



SGI® InfiniteStorage 2245 (IS2245)
User's Guide

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About This Guide

This guide provides an overview of the SGI® InfiniteStorage 2245 (IS2245) storage product along with instructions for installation and general operation. A brief overview of RAID is provided in an appendix.

Audience

This guide is written for owners, installers, system administrators, and users of the IS2245 storage unit. It is written with the assumption that the reader has a good working knowledge of computers and computer systems.

Related Publications

Depending on your choice of system components and operating system, the following SGI documents may be relevant to your IS2245 storage:

- SGI InfiniteStorage series documentation
- Man pages (online)

You can obtain SGI documentation, release notes, or man pages in the following ways:

- Refer to the SGI Technical Publications Library at <http://docs.sgi.com>. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- Refer to the SGI Supportfolio webpage for documents whose access require a support contract. See “[Product Support](#)” on page xv.
- You can also view man pages by typing `man <title>` on a command line.

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- Refer to <http://www.sgi.com/support/>
- If you are in North America, contact the Technical Assistance Center at +1 800 800 4SGI or contact your authorized service provider.
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- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

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Introduction

The SGI InfiniteStorage 2245 (IS2245) system is a 4U rackmount storage unit (see [Figure 1-1](#)) that is optimized for enterprise-level heavy-capacity storage applications.

The IS2245 provides high-density storage with the following features:

- 4U form factor
- 45 hot-swap HDD bays (24 front plus 21 rear)
Standard: 3.5-inch drives; 2.5-inch drive support with special order
- Optimized HDD signal trace routing
- Unique HDD carrier design to dampen vibration and maximize performance
- 1400W (Gold Level) high-efficiency redundant power supply
- Seven hot-plug cooling fans

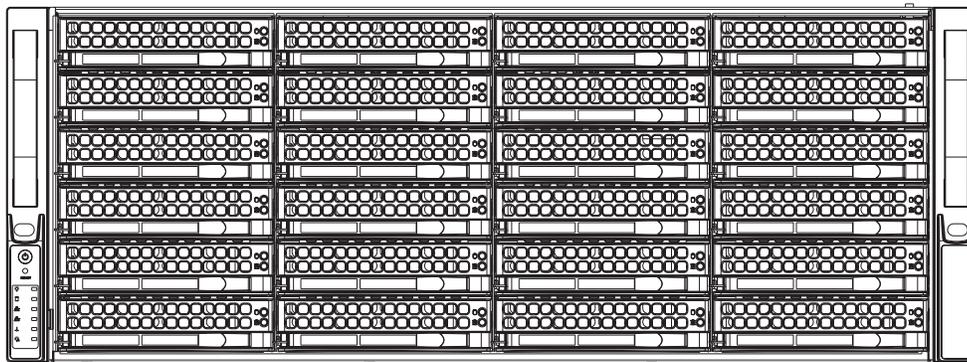


Figure 1-1 IS2245 Front Panel

Racks

The following rack assemblies are available:

- Short rack

The 20U-high deskside rack holds a maximum of five 4U-high enclosures.

- 39U tall rack

The 39U-high rack holds a maximum of nine 4U-high enclosures.

- 42U water-cooled tall rack

The 42U-high water-cooled rack holds a maximum of 10 4U-high enclosures. Only 40U of the 42U is water cooled. There is 40U in the main section of the rack and the uncooled 2U portion is located between the top plate and the top cover.

Note: Adding switches to the rack configuration will reduce the maximum number of IS2245 units supported in a rack.

Components

This section describes the major components of the IS2245 system.

Chassis and Hard Drive Bays

The IS2245 system has 45 hot-swappable hard drive bays.

Fans

The IS2245 system has seven hot-swappable fans. These fans are 4U-compatible and are powered by 3-pin connectors.

Mounting Rails

The IS2245 system is shipped with mounting rails. See [Chapter 3, “Installing the IS2245 Storage Unit in a Rack.”](#), to set up your rack.

Power Supply

Each IS2245 system includes two redundant high-efficiency hot-swappable power supplies rated at 1400 Watts. In the unlikely event of a failure in one of the power supplies, you can remove and replace the faulty power supply without powering down the system.

System Safety

This chapter describes basic safety precautions.

Electrical Safety Precautions

Basic electrical safety precautions should be followed to protect yourself from harm and the IS2245 system from damage, as follows:

- Be aware of the locations of the power on/off switch on the chassis as well as the room's emergency power-off switch, disconnection switch or electrical outlet. If an electrical accident occurs, you can then quickly remove power from the system.
- Do not work alone when working with high voltage components.
- Power should always be disconnected from the system when removing or installing main system components, such as system fans. When disconnecting power, you should first power down the operating system first and then unplug the power cords. The unit has more than one power supply cord. Disconnect two power supply cords before servicing to avoid electrical shock.
- When working around exposed electrical circuits, another person who is familiar with the power-off controls should be nearby to switch off the power if necessary.
- Use only one hand when working with powered-on electrical equipment. This is to avoid making a complete circuit, which will cause electrical shock. Use extreme caution when using metal tools, which can easily damage any electrical components or circuit boards they come into contact with.
- Do not use mats designed to decrease static electrical discharge as protection from electrical shock. Instead, use rubber mats that have been specifically designed as electrical insulators.
- The power supply power cords must include a grounding plug and must be plugged into grounded electrical outlets.

General Safety Precautions

Follow these rules to ensure general safety:

- Keep the area around the IS2245 unit clean and free of clutter.
- Place the chassis top cover and any system components that have been removed away from the system or on a table so that they won't accidentally be stepped on.
- While working on the system, do not wear loose clothing such as neckties and unbuttoned shirt sleeves, which can come into contact with electrical circuits or be pulled into a cooling fan.
- Remove any jewelry or metal objects from your body, which are excellent metal conductors that can create short circuits and harm you if they come into contact with printed circuit boards or areas where power is present.
- After accessing the inside of the system, close the system back up and secure it to the rack unit with the retention screws after ensuring that all connections have been made.

ESD Precautions



Caution: Electrostatic discharge (ESD) is generated by two objects with different electrical charges coming into contact with each other. An electrical discharge is created to neutralize this difference, which can damage electronic components and printed circuit boards.

The following measures are generally sufficient to neutralize this difference before contact is made to protect your equipment from ESD:

- Use a grounded wrist strap designed to prevent static discharge.
- Keep all components and printed circuit boards (PCBs) in their antistatic bags until ready for use.
- Touch a grounded metal object before removing the board from the antistatic bag.
- Do not let components or PCBs come into contact with your clothing, which may retain a charge even if you are wearing a wrist strap.
- Handle a board by its edges only; do not touch its components, peripheral chips, memory modules or contacts.
- When handling chips or modules, avoid touching their pins.
- For grounding purposes, make sure your computer chassis provides excellent conductivity between the power supply, the case, and the mounting fasteners.

Installing the IS2245 Storage Unit in a Rack

This chapter provides a quick setup checklist to get the IS2245 operational.

Unpack the System

Inspect the shipping container for the IS2245 and note if it was damaged in any way. If the unit shows damage, file a damage claim with the carrier who delivered it.

Decide on a suitable location for the rack that supports the weight, power requirements, and environmental requirements of the IS2245. It should be situated in a clean, dust-free environment that is well ventilated. Avoid areas where heat, electrical noise, and electromagnetic fields are generated. Place the system rack near a grounded power outlet. Refer to [“Warnings and Precautions”](#) on page 10.

Prepare for Setup

The shipping container should include two sets of rail assemblies, two rail mounting brackets and the mounting screws that you will use to install the system into a rack.

Read this section in its entirety before you begin the installation procedure.

Choose a Setup Location

Leave enough clearance in front of the rack to enable you to open the front door completely (~25 inches) and approximately 30 inches of clearance in the back of the rack to allow for sufficient airflow and ease in servicing.

Warnings and Precautions

Rack Precautions



Warning: Always use proper lifting techniques when you move the unit. Always get the assistance of another qualified person when you install the IS2245 in a location above your shoulders. Failure to do so may result in serious personal injury or damage to the equipment.

- Extend the leveling jacks on the bottom of the rack to the floor with the full weight of the rack resting on them. Failure to do so can result in serious injury or death.
- Attach stabilizers to the rack in single rack installations. Failure to do so can result in serious injury or death.
- Couple racks together in multiple rack installations. Failure to do so can result in serious injury or death.
- Be sure the rack is stable before extending a component from the rack. Failure to do so can result in serious injury or death.
- Extend only one component at a time. Extending two or more components simultaneously may cause the rack to tip over and result in serious injury or death.

System Precautions

- Review the electrical and general safety precautions.
- Determine the placement of each component in the rack before you install the rails.
- Install the heaviest server components in the bottom of the rack first, and then work up.
- Use a regulating uninterruptible power supply (UPS) to protect the system from power surges and voltage spikes and to keep your system operating in case of a power failure.
- Allow the hot-pluggable drives and power supply modules to cool before touching them.
- Always keep the rack's front door and all panels and components on the units closed when not servicing to maintain proper cooling.

Rack Mounting Considerations

Ambient Operating Temperature

If installed in a closed or multi-unit rack assembly, the ambient operating temperature of the rack environment may be greater than the ambient temperature of the room. Therefore, consideration should be given to installing the equipment in an environment compatible with the manufacturer's maximum rated ambient temperature (35° C or 95° F).

Reduced Airflow

Equipment should be mounted into a rack so that the amount of airflow required for safe operation is not compromised.

Mechanical Loading

Equipment should be mounted into a rack so that a hazardous condition does not arise due to uneven mechanical loading.

Circuit Overloading

Consideration should be given to the connection of the equipment to the power supply circuitry and the effect that any possible overloading of circuits might have on overcurrent protection and power supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

Reliable Ground

A reliable ground must be maintained at all times. To ensure this, the rack itself should be grounded. Particular attention should be given to power supply connections other than the direct connections to the branch circuit (for example, the use of power strips, and so on).

Install the System into a Rack

This section provides information on installing the IS2245 into a rack. If the system has already been mounted into a rack, refer to “[Check All Cable Connections](#)” on page 19. There are a variety of rack units on the market, which may mean the assembly procedure will differ slightly. You should also refer to the installation instructions that came with the rack unit you are using.

Separate the Sections of the Rack Rails

The chassis package includes two rail assemblies in the rack mounting kit. Each assembly consists of two sections: an inner fixed chassis rail that secures directly to the chassis and an outer fixed rack rail that secures directly to the rack itself.

To separate the inner and outer rails, perform the following steps:

1. Locate the rail assembly in the chassis packaging as shown in [Figure 3-1](#).
2. Extend the rail assembly by pulling it outward.
3. Press the quick-release tab.
4. Separate the inner rail from the outer rail assembly.

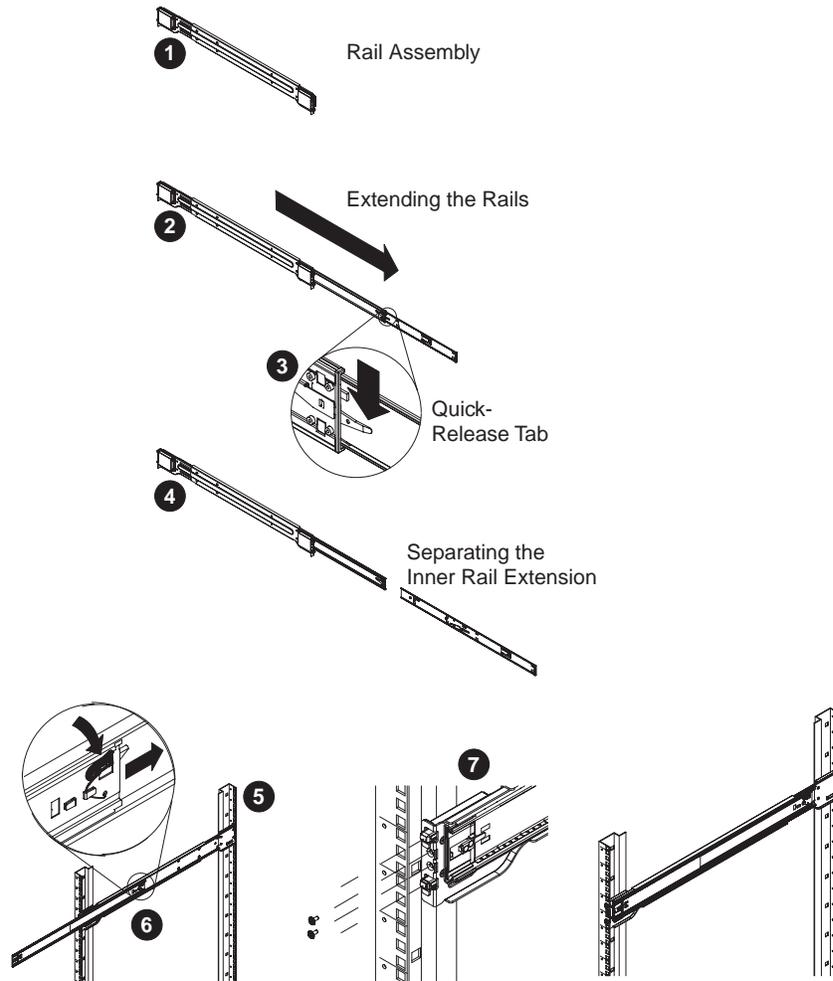


Figure 3-1 Separating and Installing the Rack Rails

Outer Rack Rails

Outer rails attach to the rack and hold the chassis in place. The outer rails for the chassis extend between 30 inches and 33 inches. You need to add the square-to-round hole adapters that attach to

the ends of the 2U quick attach rails. [Figure 3-2](#) shows the rail adapter and the end of the quick attach rail.

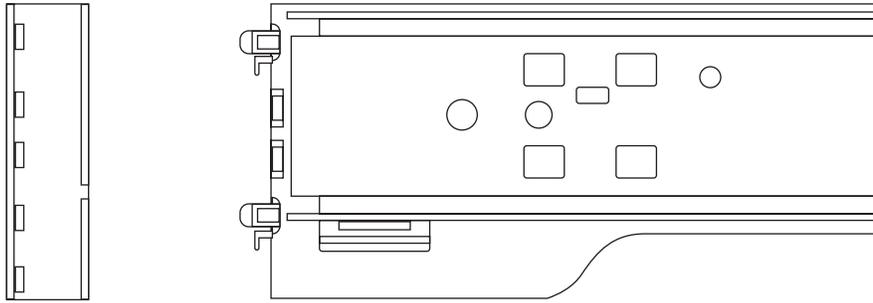


Figure 3-2 Square-to-round Hole Adapter for 2U Quick Attach Rails

[Figure 3-3](#) shows the adapter clipped onto the rail set. Use the flat head M5 screws supplied with the rails kit to bolt the rails set into the rack.

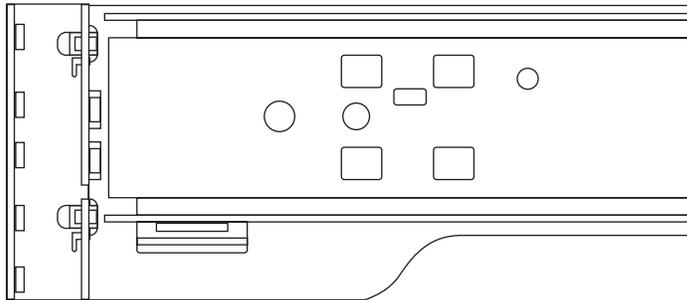


Figure 3-3 Square-to-round Hole Adapter Clipped onto the Rail Set

Install the Outer Rails to the Rack

1. Using the screws provided, secure the back end of the outer rail to the rack (see [Figure 3-1](#)).
2. Press the button where the two outer rails are joined to retract the smaller outer rail.
3. Hang the hooks of the rails onto the rack holes and, if desired, use screws to secure the front of the outer rail onto the rack.
4. Repeat steps 1-3 for the remaining outer rail.

Install the Inner Rail Extensions

The IS2245 chassis includes a set of inner rails in two sections: inner rails and inner rail extensions. The inner rails are pre-attached to the chassis and do not interfere with normal use of the chassis if you decide not to use a system rack. The inner rail extension is attached to the inner rail to mount the chassis in the rack.

Install the Inner Rails

Perform the following steps to install the inner rails:

1. Place the inner rail extensions on the side of the chassis aligning the hooks of the chassis with the rail extension holes. Make sure the extension faces "outward" just like the pre-attached inner rail (see [Figure 3-4](#)).
2. Slide the extension toward the front of the chassis.
3. Secure the chassis with two screws as illustrated. Repeat steps for the other inner rail extension.

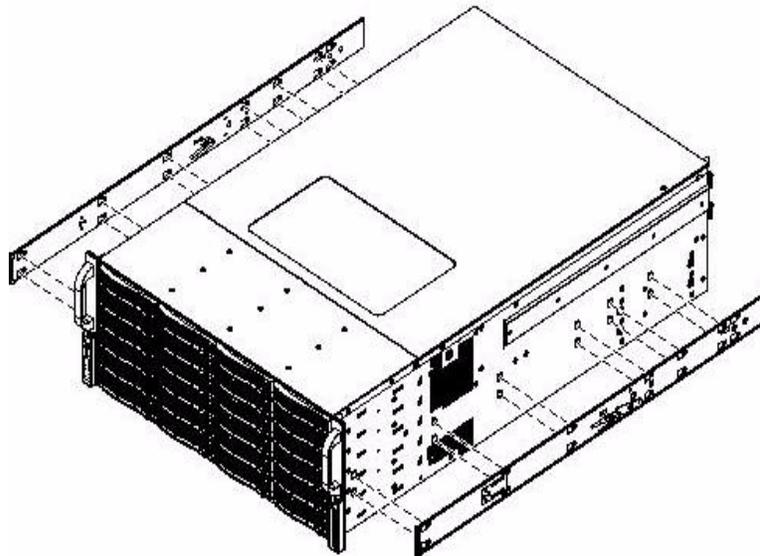


Figure 3-4 Installing the Inner Rail Extensions

Install the System in a Rack



Warning: Always use proper lifting techniques when you move the system. Always get the assistance of another qualified person when you install the IS2245 in a location above your shoulders. Failure to do so may result in serious personal injury or damage to the equipment.

You should now have rails attached to both the chassis and the rack unit. The next step is to install the system into the rack (refer to [Figure 3-5](#)).

1. Extend the outer rails as shown in [Figure 3-5](#).
2. Align the inner rails of the chassis with the outer rails on the rack.
3. Keeping the pressure even on both sides, slide the inner rails into the outer rails.

When the chassis has been pushed completely into the rack, it should click into the locked position.

4. Optional screws may be used to secure the to hold the front of the chassis to the rack.

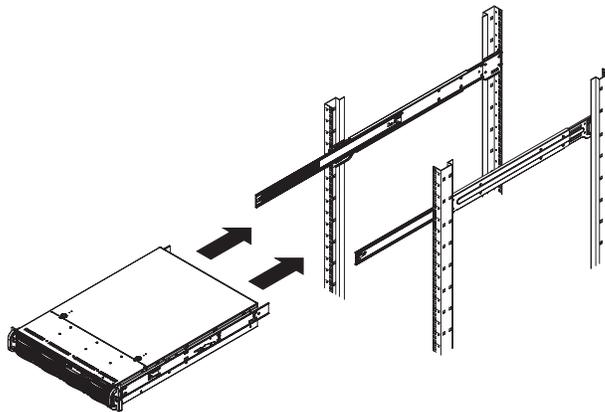


Figure 3-5 Installing the IS2245 in a Rack

Final Steps

Once the system is successfully installed in the rack, perform the following steps:

- “Remove the Chassis Cover” on page 18
- “Check All Cable Connections” on page 19
- “Check the Drive Bay Setup” on page 19
- “Check the Airflow” on page 20
- “Replace the Chassis Cover and Supply Power to the System” on page 20

Remove the Chassis Cover

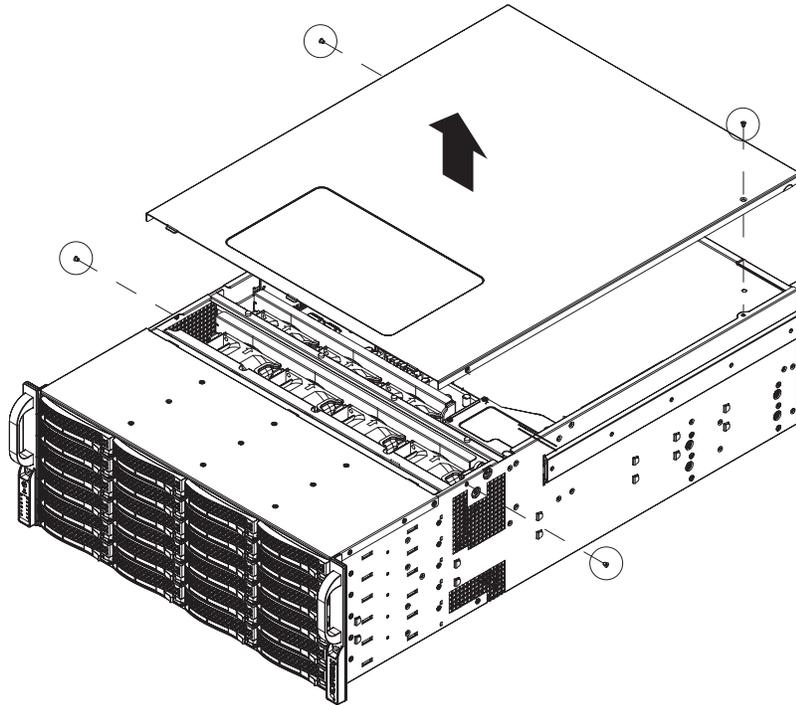


Figure 3-6 Removing the Chassis Cover



Warning: Except for short periods of time, do NOT operate the system without the cover in place. The chassis cover must be in place to allow proper airflow and prevent overheating.

Do the following:

1. Unplug the chassis from any power source.
2. Remove the screws securing the cover to the chassis, as shown in [Figure 3-6](#).
3. Lift the top cover from the chassis.

Check All Cable Connections

Make sure all power and data cables are properly connected and not blocking the chassis airflow.

Check the Drive Bay Setup

Ensure the disk drive backplane have been properly installed and all connections have been made. You can access the hot swappable data drives from the front and the rear (24 in the front and 21 in the rear, as shown in [Figure 3-7](#) and [Figure 3-8](#)).

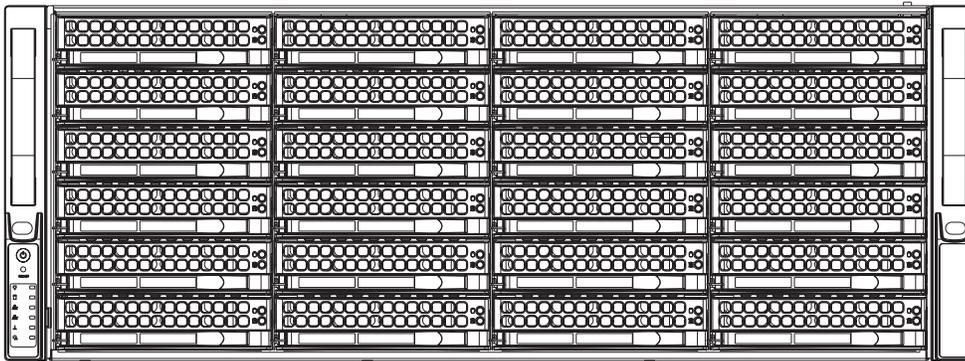


Figure 3-7 Disk Drives – Front Panel

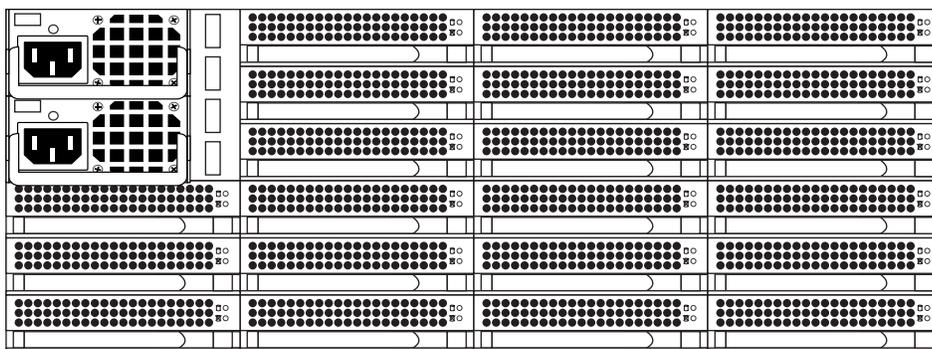


Figure 3-8 Disk Drives – Rear Panel

Depending upon your system's configuration, your system may have one or more drives already installed.

Check the Airflow

Airflow is provided by seven hot-swappable chassis cooling fans. The system component layout was carefully designed to direct sufficient cooling airflow to the components that generate the most heat.

Note: Make sure that all power and data cables have been routed in such a way that they do not block the airflow generated by the fans.

Replace the Chassis Cover and Supply Power to the System

Replace the chassis cover and connect the power cord from the power supply module into a power strip or power distribution unit (PDU). SGI also recommends that you use an uninterruptible power supply (UPS) source.

Chassis Setup and Maintenance

This chapter covers the steps required to install components and perform maintenance on the IS2245 chassis. For component installation, follow the steps in the order given to eliminate the most common problems encountered. If some steps are unnecessary, skip ahead to the step that follows.

Tools Required: The only tool you will need to install components and perform maintenance is a Phillips screwdriver.



Warning: Review the warnings and precautions listed in the manual before setting up or servicing this chassis. These include information in [Chapter 2, “System Safety”](#) and the warning/precautions listed in the setup instructions.

Static-Sensitive Device

Electrostatic discharge (ESD) can damage electronic components. To prevent damage to any printed circuit boards (PCBs), it is important to handle them very carefully. The following measures are generally sufficient to protect your equipment from ESD damage.

Precautions

- Use a grounded wrist strap designed to prevent static discharge.
- Touch a grounded metal object before removing any board from its antistatic bag.
- Handle a board by its edges only; do not touch its components, peripheral chips, memory modules or gold contacts.
- When handling chips or modules, avoid touching their pins.
- For grounding purposes, make sure your computer chassis provides excellent conductivity between the power supply, the case, and the mounting fasteners.

Unpacking

If components are shipped in antistatic packaging, use static-protected gear when handling these components.

Removing the Chassis Cover

See the instructions in [“Remove the Chassis Cover”](#) on page 18.

Installing the Hard Drives

The chassis can support up to 45 hot-swappable SAS/SATA hard disk drives, 3.5" x 1". The actual number of supported disk drives is configuration-dependent. The disk drives are mounted to hot-swappable drive trays (see [Figure 4-1](#)).

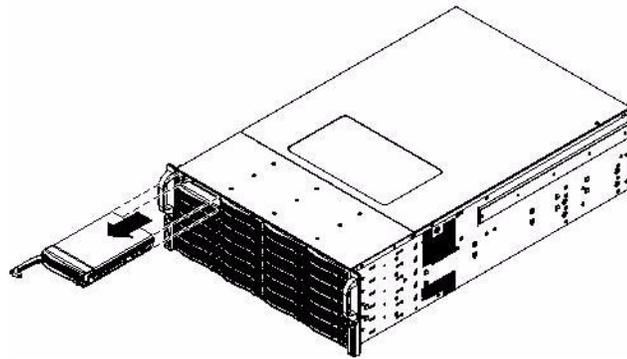


Figure 4-1 Removing the Hard Drive Carriers

The drives are mounted in driver carriers to simplify their installation and removal from the chassis.

Notes:

- Drive blanks must be used when no disk drive is used in a hard drive bay. This is necessary to maintain proper cooling of the chassis.
- Your operating system must have RAID support to enable the hot-plug capability of the drives.



Important: Regardless of how many hard drives are installed, all drive carriers must remain in the drive bays to maintain proper airflow.



Caution: Use caution when working around the SATA backplane. Do not touch the backplane with any metal objects and make sure no ribbon cables touch the backplane or obstruct the holes, which aid in proper airflow.

Removing the Hard Drive Carriers from the Chassis

To remove the hard drive carriers, perform the following steps (see [Figure 4-1](#)):

1. Press the release button on the drive carrier. This extends the drive carrier handle.
2. Use the handle to pull the drive carrier out of the chassis.

Installing a Hard Drive into the Hard Drive Carrier

To install a hard drive into the hard drive carrier, perform the following steps:

1. Remove the two screws securing the dummy drive to the drive carrier (see [Figure 4-2](#)).
2. Lift the dummy drive out of the drive carrier (see [Figure 4-2](#)).

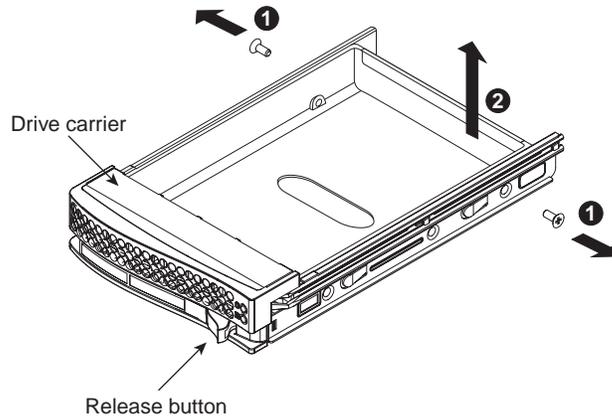


Figure 4-2 Removing the Dummy Drive from the Carrier

3. Place the hard drive carrier on a flat, stable surface such as a desk, table, or work bench.

4. Slide the hard drive into the carrier with the printed circuit board side facing down (see [Figure 4-3](#)).
5. Carefully align the mounting holes in the hard drive and the carrier. Make sure the bottom of the hard drive and bottom of the hard drive carrier are flush.
6. Secure the hard drive using all four screws (see [Figure 4-3](#)).
7. Replace the drive carrier into the chassis. Make sure to close the drive carrier using the drive carrier handle.

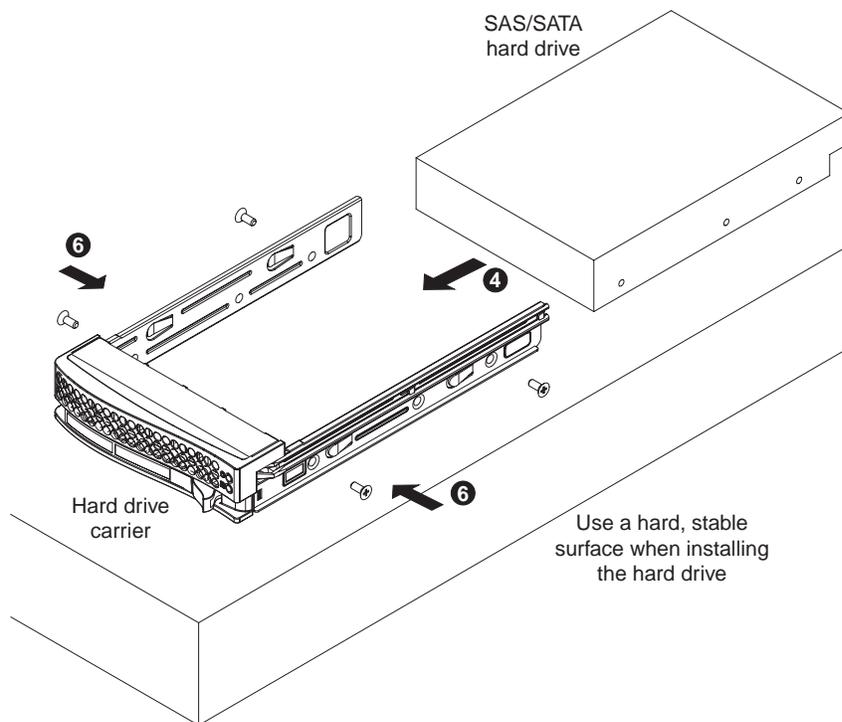


Figure 4-3 Installing a Drive into a Hard Drive Carrier

Chassis Maintenance

This section describes basic chassis maintenance.

System Fans

Seven hot-swappable, heavy-duty fans provide cooling for the chassis. These fans circulate air through the chassis as a means of lowering the internal temperature of the chassis (see [Figure 4-4](#)).

The IS2245 chassis fans are fully hot-swappable. In other words, fans may be removed and replaced without having to power down the system.

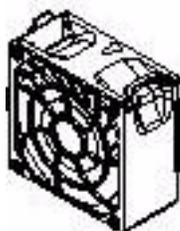


Figure 4-4 System Fan

Replacing a System Fan

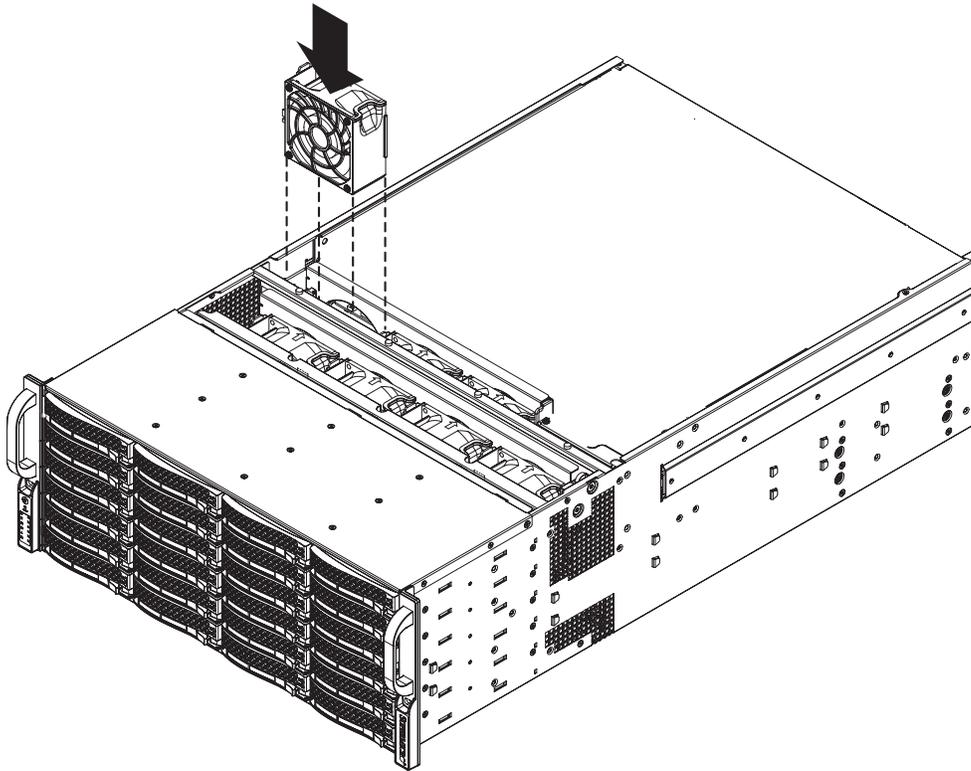


Figure 4-5 Replacing a Fan

To replace a fan, perform the following steps (See [Figure 4-5](#)):

1. Open the chassis while the power is running to determine which fan has failed.
Never run the system for an extended period of time with the chassis open.
2. Press the release tab on the fan and pull the fan up out of the chassis.
3. Slide the new fan into the fan housing while ensuring that the arrows on the top of the fan (indicating air direction) point in the same direction as the arrows of the other fans.
4. Ensure the fan is working properly before replacing the chassis cover.

Checking the System Air Flow

To check the IS2245 system air flow, perform the following steps:

1. Make sure there are no objects to obstruct airflow in and out of the system.
2. Do not operate the system without drives or drive trays in the drive bays.
3. Make sure no wires or foreign objects obstruct air flow through the chassis. Pull all excess cabling out of the airflow path or use shorter cables.

Power Supply

The IS2245 system has a 1400-watt switching power supply that operates from 100 – 240 volts AC and 50 – 60 Hz.

The power subsystem of the IS2245 system consists of an integrated power distribution module, a power module enclosure, and support for up to two power supply modules. The system can be configured with a single (1+0 non-redundant configuration) or dual power supply (N+1 configuration). Either configuration will support a maximum of 1200 watts of power.

The two power supplies are located in the left rear of the chassis.

In a single power supply configuration, the power supply is populated in the upper power supply slot. The non-operating slot must be filled with a power supply blank.

Note: The IS2245 will operate normally with a single power supply in either the top or bottom power supply bay. The top power supply bay is filled in systems configured with a single power supply.

Replacing the Power Supply

The power supply for the IS2245 system is redundant and hot-swappable. If you have this option (an additional power supply), you can replace the power supply with the system powered up, otherwise, the system must be powered off to replace the power supply.

To replace the power supply, perform the following steps:

1. The IS2245 system includes a redundant power supply (at least two power modules). The system may continue running if only one power supply module is removed at a time.
2. Unplug the power supply that will be replaced.
3. Push the release tab on the back of the power supply.
4. Pull the power supply out using the handle.
See [Figure 4-6](#).
5. Replace the failed power module with another of the same model.
6. Push the new power supply module into the power bay until it clicks into the locked position.
7. Plug the AC power cord back into the module and power up the system.

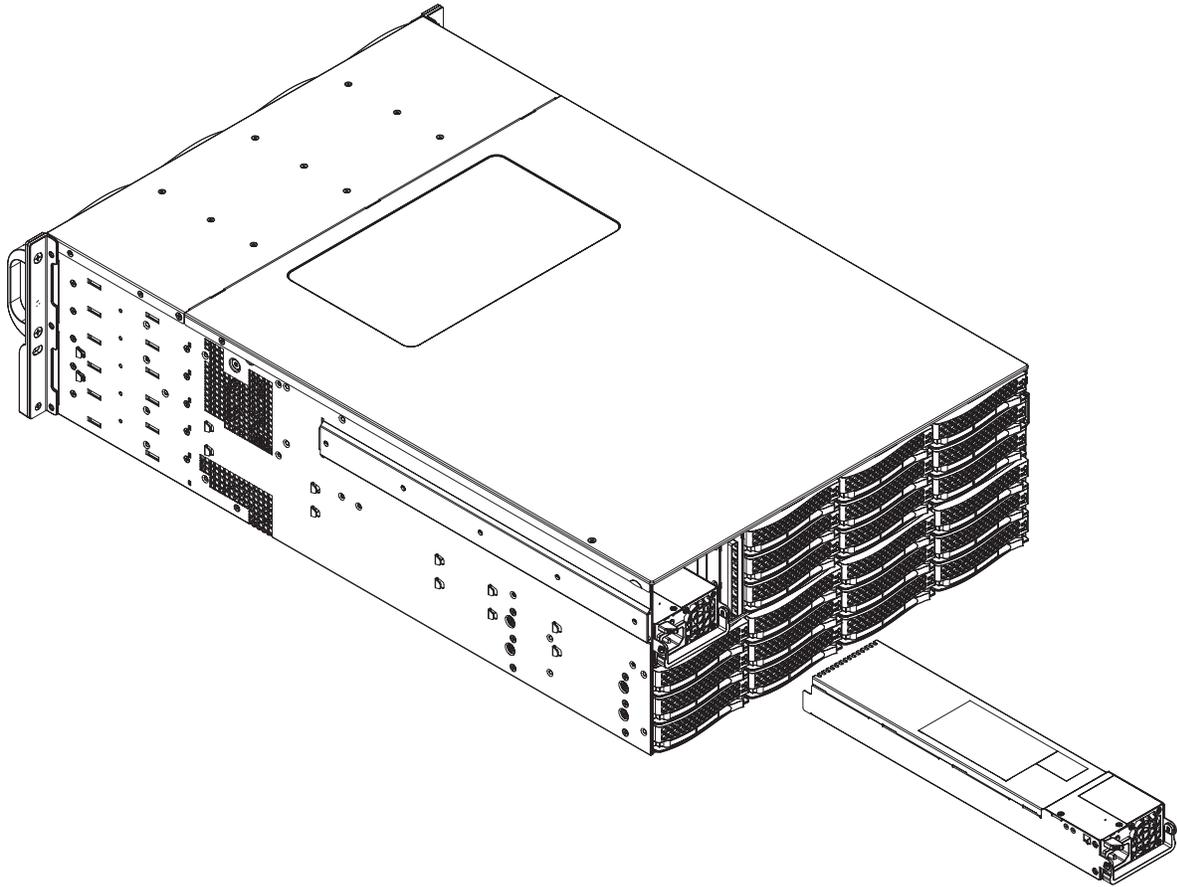


Figure 4-6 Replacing a Power Supply

System Monitoring

Overview

Shown in [Figure 5-1](#), the control panel is located on the left handle of the chassis front. There are several LEDs on the control panel as well as others on the drive carriers (see “[Drive Carrier LEDs](#)” on [page 35](#)) to keep you constantly informed of the overall status of the system as well as the activity and health of specific components. There are also two buttons on the chassis control panel. This chapter describes the buttons and LEDs.

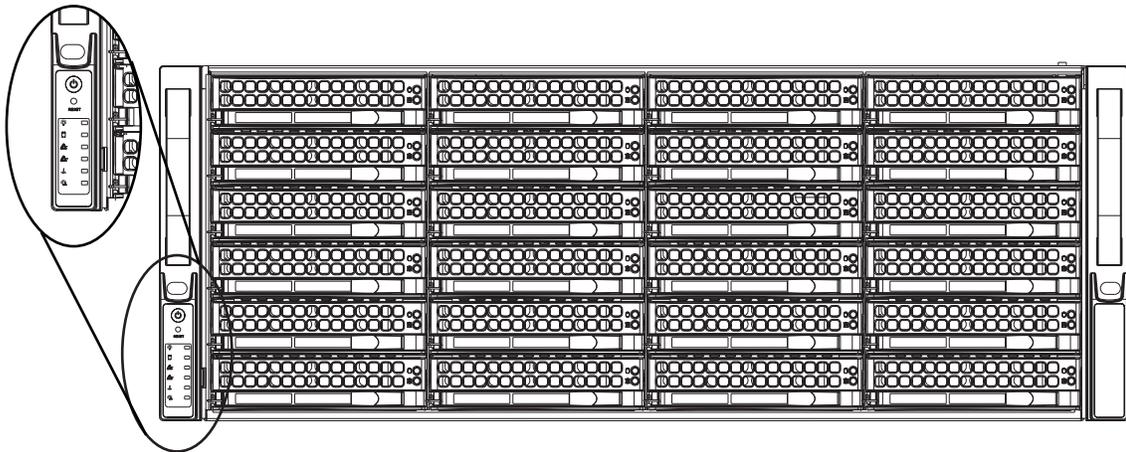


Figure 5-1 Control Panel Interface

Control Panel Buttons

There are two buttons located on the front of the chassis: a reset button and a power on/off button. The reset button, shown in [Figure 5-2](#), is not used.

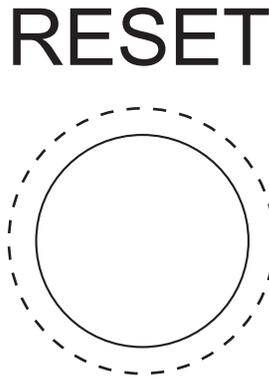


Figure 5-2 System Reset Button–Unused

[Figure 5-3](#) shows the the main power button, which is used to apply or turn off the main system power. Turning off system power with this button removes the main power but keeps standby power supplied to the system.

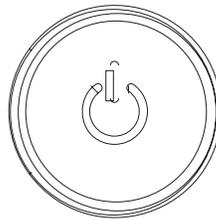


Figure 5-3 System Power On Button

Control Panel LEDs

The control panel located on the front of the chassis has six LEDs. These LEDs provide you with critical information related to different parts of the system. This section explains what each LED indicates when illuminated and any corrective action you may need to take.

Power

The green power LED indicates power is being supplied to the system's power supply units is shown in [Figure 5-4](#). This LED should normally be illuminated when the system is operating.



Figure 5-4 Power On LED

HDD

The amber HDD LED indicates hard drive drive activity when flashing (see [Figure 5-5](#)).

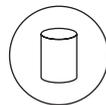


Figure 5-5 Hard Drive Activity LED

NIC1

Unused (see Figure 5-6).

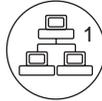


Figure 5-6 NIC1 LED

NIC2

Unused (see Figure 5-7).

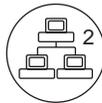


Figure 5-7 NIC2 LED

Overheat/Fan Fail

When the red overheat/fan LED flashes (shown in Figure 5-8), it indicates a fan failure. When on continuously it indicates an overheat condition, which may be caused by cables obstructing the airflow in the system or the ambient room temperature being too warm. Check the routing of the cables and make sure all fans are present and operating normally. You should also check to make sure that the chassis covers are installed. This LED will remain flashing or on as long as the indicated condition exists.

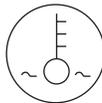


Figure 5-8 Overheat/Fan Fail LED

Power Fail

The red power fail LED indicates a power supply module has failed as shown in [Figure 5-9](#). The second power supply module will take the load and keep the system running but the failed module will need to be replaced. Refer to [“Power Supply” on page 28](#) for details on replacing a power supply. This LED should be off when the system is operating normally.



Figure 5-9 Power Fail LED

Drive Carrier LEDs

Each drive carrier has two LEDs:

- **Blue:** When illuminated, the blue LED on the drive carrier indicates drive activity. A connection to the SATA backplane enables this LED to blink on and off when that particular drive is being accessed.
- **Red:** When illuminated, the red LED indicates a drive failure. If one of the drives fails, you should be notified by your system management software. When the red LED is blinking, it indicates that the system is either building, initializing, or rebuilding RAID.

Refer to [“Installing the Hard Drives” on page 23](#) for instructions on replacing failed drives.

RAID Basics

To assist you in building RAID arrays, this chapter gives a general overview of RAID and describes various levels of RAID along with JBOD.

RAID Implementations

RAID can be implemented in either dedicated hardware or software running on standard hardware. Occasionally, you might want hybrid RAID systems—combining software- and hardware-based solutions.

With software implementations of RAID, the operating system manages the disks through the normal drive controller (SAS/SATA). Software RAID can be faster than hardware-based RAID at the cost of using CPU power. One exception to this is when a dedicated hardware RAID system has a write cache dedicated to managing the RAID.

A hardware implementation of RAID requires a RAID controller. This may be a PCIe expansion card or may be a card onboard the system motherboard in some systems. Disks may be of any type: SAS or SATA. The controller links to the system with a high-speed SCSI, or iSCSI connection. The controller handles the management of disks, including parity calculations (error checking) which is suited for larger arrays of disks. Hardware RAID tends to have better performance and makes operating system support easier. Hardware RAID typically supports *hot-swapping* of drives as well. Both hardware and software versions support the use of a hot spare, a preinstalled drive which is used to immediately replace a failed drive.

Some software RAID systems allow building arrays from partitions instead of whole disks.

The various RAID levels include the following:

Table A-1 RAID Levels

RAID Level	Feature
RAID 0	Striping
RAID 1	Mirrored
RAID 5	Parity
RAID 6	Dual parity
RAID 10	Mirrored stripes
RAID 50	Striping with parity
RAID 60	Striping with dual parity

RAID 0

RAID 0 (also known as a stripe set) splits data evenly across two or more disks with no parity information for redundancy. RAID 0 is not redundant. RAID 0 is used to increase performance, and can be used as a way to create a small number of large virtual disks out of a large number of small physical ones.

RAID 0 can be created with disks of differing sizes, but the storage that is added to the array by each disk is limited to the size of the smallest disk.

Example: A 120GB drive is striped with a 100GB drive. The size of the array will be 200GB (100+100).

RAID 0 is useful for read-only NFS servers where mounting many disks is time-consuming and redundancy is irrelevant.

JBOD (Just a Bunch of Disks)

JBOD is a popular method for combining multiple physical disk drives into a single virtual one. Disks are merely concatenated, beginning to end. JBOD is commonly used to turn several odd-sized drives into one useful drive.

One advantage JBOD has over RAID 0 is in the case of drive failure. When a single drive of a RAID 0 array fails, usually it will result in the loss of all data in the array. When a drive failure occurs in a JBOD array, only the data on the affected drive is lost.

RAID 1

RAID 1 creates an exact copy (or mirror) of all the data on two or more disks. This is useful where redundancy is more important than using all of the disk storage capacity. The array in a RAID 1 can only be as big as the smallest member disk. An ideal RAID 1 set contains two disks. Since each member can be addressed independently if the other fails, reliability is a linear multiple of the number of disks in the array. RAID 1 benefits most when an independent disk controller is used for each disk.

Seek time with a RAID 1 remains low because each drive can be accessed independently, and the requested sectors can be split evenly between disks. When writing, the RAID 1 array acts like a single disk because all writes must be written to all disks.

RAID 1 has administrative advantages: it allows 24/7 environments to do backups on the array. Mirroring is useful when critical data needs to be stored and backed up.

RAID 5

A RAID 5 array uses block-level striping with parity data distributed across all the member disks. RAID 5 is the most popular RAID level and is used in both hardware and software RAID. You can create a RAID 5 array using disks of different sizes, but the storage space added to the array by each disk will be limited to the size of the smallest disk in the array.

Example: If a 120GB disk is used to build a RAID 5 array with two 100GB disks, each disk will donate 100GB to the array. 200GB will be used for storage while 100GB will be used for parity information.

Every time a data block is written on a disk, a parity block is generated within the same stripe. If another block is written on that same stripe, the parity block is recalculated and rewritten. The disk used for the parity block is staggered from one stripe to the next.

The parity blocks are not read on data reads. The parity blocks are used when a read of a data sector results in a CRC (cyclic redundancy check) error. In a case like this, the sector in the same relative position within each of the remaining data blocks in the stripe and within the parity block are used to reconstruct the sector with the error. Also, if a disk were to fail in a RAID 5 array, the parity blocks from the surviving disks are combined mathematically with the data blocks from the surviving disks to reconstruct the data on the failed drive.

The maximum number of drives in a RAID 5 array are theoretically unlimited. However, with a greater number of disks in an array, there is a greater chance of drives failing in succession.

RAID 6 (Dual Parity)

Striped set with dual distributed parity. Provides fault tolerance from two drive failures; the array continues to operate with up to two failed drives. With dual parity, it gives time to rebuild the array without the data being volatile while the failed drive is being recovered.