services personnel.

---

1. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29](#).
2. **Insert the motherboard into the controller chassis [1].**
  - a. **Grasp the metal bracket located to the rear of the DIMMs and slightly tilt up the front of the motherboard. Push the motherboard into the opening in the rear of the controller chassis.**
  - b. **Lower the motherboard into the controller chassis and slide it to the rear until it engages the seven mushroom-shaped standoffs located on the controller chassis under the motherboard.**

- c. Ensure that the indicators, controls, and connectors on the rear of the motherboard will fit correctly into the rear of the controller chassis [1]. Lower the motherboard onto the bottom alignment pins.



3. **Install the controller mid-wall [2].**
  - a. **Lay the SAS cables along the left chassis sidewall (viewing the controller from the front).**

You will connect these cables to the internal HBA card later.
  - b. **Position the mid-wall over the front of the motherboard so that it engages the mushroom-shaped standoffs that are located on the controller chassis sidewall (one for each end of the mid-wall).**
  - c. **Ensure that SAS cables are not pinched by the mid-wall and that they run beside the mid-wall and not under it; otherwise, the cables might be damaged.**
  - d. **To secure the mid-wall to the controller chassis, use a screwdriver (No. 2 Phillips or flathead) to tighten the four captive screws.**
4. **To install the front indicator module (FIM) cable, push the side latches on the motherboard connector to the open position and push the FIM cable connector in [3].**

The side latches close, locking the connector in place.
5. **Reconnect the disk backplane auxiliary power and signal cable to the motherboard [4].**
6. **Reconnect the disk backplane power cable to the motherboard [5].**
7. **Reinstall the following components:**
  - a. **PCIe risers and attached PCIe cards**

See [“Servicing PCIe Risers \(CRU\)” on page 55.](#)
  - b. **Fan modules**

See [“Install a Fan Module” on page 41.](#)
8. **Return the controller to operation.**
  - a. **Close the fan door.**
  - b. **Install the controller top cover.**

See [“Install the Controller Top Cover” on page 144.](#)

- c. **Return the controller to the normal rack position.**

See [“Returning the Controller to Operation” on page 143.](#)

- d. **Reconnect the data cables to the controller and reconnect the power cords to the controller power supplies.**

See [“Reconnect Data Cables and Power Cords” on page 149.](#)

### Next Steps

- [“Restore the Original SP Settings” on page 121](#)

## ▼ Restore the Original SP Settings

Use the following procedure to restore the original SP host name, version information, and network configuration settings to the new motherboard.

**Before You Begin** Gather the settings you recorded in [“Prepare the Motherboard for Service” on page 109.](#)

1. **Before applying power, connect the cables to the following controller ports:**

- a. **SER MGT (for Oracle ILOM access)**

- b. **NET MGT**

- c. **NET 0**

2. **Power on the controller.**

See [“Power On the Controller” on page 150.](#)

Verify that the Power/OK status indicator is steady on.

3. **Log in to the SP through the SER MGT port.**

4. **Verify the versions for the SP firmware, Oracle ILOM, and BIOS.**

- a. **Enter `cd /SYS/MB/BIOS` and then enter `show`**

- b. **If the versions are different, upgrade the firmware, Oracle ILOM, and BIOS.**

**5. Restore the original SP host name and power on settings.**

```
-> cd ../SP
-> set hostname=<enter original hostname>
-> set /SP/policy HOST_AUTO_POWER_ON="enabled"
```

**6. Restore the original SP network settings.**

```
-> cd /SP/network
-> set pendingipaddress=<enter original SP IP address>
-> set pendingipdiscovery=static
-> set pendingipgateway=<enter original SP IP gateway>
-> set pendingipnetmask=<enter original SP IP netmask>
-> set pendingmanagementport=/SYS/MB/NET0
-> set commitpending=true
```

---

**Note** - Once the sideband management port is set to NET 0, Oracle ILOM will no longer respond on the NET MGT port. It will only respond from the host port NET 0.

---

## Next Steps

- [“Configure the BIOS Settings” on page 122](#)

## ▼ Configure the BIOS Settings

1. Open a terminal window to Oracle ILOM.
2. Update the FRU identity properties by resetting the SP.

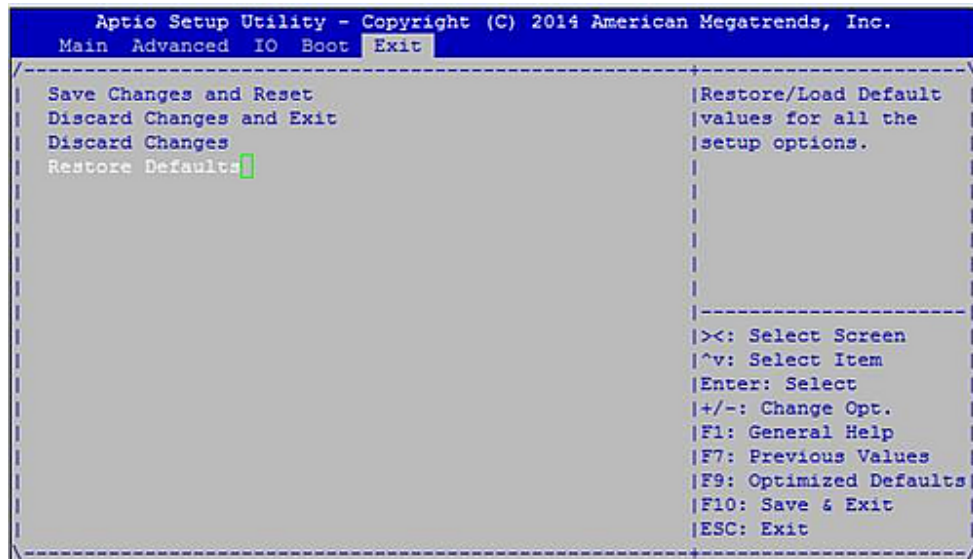
```
-> reset /SP
```

3. Reboot the system to enter BIOS.

```
-> reset /SYS
-> start /SP/console
```

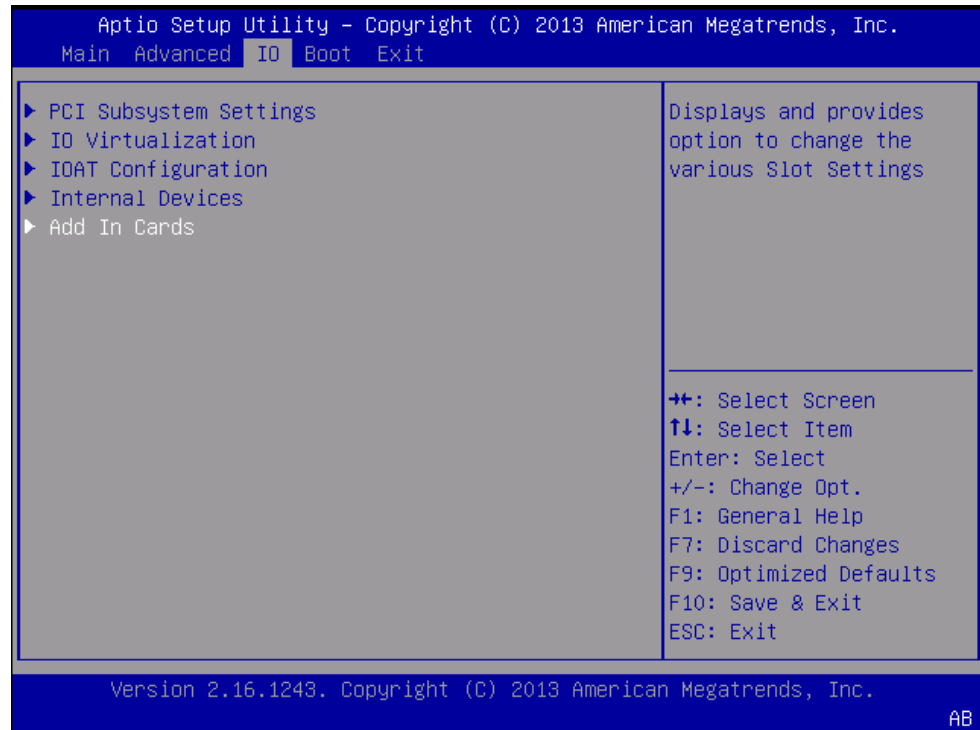
4. Enter Ctrl-E to open the BIOS menu.
5. To restore the defaults:
  - a. Use the arrow keys to navigate to the Exit menu and choose Restore Defaults.

- b. Press Enter to Load Optimized Defaults.

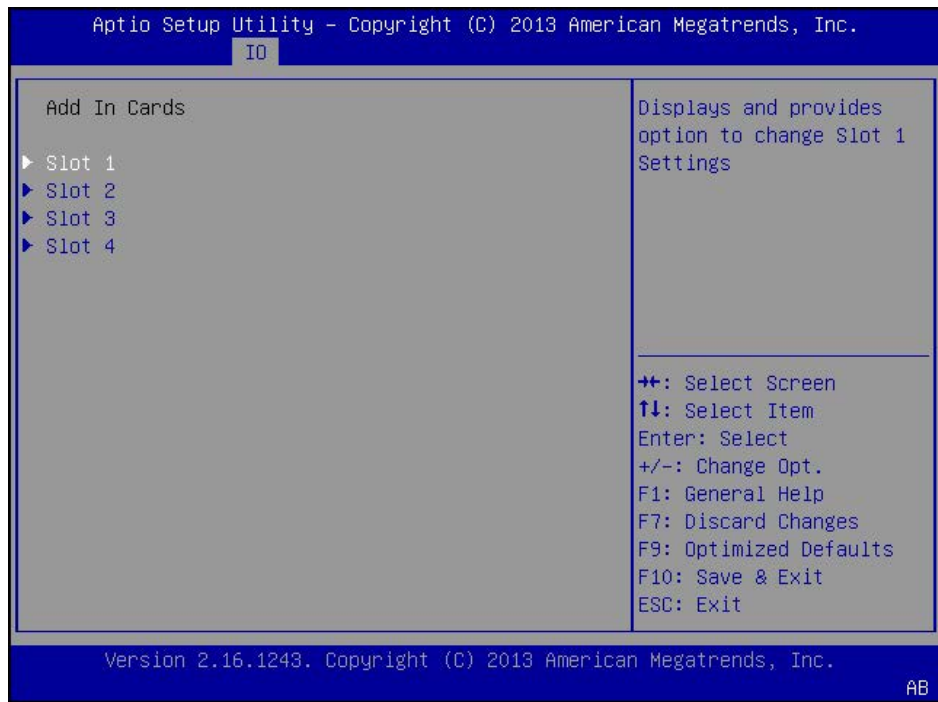


- c. When a popup screen opens, press Enter to approve loading optimal defaults.
- d. Press ESC to return to the Main menu.
6. Set the PCIe cards for each slot.
- a. Use the arrow keys to select the IO menu.

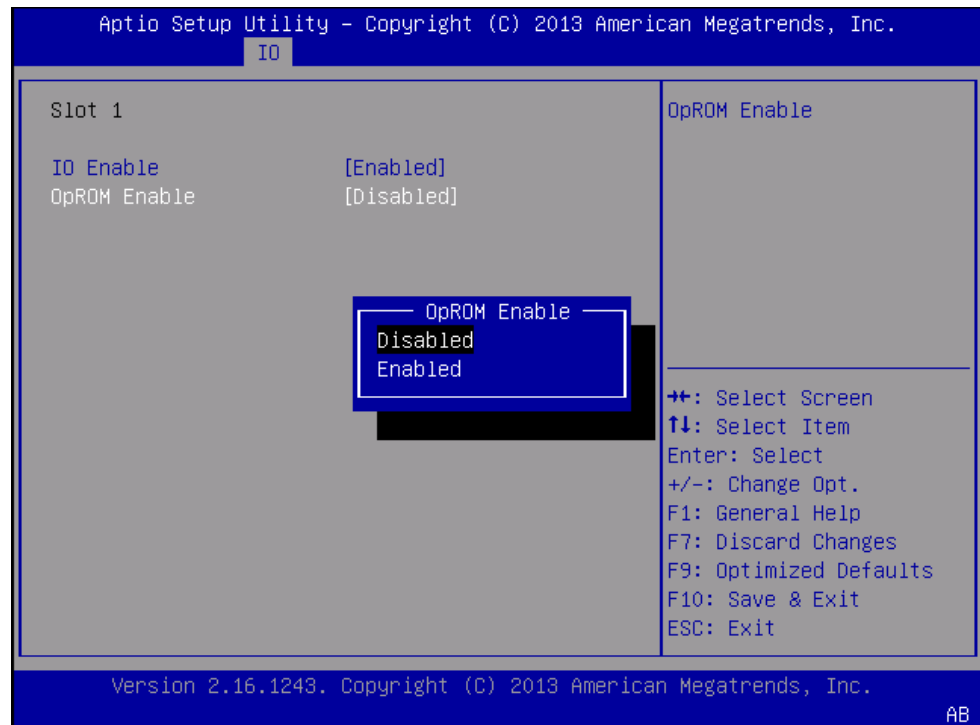
- b. Use the down arrow key to select Add In Cards.





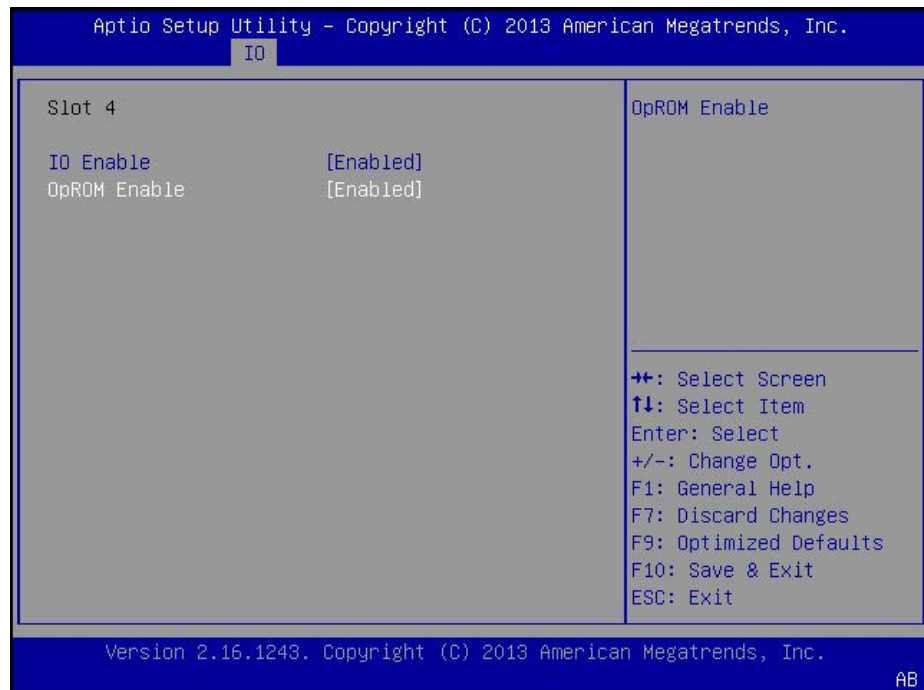
**c. Select Slot 1.**

- d. **Select Disabled for OpROM in Slot 1.**



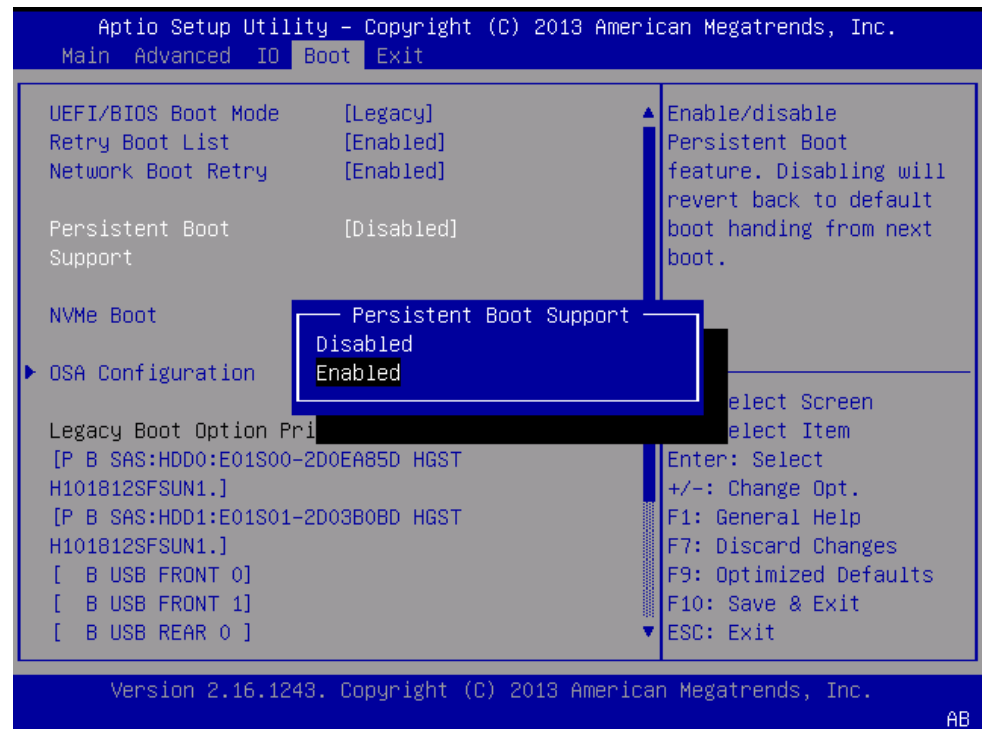
- e. **Repeat step 4b. and 4c. to set OpROM to Disabled for Slot 2 and Slot 3.**

- f. Confirm OpROM is set to Enabled for the internal HBA in Slot 4.

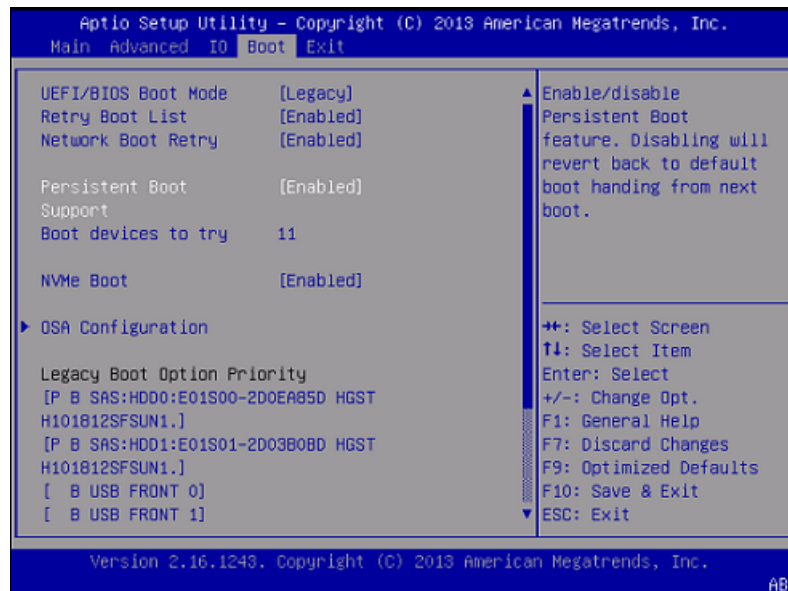


- g. Press ESC to return to the Main menu.
7. Set the Persistent Boot Mode, using these steps:
- a. Select the Boot menu.

- b. Arrow down and select **Persistent Boot Mode**, and set it to **Enabled**.

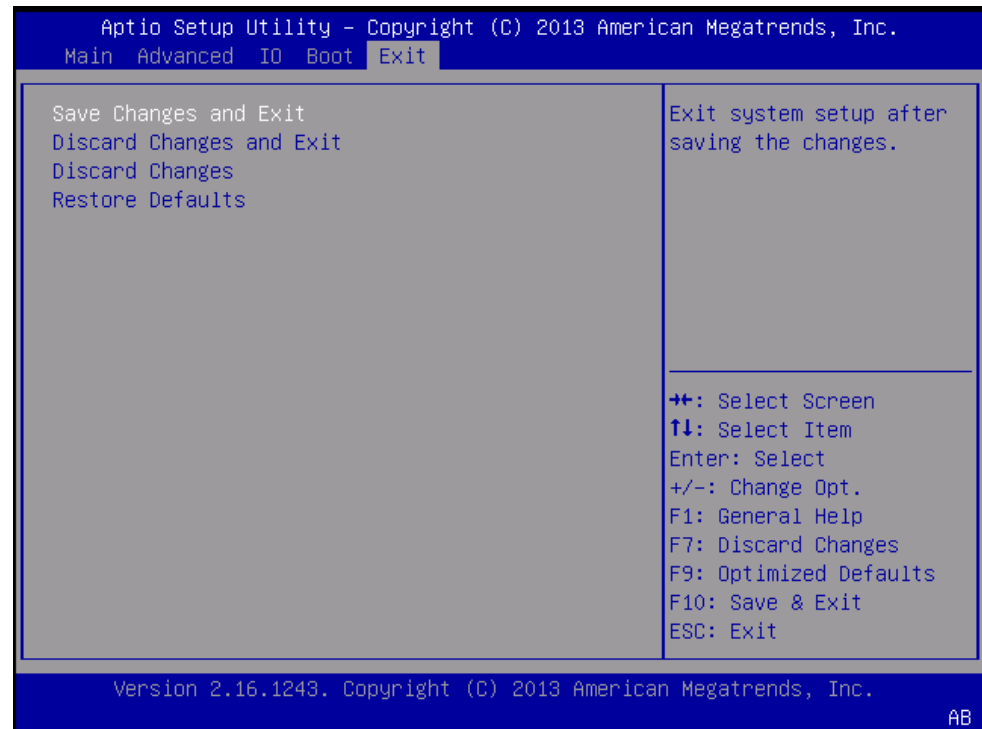


- c. Verify that **UEFI/BIOS Boot Mode**, at the top of the list, is set to **Legacy**.



- d. Return to the Main menu.
8. Save the changes and exit the utility.
    - a. Go to the Exit menu.

**b. Select Save Changes and Exit.**



The system reboots.

**Next Steps**

- [“Resync the SP Password with the Host” on page 130](#)

▼ **Resync the SP Password with the Host**

1. After the system reboots, go to the SP login by entering:  
ESC (
2. Go to the `/SP/users/root` directory:

```
> cd /SP/users/root
```

**3. Set the host password by entering:**

```
> set password=<enter host password>
```

Optionally, set a new password.

**4. Verify that the product serial number has automatically updated.**

**a. Log in to Oracle ILOM.**

**b. Enter set SESSION mode=restricted.**

```
Oracle(R) Integrated Lights Out Manager
```

```
Copyright (c) 201x, Oracle and/or its affiliates. All rights reserved.
```

```
-> set SESSION mode=restricted
```

```
WARNING: The "Restricted Shell" account is provided solely
to allow Services to perform diagnostic tasks.
```

**c. Enter showpsnc.**

```
[(restricted_shell) x5-x-sp:~]$ showpsnc
Primary: fruid:///SYS/PDB
Backup 1: file:///persist/psnc_backup1.xml
Backup 2: fruid:///SYS/CONNBD
```

Element	Primary	Backup 1	Backup 2
Container Status	Valid	Valid	Valid
PPN	4702897-1	4702897-1	4702897-1
PSN	1039BDR07E	1039BDR07E	1039BDR07E
MACADDR	00:21:28:A6:7A:FA	00:21:28:A6:7A:FA	00:21:28:A6:7A:FA
HOSTID	85a67afa	85a67afa	85a67afa

**d. Verify that the PSN element is consistent for Primary, Backup 1, and Backup 2.**

See document number [1280913.1](#) on [My Oracle Support](#) for troubleshooting help on updating product serial numbers.

**e. Enter exit to exit the restricted shell.**

```
[(restricted_shell) x5-x-sp:~]# exit  
exit
```

5. **After the motherboard is replaced and the controller has rejoined the cluster, perform a manual failback operation to return resource ownership to both controllers.**
  - From the BUI of the controller that was not serviced, go to Configuration > Cluster and click FAILBACK.
  - Or from the CLI, enter `configurationcluster failback`.

## Servicing the Internal HBA SAS Cable Assembly



---

**Caution** - The internal HBA SAS cable assembly should be serviced only by authorized Oracle Services personnel.

---



---

**Caution** - 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 antistatic practices as described in [“Take Antistatic Measures” on page 29](#).

---



---

**Caution** - The system supplies power to the cables even when the controller is powered off. To avoid personal injury or damage to the controller, you must disconnect power cords before servicing the cables.

---

This section covers the following procedures:

- [“Remove the Internal HBA SAS Cable Assembly” on page 132](#)
- [“Install the Internal HBA SAS Cable Assembly” on page 135](#)



### Remove the Internal HBA SAS Cable Assembly



---

**Caution** - The internal HBA SAS cable assembly should be removed only by authorized Oracle Services personnel.

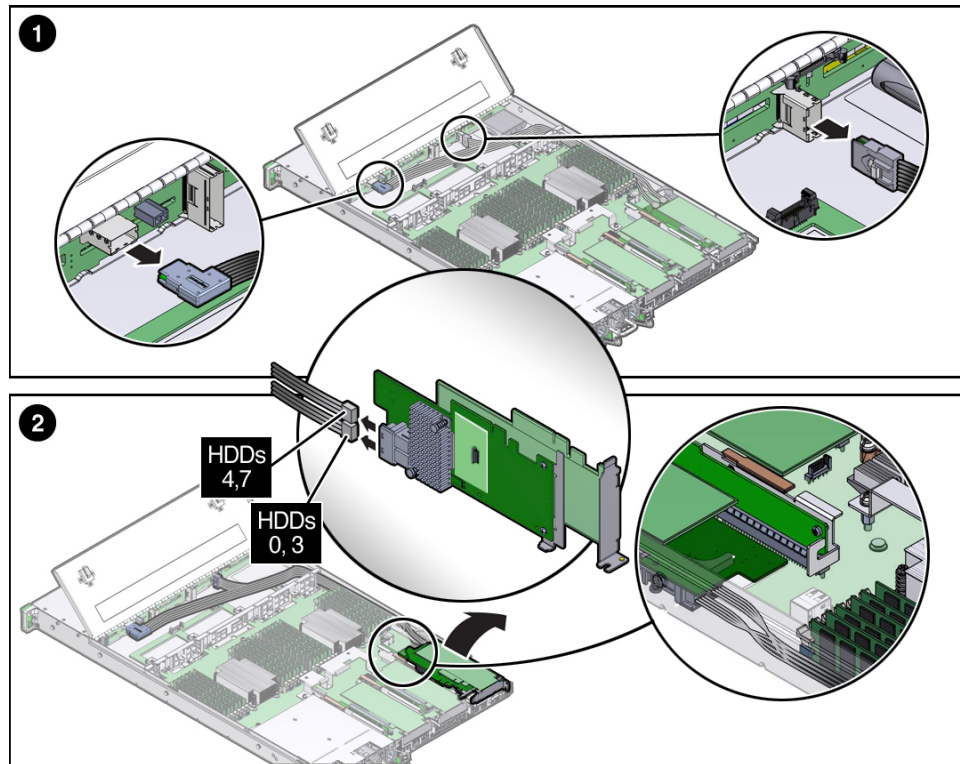
---

1. **Prepare the controller for service.**



- a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25.](#)
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26.](#)
  - c. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**  
See [“Take Antistatic Measures” on page 29.](#)
  - d. **Remove the controller top cover.**  
See [“Remove the Controller Top Cover” on page 30.](#)
2. **Remove all of the controller fan modules.**  
See [“Remove a Fan Module” on page 38.](#)
  3. **Remove the PCIe riser from PCIe slots 3 and 4.**  
See [“Remove the PCIe Riser From PCIe Slots 3 and 4” on page 62.](#)

4. To disconnect the SAS cables from the disk backplane, press the latch on the cable connectors and pull the connectors out. [1].



5. Disconnect the SAS cables from the internal host bus adapter (HBA).
  - a. Remove the PCIe riser from PCIe slot 3 and 4.  
See [“Remove the PCIe Riser From PCIe Slots 3 and 4”](#) on page 62
  - b. On the under side of the HBA, card press the SAS cable connector latches and then pull out the connectors [2].
6. Carefully remove the SAS cables from the controller.

#### Related Information

- [“Install the Internal HBA SAS Cable Assembly”](#) on page 135

## ▼ Install the Internal HBA SAS Cable Assembly



**Caution** - The internal HBA SAS cable assembly should be installed only by authorized Oracle Services personnel.

1. **Carefully guide SAS cables along the side of the chassis.**
2. **Connect the SAS cables to the internal HBA card [2].**
3. **Install the SAS cables into the disk backplane [1].**
4. **Install the PCIe riser with the internal HBA card into PCIe slot 3.**  
See [“Install the PCIe Riser Into PCIe Slots 3 and 4” on page 64.](#)
5. **Install all of the controller fan modules.**  
See [“Install a Fan Module” on page 41.](#)
6. **Return the controller to operation.**
  - a. **Install the controller top cover.**  
See [“Install the Controller Top Cover” on page 144.](#)
  - b. **Close the controller fan door.**
  - c. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143.](#)
  - d. **Reconnect the data cables to the controller and reconnect the power cords to the controller power supplies.**  
See [“Reconnect Data Cables and Power Cords” on page 149.](#)
  - e. **Power on the controller.**  
See [“Power On the Controller” on page 150.](#)  
Verify that the Power/OK status indicator is steady on.

### Related Information

- [“Remove the Internal HBA SAS Cable Assembly” on page 132](#)

## Servicing the Power, FIM, and Disk Backplane Data Cables



---

**Caution** - The power, front indicator module (FIM), and disk backplane data cables should be serviced only by authorized Oracle Services personnel.

---



---

**Caution** - The system supplies power to the cables even when the controller is powered off. To avoid personal injury or damage to the controller, you must disconnect power cords before servicing the cables.

---

This section covers the following procedures:

- [“Remove the Internal HBA SAS Cable Assembly” on page 132](#)
- [“Install the Internal HBA SAS Cable Assembly” on page 135](#)

### Related Information

- [“Extend the Controller to the Maintenance Position” on page 26](#)
- [“Take Antistatic Measures” on page 29](#)
- [“Remove the Controller Top Cover” on page 30](#)

## ▼ Removing the Power, FIM, and Disk Backplane Data Cables



---

**Caution** - The power, front indicator module (FIM), and disk backplane data cables should be removed only by authorized Oracle Services personnel.

---

1. **Prepare the controller for service.**
  - a. **Power off the controller and disconnect the power cords from the power supplies.**  
See [“Powering Off the Controller” on page 25](#).
  - b. **Extend the controller to the maintenance position.**  
See [“Extend the Controller to the Maintenance Position” on page 26](#).
  - c. **Attach an antistatic wrist strap to your wrist, and then to a metal area on the chassis.**

See [“Take Antistatic Measures”](#) on page 29.

**d. Remove the controller top cover.**

See [“Remove the Controller Top Cover”](#) on page 30.

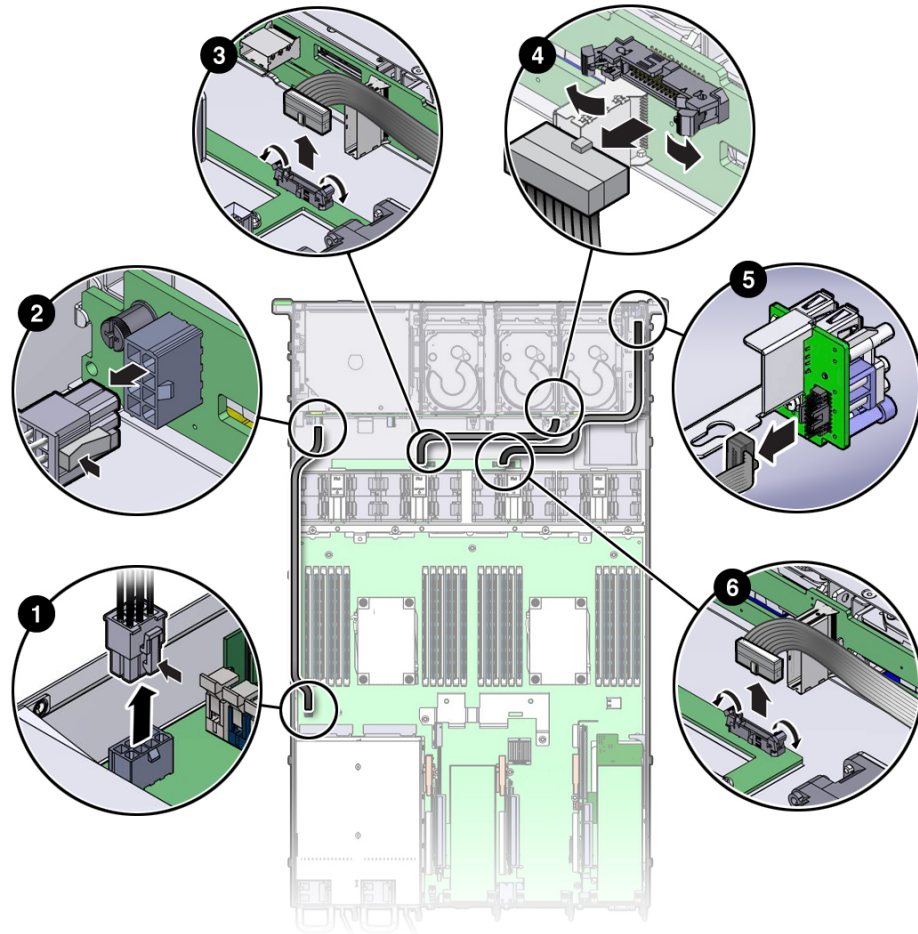
**2. Remove all of the controller fan modules.**

See [“Remove a Fan Module”](#) on page 38.

**3. To remove the disk backplane power cable, perform these steps:**

- a. To disconnect the disk backplane power cable from the motherboard, press the release latches on the sides of the cable connector and pull the connector out. [1].

- b. To disconnect the disk backplane power cable from the disk backplane, press the release latches on the side of the cable connector and pull the connector out. [2].



Legend			
1	Disk backplane power cable connector on motherboard	4	Auxiliary power and signal cable connector latches on disk backplane

Legend			
2	Disk backplane power cable connector on disk backplane	5	FIM cable connector on FIM
3	Auxiliary power and signal cable connector latches on motherboard	6	FIM cable side latches on motherboard

4. To remove the auxiliary power and signal cable, perform these steps:
  - a. To eject the auxiliary power and signal cable from the motherboard, open the latches on the connector [3].
  - b. To eject the auxiliary power and signal cable from the disk backplane, open the latches on the connector [4].
5. To remove the FIM cable, perform these steps:
  - a. Remove the FIM from the controller.  
See [“Remove the Front Indicator Module” on page 106](#)
  - b. Disconnect the FIM cable from the FIM [5].
  - c. To eject the FIM cable from the motherboard, open both side latches [6].

## ▼ Install the Power, FIM, and Disk Backplane Data Cables



**Caution** - The power, front indicator module (FIM), and disk backplane data cables should be installed only by authorized Oracle Services personnel.

1. Install the FIM cable.
  - a. To install the FIM cable into the motherboard, open both side latches and plug the FIM connector into motherboard connector [6].  
The motherboard connector side latches will close, locking the FIM cable connector in place.
  - b. Connect the FIM cable to the FIM [5].

- c. **Install the FIM into the controller.**  
See [“Install the Front Indicator Module” on page 108](#)
2. **Install the auxiliary power and signal cable.**
  - a. **To install the auxiliary power and signal cable into the disk backplane, ensure that the latches on the disk backplane connector are in the open position and plug the cable connector into the disk backplane connector [4].**  
The disk backplane connector side latches will close, locking the auxiliary power and signal cable connector in place.
  - b. **To install the auxiliary power and signal cable into the motherboard, ensure that the latches on the motherboard connector are in the open position and plug the cable connector into the motherboard connector [3].**  
The motherboard connector side latches will close, locking the auxiliary power and signal cable connector in place.
3. **Install the disk backplane power cable.**
  - a. **To connect the disk backplane power cable to the disk backplane, plug the cable connector into the disk backplane connector. [2].**
  - b. **To connect the disk backplane power cable to the motherboard, plug the cable connector into the motherboard connector. [1].**
4. **Install all of the controller fan modules.**  
See [“Install a Fan Module” on page 41](#).
5. **Return the controller to operation.**
  - a. **Install the controller top cover.**  
See [“Install the Controller Top Cover” on page 144](#).
  - b. **Close the controller fan door.**
  - c. **Return the controller to the normal rack position.**  
See [“Returning the Controller to Operation” on page 143](#).
  - d. **Power on the controller.**



See [“Power On the Controller” on page 150](#).

Verify that the Power/OK status indicator is steady on.

### **Related Information**

- [“Removing the Power, FIM, and Disk Backplane Data Cables” on page 136](#)



## Returning the Controller to Operation

---

After replacing components inside of the controller, perform the procedures in the following sections.

Description	Links
Learn about filler panels.	<a href="#">“Installing Controller Filler Panels” on page 143</a>
Install the controller top cover.	<a href="#">“Install the Controller Top Cover” on page 144</a>
Remove antistatic measures.	<a href="#">“Remove Antistatic Measures” on page 145</a>
Install the controller chassis into the rack.	<a href="#">“Reinstall the Controller Into the Rack” on page 145</a>
Return the controller to the normal rack position.	<a href="#">“Returning the Controller to Operation” on page 143</a>
Reconnecting data cables and power cords.	<a href="#">“Reconnect Data Cables and Power Cords” on page 149</a>
Power on the controller.	<a href="#">“Power On the Controller” on page 150</a>

## Installing Controller Filler Panels

If you remove a read cache device from the controller, you must install either a replacement component or a filler panel.

See the following procedure for instructions for installing the controller filler panels:

- [“Install Filler Panels” on page 143](#)

### ▼ Install Filler Panels

1. **Locate the vacant storage drive module slot in the controller, and then ensure that the release lever on the filler panel is fully opened.**
2. **Slide the filler panel into the vacant slot by pressing the middle of the filler panel faceplate with your thumb or finger.**

3. The release lever will close as it makes contact with the chassis. Do not slide the filler panel in all the way. Leave the filler panel out approximately 0.25 to 0.50 inch (6 to 12 mm) from the opening.
4. Using your thumb or finger, press on the middle of the filler panel faceplate until the release lever engages with the chassis.
5. Close the release lever until it clicks into place and is flush with the front of the controller.

## ▼ Install the Controller Top Cover

1. **Open the controller fan door.**  
See [“Open the Controller Fan Door”](#) on page 29.

2. **Place the top cover on the chassis [1].**

Place the cover down so that it hangs over the rear of the controller by about 13 mm (0.5 inches) and the side latches align with the slots in the sides of the chassis.

---

**Note** - There are three latching tabs on the sides of the cover, two on the right side and one on the left side (viewing the controller from the front). There is also a latch on the underside of the cover in the front left corner.

---

3. **Check both sides of the chassis to ensure that the four corners of the top cover are fully down and flush with the chassis.**

If the cover corners are not flush with the chassis, slide the cover towards the rear of the chassis until you can position the cover correctly.



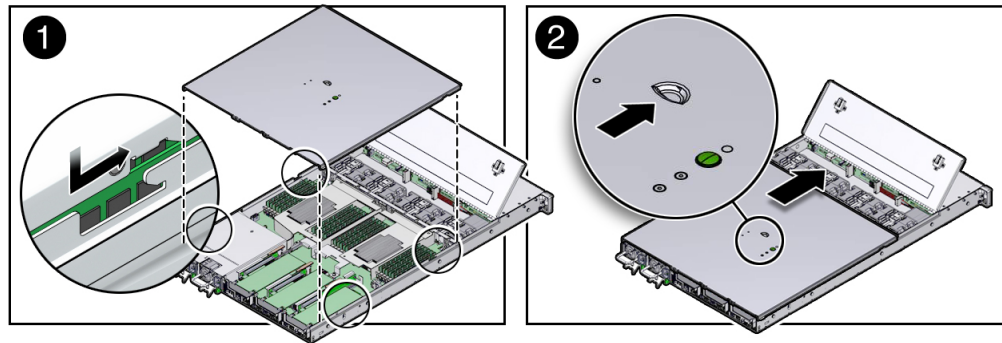
---

**Caution** - If the top cover is not correctly positioned before you attempt to slide the cover toward the front of the chassis, the internal latch that is located on the underside of the cover might be damaged.

---

4. **Gently slide the cover toward the front of the chassis until it locks into place (with an audible click) [2].**

As you slide the cover toward the front of the controller, watch the green release button. You will hear an audible click when the green release button pops up, indicating that the cover is locked.



5. **Close the controller fan door.**
6. **Remove the antistatic precautions.**  
See [“Remove Antistatic Measures”](#) on page 145.

#### Related Information

- [“Remove the Controller Top Cover”](#) on page 30
- [“Remove Antistatic Measures”](#) on page 145

## ▼ Remove Antistatic Measures

1. **Remove any antistatic straps or conductors from the controller chassis.**
2. **Remove the antistatic wrist strap from yourself.**

## ▼ Reinstall the Controller Into the Rack

If you removed the controller chassis from the rack, perform these steps to reinstall it.



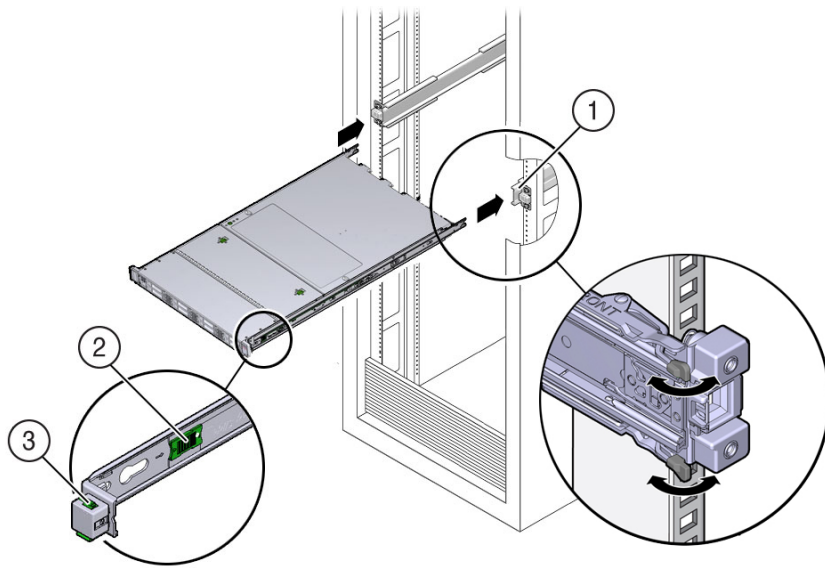
**Caution** - Deploy any rack anti-tilt mechanisms before installing the controller into the rack.



**Caution** - The controller weighs approximately 18.1 kg (40.0 lbs). Two people are required to carry the chassis and install it into the rack.

1. **Push the slide-rails into the slide-rail assemblies in the rack as far as possible.**
2. **Raise the controller so that the rear ends of the mounting brackets are aligned with the slide-rail assemblies that are mounted in the rack.**
3. **Insert the mounting brackets into the slide-rails, and then push the controller into the rack until the mounting brackets encounter the slide-rail stops, approximately 30 cm (12 inches).**

The controller is now in the extended maintenance position.



Legend	
1	Inserting mounting brackets into slide-rails
2	Slide-rail release tab (green)
3	Slide-rail lock

### Related Information

- [“Remove the Controller From the Rack” on page 28](#)
- [“Remove Antistatic Measures” on page 145](#)
- [“Reconnect Data Cables and Power Cords” on page 149](#)

## ▼ Return the Controller to the Normal Rack Position

If the controller is in the extended maintenance position, use this procedure to return the controller to the normal rack position.

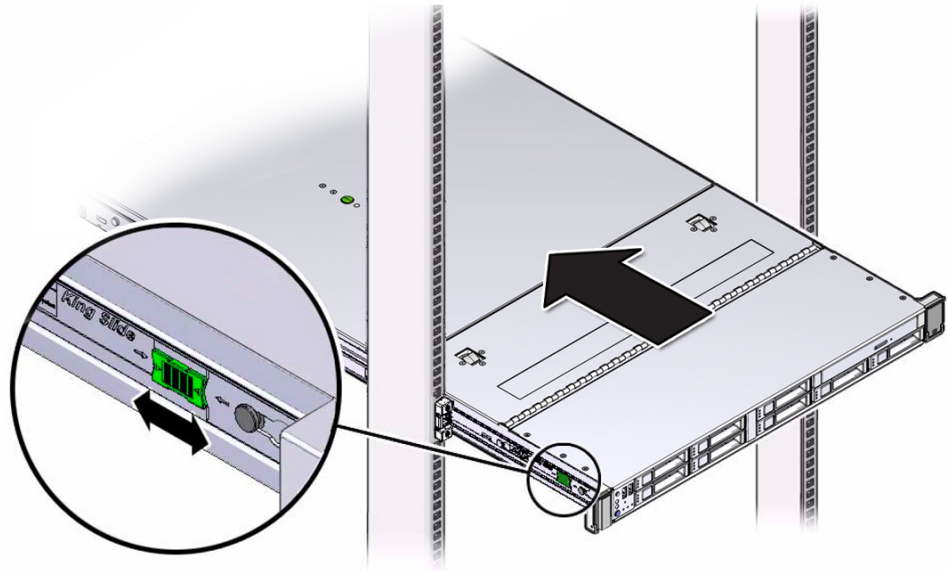
1. **Push the controller back into the rack, as described in the following steps.**
  - a. **Simultaneously pull and hold the two green release tabs (one on each side of the slide rails on the controller) toward the front of the controller while you push the controller into the rack.**

As you push the controller into the rack, verify that the cable management arm (CMA) retracts without binding.

---

**Note** - To pull a green release tab, place your finger in the center of the tab, not on the end, and apply pressure as you pull the tab toward the front of the controller.

---



- b. Continue pushing the controller into the rack until the slide-rail locks (on the front of the controller) engage the slide-rail assemblies.**

You will hear an audible click when the controller is in the normal rack position.

- 2. If the CMA is not installed, that is, you removed it because you removed the controller completely out of the rack, install the CMA.**  
For installation instructions for the CMA, refer to [“\(Optional\) Install the Cable Management Arm” in Oracle ZFS Storage ZS5-ES Installation Guide, Release OS8.7.x.](#)
- 3. If the cables are disconnected from the rear of the controller, that is, you disconnected the cables because you removed the controller completely out of the rack, reconnect the cables.**
  - For instructions on reconnecting cables to the rear of the controller, see [“Reconnect Data Cables and Power Cords” on page 149.](#)



- For detailed information on connecting cables to the rear of the controller, refer to [Oracle ZFS Storage ZS5-ES Installation Guide, Release OS8.7.x](#).

### Related Information

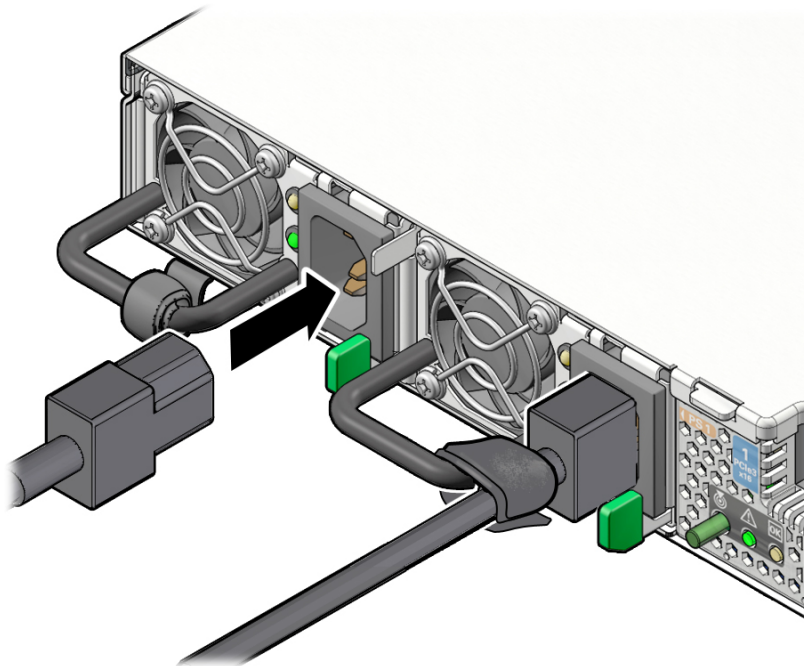
- [“Reconnect Data Cables and Power Cords” on page 149](#)

## ▼ Reconnect Data Cables and Power Cords

1. **Reconnect the data cables and cluster cables to the rear of the controller, as required.**

If the cable management arm (CMA) is in the way, extend the controller approximately 13 cm (5 inches) out of the front of the rack.

2. **Reconnect the power cables to the power supplies and secure them with the reclosable straps as shown in the following figure.**



3. **If necessary, reinstall the cables into the CMA and secure them with the reclosable cable straps.**
4. **If you pulled the controller out of the rack to make it easier to connect the cables, push the controller into the rack until the slide-rail locks (on the front of the controller) engage the slide-rail assemblies.**

You will hear an audible click when the controller is in the normal rack position.

### **Related Information**

- [“Disconnect Cables From the Controller” on page 26](#)
- [“Reinstall the Controller Into the Rack” on page 145](#)
- [“Returning the Controller to Operation” on page 143](#)
- [“Power On the Controller” on page 150](#)

## **Power On the Controller**

As soon as the power cords are connected, standby power is applied and the green Power/OK status indicator on the controller front panel blinks. Depending on the configuration of the firmware, the system might boot. If it does not boot, follow this procedure.

Power on the controller by performing one of the following steps:

- Press the Power button on the controller front panel.
- Log in to the Oracle ILOM web interface, click Host Management → Power Control and select Power On from the Select Action list.
- Log in to the Oracle ILOM command-line interface (CLI), and type the following command at the Oracle ILOM prompt:

```
-> start /System
```

When the controller is powered on and the power-on self-test (POST) code checkpoint tests have completed, the green Power/OK status indicator on the front panel lights and remains lit.

### **Related Information**

- [“Powering Off the Controller” on page 25](#)
- [“Reconnect Data Cables and Power Cords” on page 149](#)