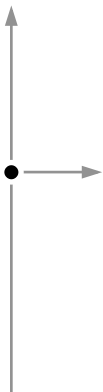


K2 Level 3 RAID

FIBRE CHANNEL STORAGE

Instruction Manual



071-8463-00
NOVEMBER 2005

the most watched worldwide

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Revision Status

Rev Date	Description
November 23, 2005	Initial release of K2 Level 3 RAID Instruction Manual. Part number 071-8463-00

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Safety Summaries

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety summary* in other system manuals for warnings and cautions related to operating the system.

Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry

To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Battery Replacement

To avoid damage, replace only with the same or equivalent type recommended by the circuit board manufacturer. Dispose of used battery according to the circuit board manufacturer's instructions.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:



WARNING: Warning statements identify conditions or practices that can result in personal injury or loss of life.



CAUTION: Caution statements identify conditions or practices that may result in damage to equipment or other property, or which may cause equipment crucial to your business environment to become temporarily non-operational.

Terms on the Product

These terms may appear on the product:

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

WARNING indicates a personal injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:



DANGER high voltage



Protective ground (earth) terminal



ATTENTION – refer to manual

Service Safety Summary



WARNING: *The service instructions in this manual are intended for use by qualified service personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries before performing service.*

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power

To avoid electric shock, disconnect the main power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On

Dangerous voltages or currents may exist in this product. Disconnect power and remove battery (if applicable) before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Certifications and Compliances

Canadian Certified Power Cords

Canadian approval includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

FCC Emission Control

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by Grass Valley can affect emission compliance and could void the user's authority to operate this equipment.

Canadian EMC Notice of Compliance

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

EN55103 1/2 Class A Warning

This product has been evaluated for Electromagnetic Compatibility under the EN 55103-1/2 standards for Emissions and Immunity and meets the requirements for E4 environment.

This product complies with Class A (E4 environment). In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

FCC Emission Limits

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

Laser Compliance

Laser Safety Requirements

The device used in this product is a Class 1 certified laser product. Operating this product outside specifications or altering its original design may result in hazardous radiation exposure, and may be considered an act of modifying or new manufacturing of a laser product under U.S. regulations contained in 21CFR Chapter 1, subchapter J or CENELEC regulations in HD 482 S1. People performing such an act are required by law to recertify and reidentify this product in accordance with provisions of 21CFR subchapter J for distribution within the U.S.A., and in accordance with CENELEC HD 482 S1 for distribution within countries using the IEC 825 standard.

Laser Safety

Laser safety in the United States is regulated by the Center for Devices and Radiological Health (CDRH). The laser safety regulations are published in the "Laser Product Performance Standard," Code of Federal Regulation (CFR), Title 21, Subchapter J.

The International Electrotechnical Commission (IEC) Standard 825, "Radiation of Laser Products, Equipment Classification, Requirements and User's Guide," governs laser products outside the United States. Europe and member nations of the European Free Trade Association fall under the jurisdiction of the Comité Européen de Normalization Electrotechnique (CENELEC).

Safety Certification

This product has been evaluated and meets the following Safety Certification Standards:

Standard	Designed/tested for compliance with:
UL1950	Safety of Information Technology Equipment, including Electrical Business Equipment (Third edition).
IEC 950	Safety of Information Technology Equipment, including Electrical Business Equipment (Second edition, 1991).
CAN/CSA C22.2, No. 950-95	Safety of Information Technology Equipment, including Electrical Business Equipment.
EN60950	Safety of Information Technology Equipment, including Electrical Business Equipment 1992.

Disposing of your used product



In the European Union — EU-wide legislation as implemented in each member state requires that used electrical and electronic products carrying the mark at left must be disposed of separately from normal household waste. The equipment with this mark may include electrical accessories (e.g. memory cards). When you dispose of such products, please follow the agreements made between you and Grass Valley. The mark on the electrical and electronic products only applies to the current European Union Member States. This statement is in compliance with European Commission Directive 2002/96/EC Waste Electrical and Electronic Equipment.

Outside the European Union — If you wish to dispose of used electrical and electronic products outside of the European Union, please contact your local authority and ask for the correct method of disposal.

Preface

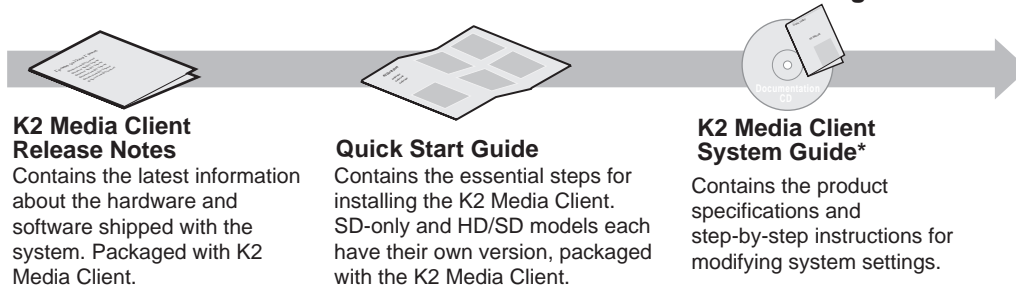
About this manual

The K2 Level 3 Fibre Channel RAID Storage Chassis provides RAID protected storage for the K2 Storage System. If you are responsible for installing and servicing K2 Level 3 RAID storage, you should read this manual.

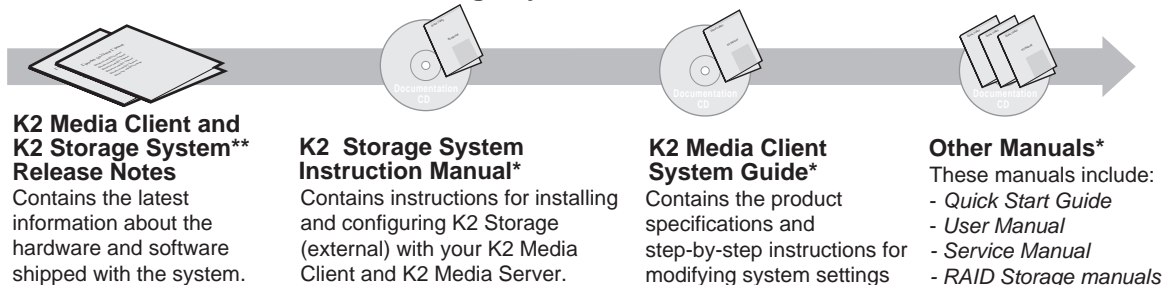
Using the K2 Documentation Set

The following illustration shows the recommended order in which to reference the documentation.

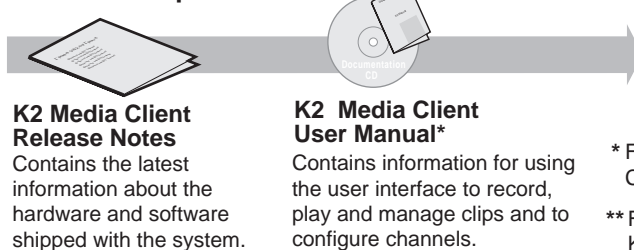
Path for the installer of K2 Media Client models with internal storage



Path for the installer of the K2 Storage System with connected K2 Media Clients



Path for the operator



* Find the K2 Documentation CD packaged with K2 Media Clients and with K2 RAID Storage devices, primary chassis.

** Find the K2 Storage System Release Notes packaged with K2 RAID Storage devices, primary chassis.

Documentation descriptions

Use the following descriptions to choose the other documentation you need as you install, operate, and maintain your system.

K2 Storage System Release Notes

The release notes contain the latest information about the software shipped on your system. The information in this document includes software upgrade instructions, software specifications and requirements, feature changes from the previous releases, and any known problems. Because release notes contain the latest information, they are printed out rather than included in the Documentation CD-ROM. You can find the release notes packaged with the RAID storage chassis.

K2 Media Client Quick Start Guides

The Quick Start Guides provides step-by-step installation instructions for basic installation and operation of the SD-only and the HD/SD K2 Media Client, including recording and playing clips. You can find the Quick Start Guide for your particular model packaged with the K2 Media Client.

Documentation CD-ROM

Except for the release notes and Quick Start guide, the full set of support documentation, including this manual, is available on the Documentation CD-ROM that you receive with your K2 Media Client. You can find the Documentation CD-ROM packaged with the RAID storage chassis.

The Documentation CD-ROM includes the following:

- **K2 Storage System Instruction Manual** — Contains installation, configuration, and maintenance procedures for shared storage options.
- **RAID Instruction Manuals** — There is an Instruction Manual for each type of RAID storage device that can be a part of a K2 Media Client. These manuals contain procedures for configuring and servicing the device.
- **K2 Media Client System Guide** — Contains the product specifications and step-by-step instructions for modifying system settings. Includes instructions for adding a K2 Media Client to the K2 Storage System.
- **K2 Media Client User Manual** — Describes the K2 Media Client and provides instructions for configuring and operating the product.
- **K2 Media Client Service Manual** — Contains information on servicing and maintenance.

How this manual is organized

The *K2 Level 3 RAID Storage Instruction Manual* is organized around the tasks you'll be performing to install and service your Fibre Channel RAID External Storage System. You can see this reflected in the chapter titles chosen for this manual. The following identifies and describes the chapters included in this manual:

Chapter 1, About the K2 Level 3 RAID storage

Introduces the K2 RAID Storage. You can read this chapter to get familiar with the K2 Level 3 RAID external storage key features and components.

Chapter 2, Level 3 RAID Installation Information

Describes how to install a K2 RAID Storage and K2 Level 3 Expansion Chassis, including rack mounting. Refer to the *K2 Media Client System Guide* for connection and configuration information.

[Chapter 3, Servicing the Level 3 RAID](#)

Describes how to replace FRUs, such as disk modules, and add disk modules and redundant FRUs.

[Chapter 4, Level 3 RAID Technical Specifications and Operating Limits](#)

This appendix consists of electrical and environmental specifications.

[Glossary](#)

The Glossary explains terms used throughout this manual.

Terminology used in this manual

K2 Media Client models with internal storage access their own RAID protected media storage drives, as a “standalone” system. K2 Media Client models with external storage access RAID protected media storage drives that are in a separate RAID chassis, such as the K2 Level 3 Fibre Channel RAID Storage Chassis. In order to avoid confusion between the two types of storage, the following terms will be used consistently throughout the K2 documentation:

K2 Storage System: specifically refers to external, or shared, storage.

K2 Media Client internal storage: refers to the internal storage system used in a standalone K2 Media Client.

Getting more information

Product information is readily available at the following sources:

On-line Help Systems

K2 Media Client Help — You can access the on-line help through the AppCenter user interface as follows:

- In the menu bar select **Help**, then choose **AppCenter Help Topics** from the drop-down menu.

NetCentral Help — From the NetCentral interface access on-line help as follows:

- For general help with NetCentral manager, select **Help | NetCentral Help Topics**.
- For help specific to monitoring K2 Media Client system devices, select **Help | Device Providers** and then select the monitored device.

Thomson Grass Valley Web Site

This public Web site contains all the latest manuals and documentation, and additional support information. Use the following URL.

<http://www.thomsongrassvalley.com>.

Grass Valley Product Support

To get technical assistance, check on the status of problems, or report new problems, contact Grass Valley Product Support via e-mail, the Web, or by phone or fax.

Web Technical Support

To access support information on the Web, visit the product support Web page on the Grass Valley Web site. You can download software or find solutions to problems by searching our Frequently Asked Questions (FAQ) database.

World Wide Web: <http://www.thomsongrassvalley.com/support/>

Technical Support E-mail Address: gvgtechsupport@thomson.net.

Phone Support

Use the following information to contact product support by phone during business hours. Afterhours phone support is available for warranty and contract customers.

United States	(800) 547-8949 (Toll Free)	France	+33 (1) 34 20 77 77
Latin America	(800) 547-8949 (Toll Free)	Germany	+49 6155 870 606
Eastern Europe	+49 6155 870 606	Greece	+33 (1) 34 20 77 77
Southern Europe	+33 (1) 34 20 77 77	Hong Kong	+852 2531 3058
Middle East	+33 (1) 34 20 77 77	Italy	+39 06 8720351
Australia	+61 3 9721 3737	Netherlands	+31 35 6238421
Belgium	+32 2 3349031	Poland	+49 6155 870 606
Brazil	+55 11 5509 3440	Russia	+49 6155 870 606
Canada	(800) 547-8949 (Toll Free)	Singapore	+656379 1390
China	+86 106615 9450	Spain	+ 34 91 512 03 50
Denmark	+45 45968800	Sweden	+46 87680705
Dubai	+ 971 4 299 64 40	Switzerland	+41 (1) 487 80 02
Finland	+35 9 68284600	UK	+44 870 903 2022

Authorized Support Representative

A local authorized support representative may be available in your country. To locate the support representative for your country, visit the product support Web page on the Grass Valley Web site.

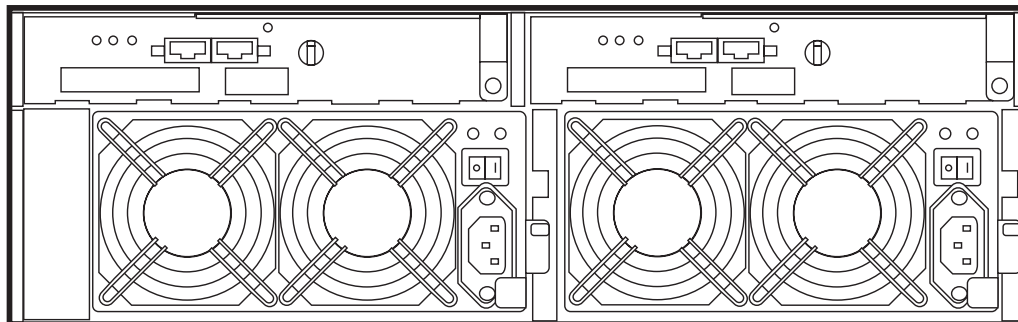
About the K2 Level 3 RAID storage

This chapter introduces the K2 RAID Storage. Topics include:

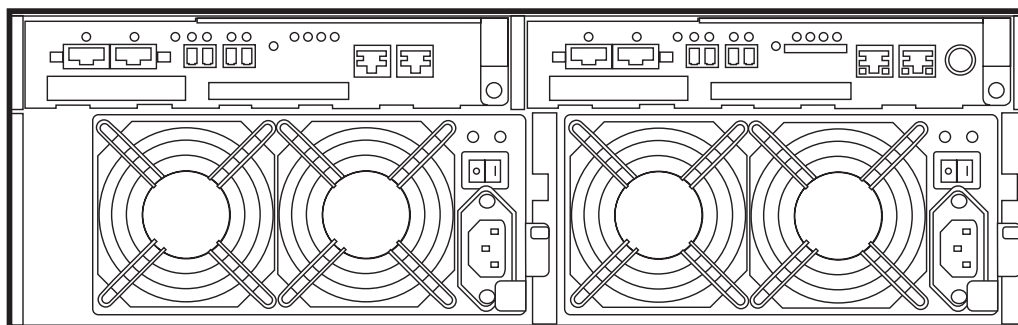
- “Level 3 RAID features” on page 15
- “Level 3 RAID components” on page 17
- “Configurations” on page 23

Level 3 RAID features

The K2 Level 3 RAID Storage is used in Level 3 and Level 3R K2 Storage Systems. The RAID storage device is a high performance, high availability mass storage system. The L3 RAID chassis 2Gb/s host interface supports industry standard Fibre Channel technology.



**L3 RAID
Expansion
Chassis**



**L3 RAID
Chassis**

Four FC host ports are available, so that the L3 RAID chassis can be connected directly to up to four media servers without Fibre Channel switches. The L3 RAID chassis utilizes dual FC-AL technology, allowing four loop configurations within a single chassis. Port-BypassCircuits have been added to maintain loop integrity during failures without user intervention. Each loop and associated Port Bypass Circuits along with all other active components are on redundant, separate hot swappable modules. With two RAID Controllers, the two loops within a single standard chassis are configured as a single loop with a backup loop in standby mode.

High-performance RAID processors that enable inter-controller communication at 2Gb/s are installed to implement the shared memory system. This feature not only enhances the performance, but also helps dynamic load balancing of the host interfaces.

The Switch based disk enclosures permits high-speed access to the disk drives being used.

The L3 RAID chassis contains from fifteen low profile 3.5" Fibre Channel Arbitrated Loop (FC-AL) disk drives. The chassis also supports one or two hardware RAID Controllers in one 3U high rack-mountable chassis.

The L3 RAID Expansion Chassis provides additional storage capacity. The Expansion Chassis has one or two Expansion Adapters installed. Up to seven L3 RAID Expansion Chassis can be connected to a single L3 RAID chassis comprising a single disk-array storage system with up to 120 drives.

NOTE: Grass Valley does not support mixing disk drives of differing capacities in a file system stripe group.

K2 Level 3 features

The K2 Level 3 provides 350 MB/s maximum data rate. Optical cables connect to hosts, such as to a K2 Media Server or to a Fibre Channel switch.

The Level 3 RAID supports up to seven K2 Level 3 RAID Expansion Chassis. It does not support connection to PFC500E, PFR500E, PFR600E, or PFR700E RAID Expansion Chassis.

Capacity and redundancy

The level 3 RAID contains five, ten, or fifteen low profile 3.5" Fibre Channel Arbitrated Loop (FC-AL) disk drives. The chassis also supports one or two hardware RAID controllers in one 3U high rack-mountable chassis. The Level 3 RAID currently uses 73GB, 146GB or 300GB drive capacities. With 15 drives, one chassis holds up to 876GB, 1.7TB, or 3.6TB depending on the disk drive option.

The Level 3 Expansion Chassis provides additional storage capacity. Up to seven Level 3 Expansion Chassis can be connected to a single K2 RAID Storage Chassis comprising a single disk-array storage system with a total of 120 drives and approximately 1.7TB, 3.4TB, 7.2TB of storage depending on the disk drive option. This provides for cost effective storage expansion as requirements grow.

Level 3 RAID components

The Level 3 RAID components are:

- The chassis with passive midplane board
- One or two RAID controllers (K2 Level 3R) or two expansion adapters
- As many as fifteen Fibre Channel disk drives per chassis
- Two RAID chassis power supplies (K2 Level 3) or expansion chassis power supplies

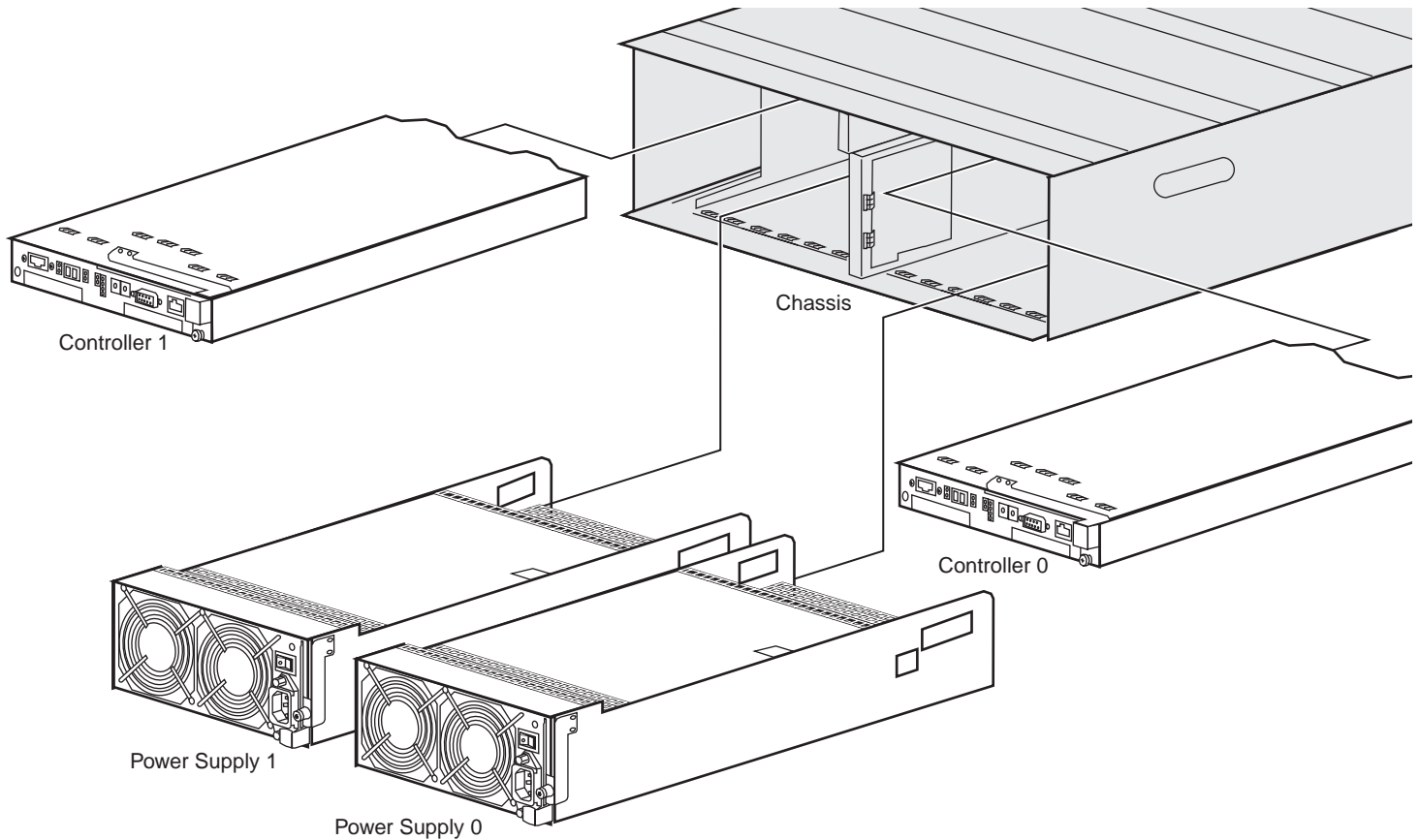
Any unoccupied slot (RAID controller or disk module) has a filler module to maintain air flow and compliance with electromagnetic interference (EMI) standards.

The RAID controllers, expansion adapters, disk drives and power supplies are hot-swappable field replaceable units (FRUs), which means you can add or replace them while the Level 3 RAID is powered up.

IMPORTANT: You must not hot swap operational RAID controllers or disk drives without first disabling the target component using the Grass Valley Storage Utility.

An optional second RAID controller module in the Level 3 RAID, allows for continued access to the Level 3 RAID if the primary RAID controller fails. Refer to the *K2 Storage System Instruction Manual* for detailed connection and configuration instructions.

The following figure shows the RAID Storage Chassis components. Details on each component follow the figure.



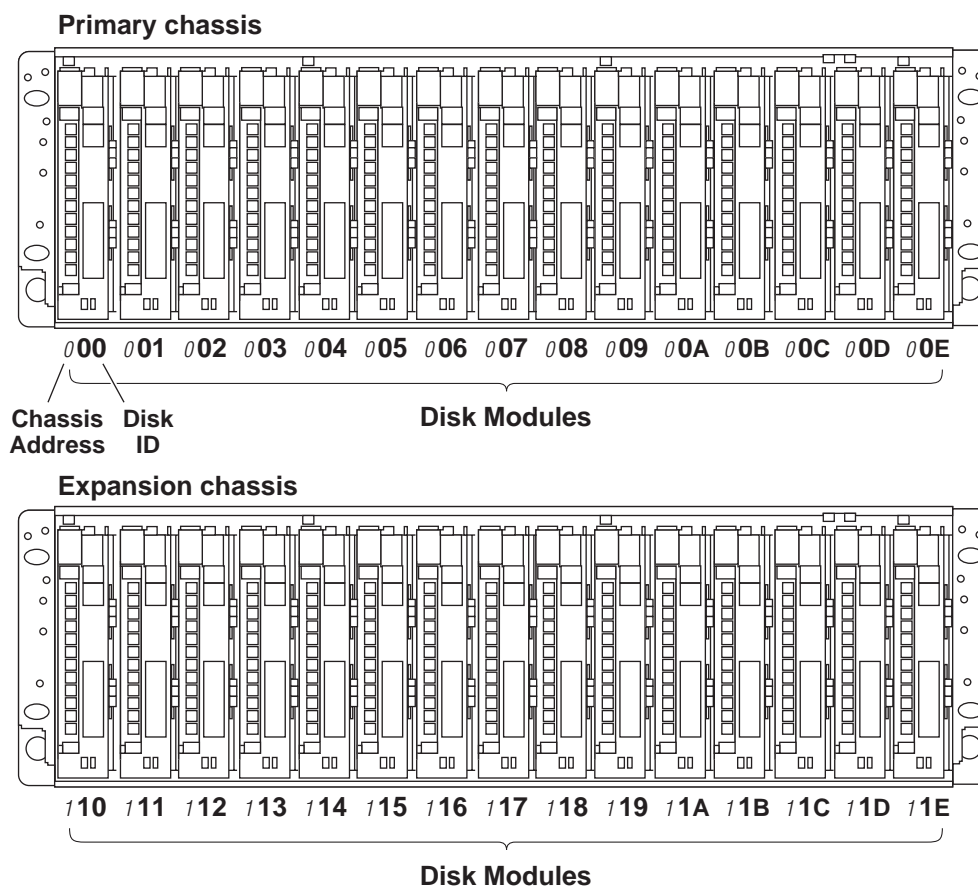
NOTE: Every Level 3 RAID chassis power supply includes a backup battery so that if electrical power is lost, data stored in cache memory will be saved. (Used for nearline storage only.)

Chassis

The chassis is a sheet-metal housing that contains a passive midplane and chassis slots for the RAID controllers or expansion adapters, disk drives, power supplies, and the LAN card.

A RAID chassis (which houses one or two RAID controllers) has a pre-set chassis address of 0. An expansion chassis (which houses one or two expansion adapters) must have its chassis address manually configured. This address is set by a control on the expansion adapter. Refer to your *K2 Storage System Instruction Manual* for information on setting the chassis address switch. See also, [“Addressing requirements” on page 26](#).

The following diagram shows how disk modules are identified based on the chassis address and physical location. The chassis with an address set to 0 contains drives from 00 to 0E; the expansion chassis with an address set to 1 contains drives from 10 to 1E.



An operating primary RAID chassis must have, at a minimum, the first three physical drives (00 - 02) installed, as the RAID configuration information is written to these drives. Microcode is also written to these disks when RAID controller microcode is loaded.

Midplane

The midplane distributes power and signals to all the chassis components. All FRUs plug directly into midplane connectors.

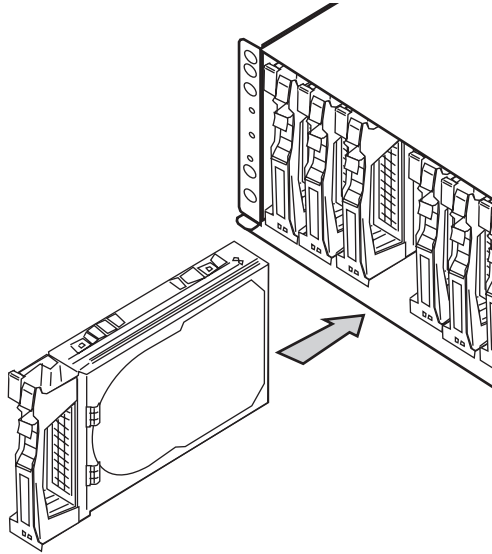
Disk modules

Each disk module consists of a Fibre Channel disk drive in a carrier assembly. If a disk drive fails, and needs replacing, you can do so while the RAID Storage Chassis is powered up. Replacement disk drives begin rebuilding immediately after being installed. (See [“Removing and installing disk modules” on page 43.](#))

The disk drives are 3.5-inch FC-AL drives that conform to the Fibre Channel Arbitrated Loop (FC-AL) standards and support dual-port FC-AL interconnects through the two RAID controllers and their cabling.



NOTE: *Once the Level 3 RAID is installed and configured, the disk modules become slot dependent. Moving disk modules between physical slots will result in loss of data and the need to reconfigure the system.*



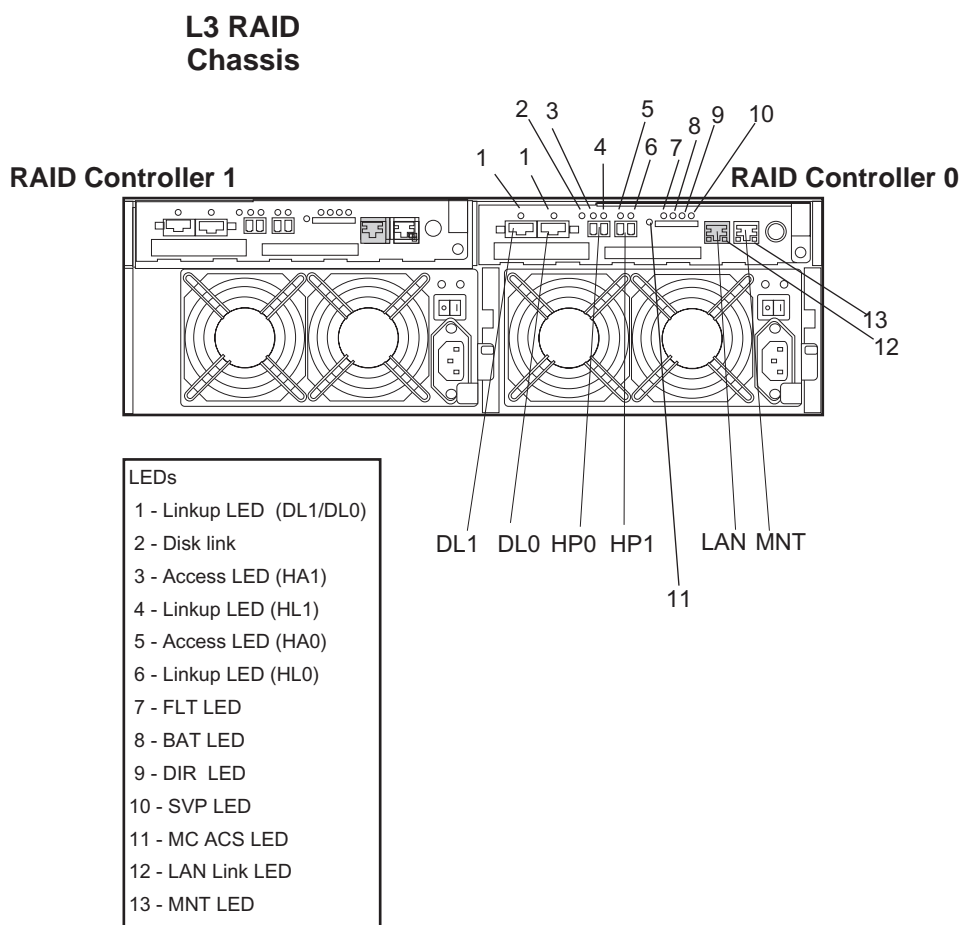
Level 3 RAID Circuit board modules

There are two circuit board modules used: the RAID controller module and the expansion adapter. The RAID controller module is in the primary RAID chassis. It manages the disk drives and provides a Fibre Channel interface to the K2 Media Server system or Fibre Channel switch fabric. The expansion adapter is in an Expansion chassis. It manages the disk drives, in conjunction with the connected RAID controller and provides a Fibre Channel interface to the primary chassis.

Level 3 RAID Storage Chassis circuit board modules

The K2 Level 3R includes one or two RAID controller modules. This provides redundant Fiber Channel interface ports.

The following figure shows a K2 Level 3 RAID Storage Chassis with the two RAID controller modules installed.

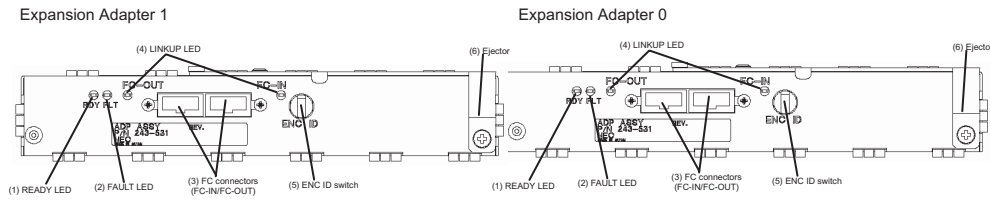


The RAID controller module has four Fibre Channel ports: two Host Fibre Channel Ports (HP0/HP1) and two Expansion Chassis Ports (DL1/DL0). The Host Fibre Channel Ports require LCC cables (optical) for the Fibre Channel connection to a K2 Media Server or to a Fibre Channel switch. The Expansion Chassis Ports require HSSDC cables (copper) for the Fibre Channel connections with a Level 3 Expansion Chassis. This extends the Fibre Channel loop of the corresponding K2 Level 3 chassis. There is a port status LED for each Fibre Channel port. Refer to [“Interpreting controller status LEDs”](#) on page 39.

When the redundant Fiber Channel option is not installed in the K2 Level 3 RAID Storage Chassis, only one RAID controller is installed. A blank fills the other RAID controller slot.

K2 Level 3 RAID Expansion Chassis circuit board modules

The K2 Level 3 RAID Expansion Chassis has two expansion adapters as shown in the following figure.



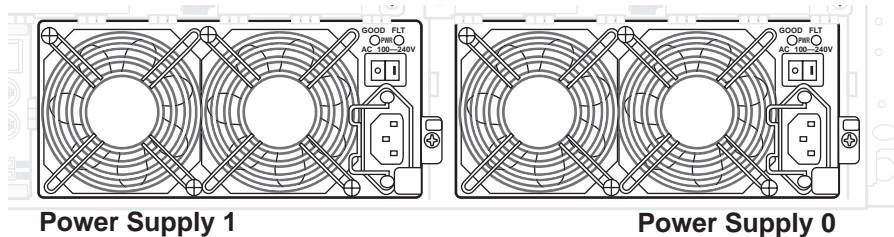
The expansion adapter in the K2 Level 3 has two Fibre Channel ports: FC-IN and FC-OUT. HSSDC (copper) Fibre Channel cabling connects the FC-IN port to a K2 Level 3. This extends the Fibre Channel loop of the corresponding K2 Level 3 chassis. There is a port status LED for each Fibre Channel port. Refer to [“Interpreting expansion adapter status LEDs”](#) on page 42.

NOTE: The K2 Level 3 Expansion chassis and K2 Level 3 Controller chassis must be powered on and off in the proper sequence. Refer to proper power procedures in [Chapter 2, “Level 3 RAID Installation Information”](#).

Power supplies

There are two auto-ranging power supplies, power cord and standby switch. Each supply supports a fully configured K2 Level 3 External RAID and shares load currents with the other supply, if it is present. The power supplies are designed so as to protect the disk drives if you install them while the K2 Level 3 External RAID is powered up. A disk with power-related faults will not adversely affect the operation of any other disk.

The RAID chassis and the expansion chassis each have their own type of power supply. The two types are not interchangeable.



Each power supplies includes two fan modules used to cool the components installed in the K2 Level 3 External RAID chassis. Each power supply has status LEDs visible from the rear panel. The status LEDs are described in the [“Interpreting power supply status LEDs”](#) on page 43. You can add or remove one power supply in the RAID Storage Chassis while the RAID Storage Chassis is powered up.

Configurations

The K2 Level 3 minimum and maximum configurations are as follows.

K2 Level 3 Configuration	RAID Controllers	Power Supplies	Disk Modules
minimum (level 3)	1	2	5
maximum (level 3R)	2	2	15

The maximum configuration provides the most redundancy, and therefore the highest degree of system availability.

The K2 Level 3 RAID Expansion Chassis minimum and maximum configurations are as follows.

Level 3 Expansion Chassis Configuration	Expansion Adapter	Power Supplies	Disk Modules
minimum (level 3)	2	2	5
maximum (level 3R)	2	2	15

Level 3 RAID Installation Information

This chapter describes information you'll need to install the K2 RAID Storage (K2 Level 3 Expansion Chassis). Major topics are:

- [“Installation requirements”](#)
- [“Installing a K2 Level 3 RAID Storage in an equipment rack”](#)
- [“K2 Level 3 RAID Storage power-up and initialization”](#)
- [“K2 Level 3 RAID Storage power-down”](#)

Installation requirements

This section describes the following requirements:

- [“Site requirements” on page 25](#)
- [“Addressing requirements” on page 26](#)
- [“Cabling requirements” on page 26](#)
- [“Binding disk modules into groups” on page 27](#)

Site requirements

For proper K2 Level 3 Expansion Chassis operation, the installation site must conform to certain environmental specifications. These are detailed below and in [Chapter 4, *Level 3 RAID Technical Specifications and Operating Limits*](#).

Power

Refer to [“Data handling specifications” on page 55](#) for AC power requirements. The values indicate either the values for the power cord of a K2 Level 3 Expansion Chassis with a single power supply, or the total values shared by the line cords of two power supplies in the same K2 Level 3 Expansion Chassis, with the division between the power cords and supplies at the current sharing ratio. If one of the two power supplies fails, the remaining supply and cord must support the full load. You must use a rack mount cabinet with ac power distribution, and have main branch ac distribution that can handle these values for the number of K2 Level 3s and K2 Level 3 Expansion Chassis units that you will interconnect.

Cooling

Make sure your site has air conditioning of the correct size and placement to maintain the specified ambient temperature range. The air conditioning must be able to handle the requirements of the K2 Level 3s and any connected Level 3 Expansions as indicated under [“Environmental limits” on page 56](#).

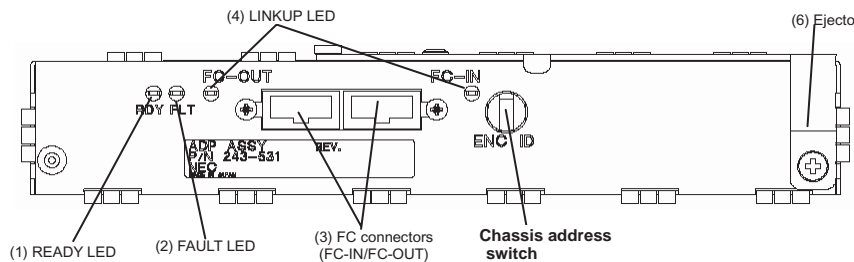
Addressing requirements

There are two addresses for the K2 Level 3: the Fibre Channel Arbitrated Loop address ID (FC-AL address ID) and the chassis address. If you have a custom system that needs multiple primary RAID chassis connected to an FC switch, consult your Grass Valley representative.

Chassis address setting requirement

The chassis address for a K2 Level 3 primary RAID chassis is pre-set at 0 and does not need to be configured.

Each Level 3 Expansion expansion chassis must have its chassis address configured. This is set by the chassis address switch, which is located on the expansion adapter. The following figure identifies the switch.



Set the switch as explained in the *K2 Storage System Instruction Manual*.

NOTE: When the switches of the left and right adapters are set differently, the FAULT LEDs blink and the Expansion chassis is not started. If different values are set, turn off the power of the system including the Expansion chassis, re-set the values to 1, and turn on the power again.

Cabling requirements

It is recommended that you use the Fibre Channel cables shipped with your K2 Level 3 Expansion Chassis when making connections. For cable specifications, refer to [“Cable lengths” on page 55](#).

Optical cables must meet the appropriate 2-Gbit FC-AL loop standards. You must use this type of cable to connect a host to the K2 Level 3 controller.

Copper cables must meet the appropriate standards for 2-Gbit FC-AL loops. You must use this type of cable to connect Expansion chassis.

Do not leave an unused (that is, dangling) cable connected to a Fibre Channel port because it may cause excess noise on the loop.

NOTE: Also refer to the *K2 Storage System Instruction Manual* for cabling diagrams and step-by-step instructions.

Binding disk modules into groups

After cabling a K2 Level 3 and any Level 3 Expansions, you must bind disk modules into LUNs using the Storage Utility provided by Grass Valley. Refer to the *K2 Storage System Instruction Manual* for information on using the Storage Utility to bind drives.

NOTE: Make sure you allow adequate time for binding disk modules into LUNs. K2 Level 3 RAID controllers bind multiple LUNs at the same time, yet take more than an hour to bind a LUN. Large drive capacities and multiple LUNs can increase the binding time to 10 hours or more.

Installing a K2 Level 3 RAID Storage in an equipment rack

Use the information in this section to unpack the K2 Level 3 RAID Storage chassis and mount in an equipment rack.

Procedures include:

- “Unpacking the chassis”
- “Installing the rack mounts”
- “Inserting the K2 Level 3 RAID Storage chassis in the rack”

Unpacking the chassis

Unpack the Level 3 RAID chassis, cables, and installation kit, as illustrated by the diagram on the outside of the packing box.

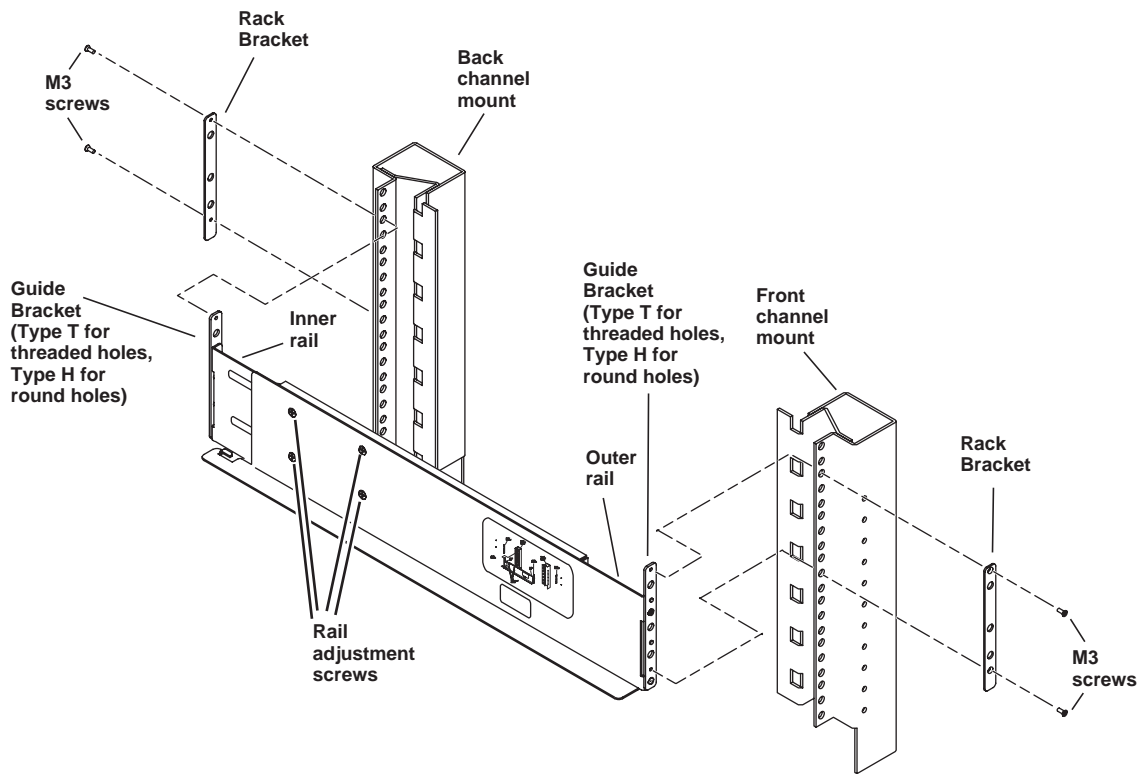


CAUTION: A Level 3 RAID chassis is heavy. Two people should lift and move it.

NOTE: Save the chassis packaging. Use only K2 approved packaging to ship.

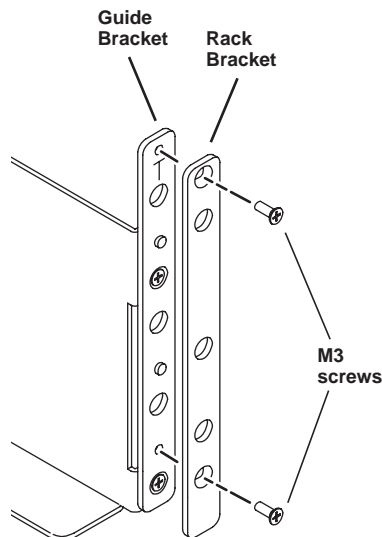
Installing the rack mounts

The following diagram and procedure describe installing the right side rail. Installation is similar for the left side rail.

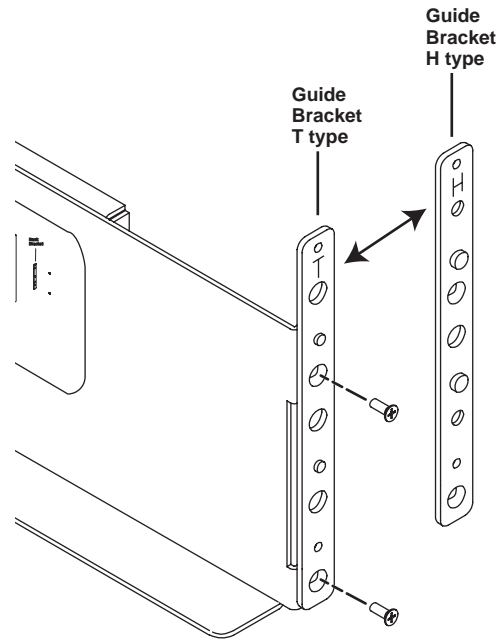


To install the K2 Level 3 RAID Storage rack mounts:

1. Remove the rack brackets from the guide brackets at both ends of the rail. Save the rack brackets and the M3 screws, as they are used later in this procedure.



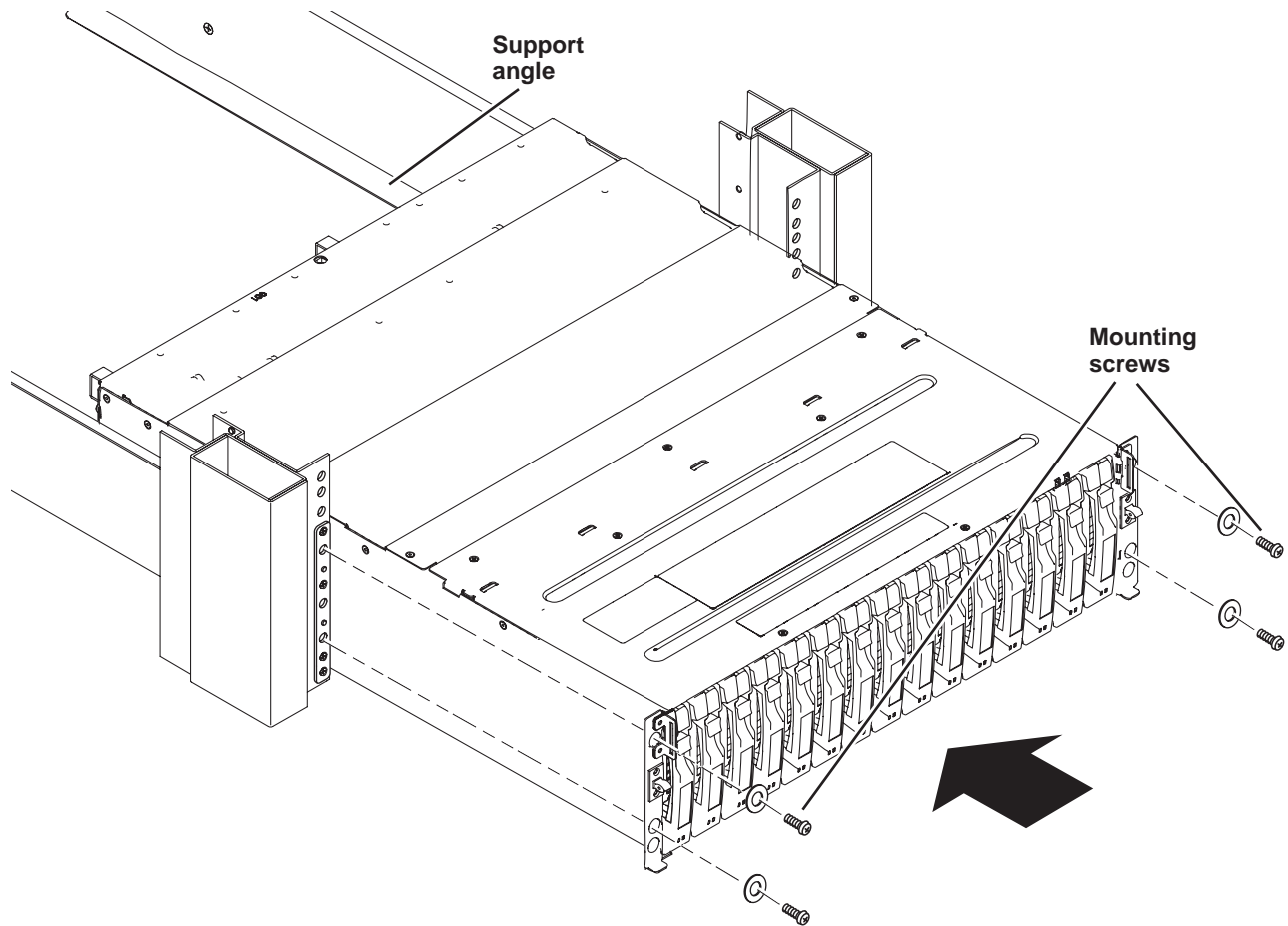
2. If your rack has 10-32 threaded holes, skip ahead to the next step in this procedure.
If your rack has 0.281-inch round holes, at both ends of the rail replace the T type guide brackets with the H type guide brackets.



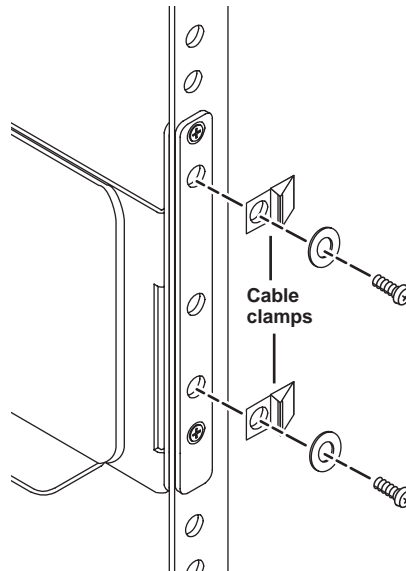
3. Loosen the rail adjustment screws so that the inner rail slides freely.
4. Align the mounting holes on the outer rail guide bracket with the front channel mount holes. The protrusions on the guide bracket guide the rail to appropriate positions on the rack.
5. Place the two M3 mounting screws through the rack bracket, through the front channel mount holes, and into the mounting holes on the guide bracket. Tighten the screws to secure the outer rail to the front channel mount.
6. Move to the rear of the rack and pull the inner rail toward you to align the inner rail guide bracket mounting holes with the back channel mount holes. The protrusions on the guide bracket guide the rail to appropriate positions on the rack.
7. Place the two mounting screws through the rack bracket, through the back channel mount holes, and into the mounting holes on the guide bracket. Tighten the screws to secure the outer rail to the back channel mount.
8. Firmly tighten the rail adjustment screws.
9. Repeat this procedure for the other side rail.

Inserting the K2 Level 3 RAID Storage chassis in the rack

1. Rest the chassis on the support angles shown. Slide the chassis back and into place
2. Secure the chassis to the rack with the 10-32 mounting screws. On racks with threaded holes the mounting screws engage the rack's threaded holes. On racks without threaded holes the mounting screws engage the H type guide bracket's threaded holes.



3. At the rear of the rack, insert and tighten the 10-32 mounting screws, with cable clamps, through the rear rack brackets. On racks with threaded holes the mounting screws engage the rack's threaded holes. On racks without threaded holes the mounting screws engage the H type guide bracket's threaded holes.



The 10-32 screws in the rear provide necessary reinforcement to the M3 screws.

4. Repeat this procedure to insert each K2 Level 3 RAID Storage chassis in the rack.

K2 Level 3 RAID Storage power-up and initialization

This section gives information about connecting power and powering-on the K2 Level 3 RAID Storage system.

Connecting electrical cables

For each chassis, there are two electrical cables (one for each power supply) that should be connected to separate outside power sources.



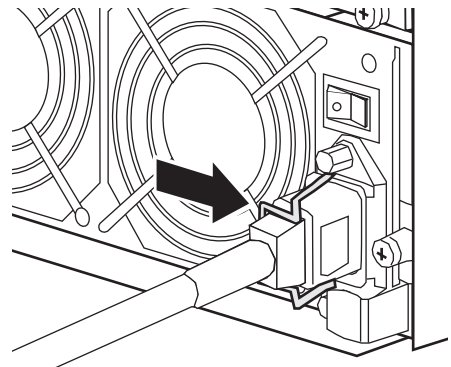
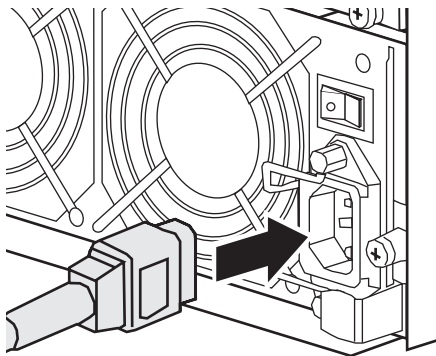
WARNING: Make sure the power cords meet local safety and electrical standards.



CAUTION: The K2 Level 3 RAID Storage system must be electrically grounded. Operating the system without proper grounding can damage disk drives. If the outlet you use is not grounded, make sure that a licensed electrician replaces it and installs a grounding conductor.

To prevent the plug from being inadvertently disconnected, secure the electrical cable into the outlet by doing the following:

1. Check that the power switch on the RAID chassis and those on the host system are all set to OFF.



2. Insert the power cord into the power supply.
3. Secure the power cord with the stopper.
4. Insert the plug of the power cord into an AC outlet. Use a grounded AC outlet.

Powering-up the K2 Level 3 RAID Storage system

1. Power-up the Level 3 Expansion Expansion chassis prior to or at the same time as the K2 Level 3 Controller chassis.

NOTE: You must always power-up the Level 3 Expansion Expansion chassis prior to, or at the same time as, the K2 Level 3 RAID controller chassis. Failure to do so may prevent some LUNs in the expansion chassis from being recognized.

Before turning on the AC power, check for loose disk drives by pushing each disk drive.

2. Turn on power switches on both power supplies.

When turning on the power switches, confirm that the POWER GOOD LEDs (green) on all the power supplies and POWER LEDs (green) on the front panel of the RAID chassis and Expansion chassis go on. The power supply starts, and the POWER LED (green) is on while the power switches are on.

The RAID chassis performs the self-test and initialization immediately after the power is turned on. When the self-test and initialization terminate and the RAID chassis becomes ready, the READY LED of the controller stops flashing and enters the on state.

3. Confirm that the READY LED is on, and then turn on the host system.

The chassis takes four minutes (at maximum) to start.

Refer to sections in [Chapter 3, “Servicing the Level 3 RAID”](#) for information on interpreting status LED behavior.

NOTE: Refer to the *K2 Storage System Instruction Manual* for complete system power-up procedures.

K2 Level 3 RAID Storage power-down

NOTE: If your K2 Level 3 RAID Storage system is part of a shared storage system, refer to the *K2 Storage System Instruction Manual* for instructions on shutting down the shared storage before powering down a K2 Level 3 RAID Storage.

To power-down the K2 Level 3 RAID Storage correctly:

1. Stop all read/write activity to the K2 Level 3 RAID Storage storage system.
2. On the RAID controller chassis, turn off power switches on both power supplies.
3. On the Expansion chassis, turn off both power switches on both power supplies.

Alternatively, turn off all power switches of the RAID controller chassis and the Expansion chassis at the same time.



CAUTION: You must always power down the K2 Level 3 RAID controller chassis prior to, or at the same time as the Level 3 Expansion Chassis.

To turn on power, refer to [“K2 Level 3 RAID Storage power-up and initialization” on page 33](#).

Battery Backup

Every K2 Level 3 RAID chassis power supply includes a backup battery so that if electrical power is lost, data stored in cache memory will be saved. [Nearline storage only.]

Servicing the Level 3 RAID

This chapter describes how to monitor K2 Level 3 External RAID status and replace Field Replaceable Units (FRU).

Topics include:

- “Maintenance procedures using Grass Valley Storage Utility” on page 35
- “Monitoring K2 Level 3 External RAID status using NetCentral” on page 35
- “Interpreting disk module LEDs” on page 38
- “Interpreting controller status LEDs” on page 39
- “Interpreting expansion adapter status LEDs” on page 42
- “Interpreting power supply status LEDs” on page 43
- “Removing and installing disk modules” on page 43
- “Replacing a RAID controller or expansion adapter” on page 46
- “Replacing a power supply” on page 49

Maintenance procedures using Grass Valley Storage Utility

Several maintenance procedures can be performed using the Grass Valley Storage Utility.

To perform the following tasks, refer to the *K2 Storage System Instruction Manual*:

- Checking RAID controller microcode version
- Loading RAID controller microcode
- Identifying disk modules prior to removal
- Downloading K2 Level 3 disk drive firmware
- Disabling a K2 Level 3 RAID controller for removal
- Disabling a K2 Level 3 disk module for removal
- Configuring K2 Level 3 network and SNMP settings

Monitoring K2 Level 3 External RAID status using NetCentral

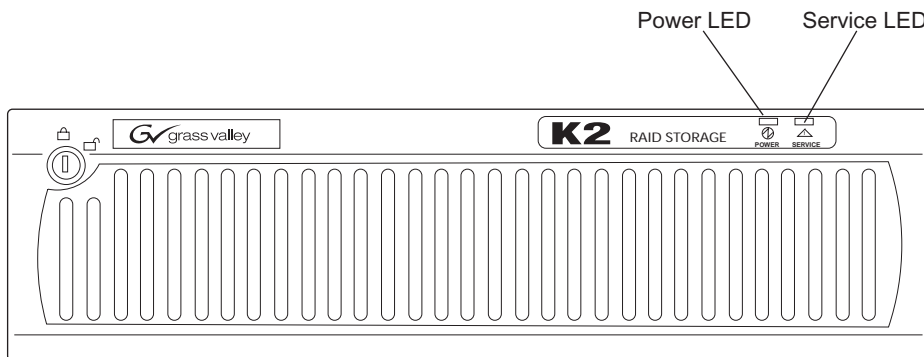
You can monitor K2 Level 3 External RAID Storage systems using Grass Valley’s NetCentral monitoring software. Enabled by SNMP, NetCentral can continuously monitor the storage system and send notifications if there is a problem. The SNMP agent software required for NetCentral monitoring resides on the RAID storage device itself. As a result, the K2 Level 3 External RAID appears in NetCentral as a standalone device rather than as a subsystem of the K2 Media Client.

Communication with NetCentral takes place over the Ethernet connection on each RAID controller. To monitor the K2 Level 3 External RAID, you must connect network cabling, power on the system, then configure network and SNMP settings as described in the *K2 Storage System Instruction Manual*.

Refer to the *NetCentral On-line Help* for information on monitoring the Level 3 RAID with NetCentral.

Interpreting front panel LEDs

Use the following illustration and table to identify and interpret front panel LEDs.



Primary RAID chassis

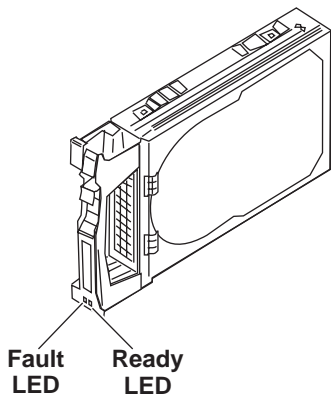
Operating Condition	Power LED	Service LED	Meaning
Running	On	Off	DC power is being supplied to the system.
	On	On	Temperature alarm
	On	On	Resources in online status are missing or invisible, as in one or more of the following: - The controller is down. - At least one Backup Battery Unit on power supply is faulty. - At least one fan on the power supply is faulty. - One or more power alarms are in effect - A disk drive (RAID chassis or Expansion chassis) is faulty. - An Expansion adapter is faulty. - The logic is occluded. - The logic is degraded. - The logic is being restored. - The logic is being restored to the hot spare.
Starting up	On	Flash	Chassis is between power-on and ready state.
	On	Flash (5 sec.) and Off (7 sec.)	Backup data is lost due to excess of data retaining period in Backup Battery Unit. (Nearline only)
Shutting down	Flash	Off	Shutdown sequence is being executed.
	Off	Off	Shutdown sequence is complete.

Expansion chassis

Operating Condition	Power LED	Service LED	Meaning
Running	On	Off	The chassis is operating normally.
	Off	On	The FAULT LED is lit on one or more disks
			Fault detected on one or more power supplies
			High temperature on one or more Expansion chassis
			Fault on one or more fans
			One or more temperature sensors failed
Starting up	Off	Off	System startup
	On	Off	Startup successful. Entering ready state.
	Off	On —> Off	The ESD is successfully initialized and operating normally.
	Off	On	Faulty condition or illegal switch setting detected on ESD.

Interpreting disk module LEDs

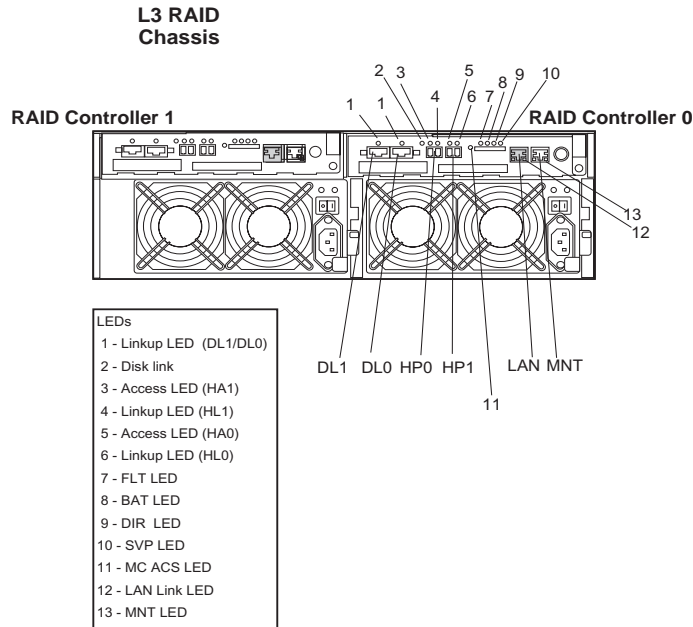
Use the following illustration and table to identify and interpret disk module LEDs



Ready LED	Fault LED	Meaning
On	Off	Normal state
On	On	Fault state
Off	Off	Disk module power off
Long period Flash or Off	Off	The disk module SPM is being stopped
Flash	Off	The disk module SPM is starting up.
On	Off	The disk module is in ready state.
Flash	Off	The disk module is being formatted
Off	Off	The disk module is processing commands

Interpreting controller status LEDs

Use the following illustration and table to identify and interpret controller LEDs.



SVP LED	DIR LED	FLT LED	Meaning
—	—	On	The controller is faulty
Flash	Flash	Off	The controller is successfully booted
Flash	On	Off	The controller is being booted
Flash	Busy flashing	Busy flashing	Firmware is being updated automatically
Flash (synchronized with Fault LED)	Off	Flash (synchronized with SVP LED)	Download mode
Busy flashing	Flash	Off	Online downloading is being executed through maintenance PC.

SVP LED	DIR LED	FLT LED	Meaning
—	—	On	The controller is faulty
Flash	Flash	Off	The controller is successfully booted

SVP LED	DIR LED	FLT LED	Meaning
Flash	On	Off	The controller is being booted
Flash	Busy flashing	Busy flashing	Firmware is being updated automatically
Flash (synchronized with Fault LED)	Off	Flash (synchronized with SVP LED)	Download mode
Busy flashing	Flash	Off	Online downloading is being executed through maintenance PC.

HL0/1	HA0/1	Meaning
On	Off	The host Fibre Channel link-up is being executed
Off	Off	The host Fibre Channel link-down is being executed
Flash	Flash	Host Fibre Channel port offline
Flash twice in 2 sec.	Flash twice in 2 sec.	Wait for setting for host Fibre Channel port

DL0/1	Meaning
On	The Fibre Channel link-up is being executed on the Expansion chassis
Off	The Fibre Channel link-down is being executed on the Expansion chassis

DISKLINK	Meaning
On	The Fibre Channel link-up is in progress on the internal Ezpansion Chassis side
Off	The Fibre Channel link-down is in progress on the internal Ezpansion Chassis side

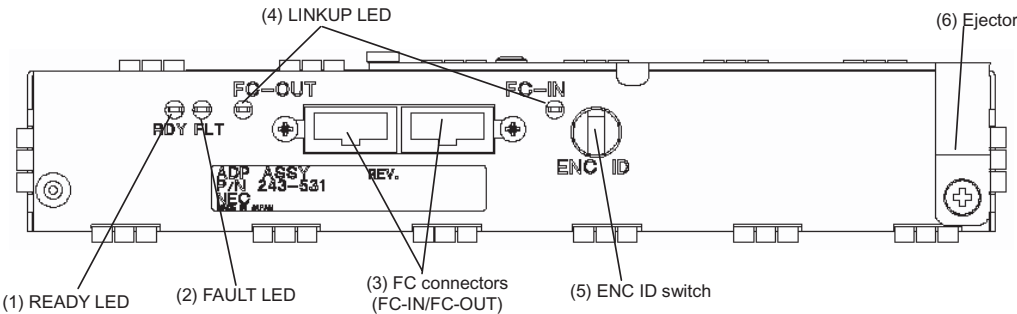
MC ACD LED (ACS)	Meaning
On	SD card is being accessed

MNT Port LED (L/A)	Meaning
On	The port becomes operable (to link up)
Off	The port is sending data

LAN Port LED (L/A)	Meaning
On	The connection is being established
Off	The port is sending data

Interpreting expansion adapter status LEDs

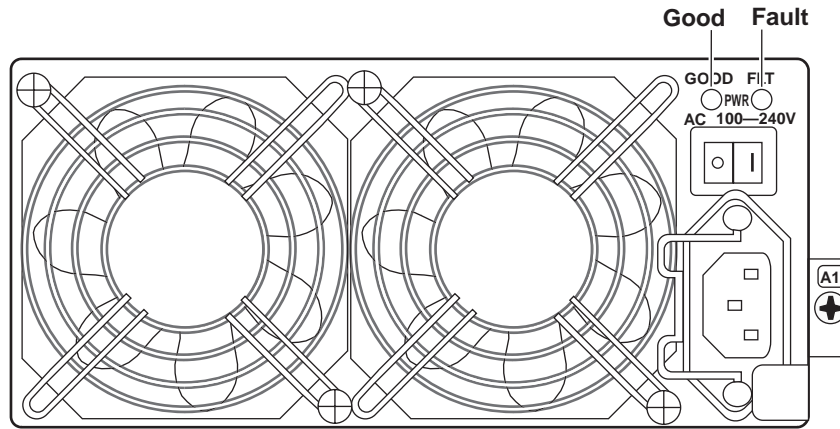
Use the following illustration and table to identify and interpret expansion adapter LEDs



LED	Action	Meaning
Ready (Green)	On	Module is powered on and initial diagnostics completed normally
Fault (Orange)	On	Fault in the module. Also on at power-on and then off at the completion of the self-test.
Linkup LED (Green)	On	Fibre Channel In port (from primary RAID chassis) is operable and linked up.
	Off or flashing	Self-test or initialization just after power-on.

Interpreting power supply status LEDs

Use the following illustration and table to identify and interpret power supply LEDs



LED	Action	Meaning
Good	On	AC power is supplied to the chassis
Fault (orange)	On	Fault in power supply, battery backup unit, or fan

Removing and installing disk modules



CAUTION: If the RAID chassis does not have the redundant controller option, when a replacement disk module is inserted there can be a 1.5 second (maximum) disruption. Video record/play is not affected.

Use the following instructions to replace a faulty disk module. It should be replaced while the RAID chassis is running (hot-swapped).

Moving disk modules



CAUTION: You can destroy the media file system beyond recovery if you move a disk module to a different slot. The service person can move a disk module when you don't care about losing the media in the media file system and under the following cautions:

- The disk module must be unbound.
- Moving a drive module that is part of a LUN to another slot makes all information on the LUN inaccessible.
- You must remove and install the disk module while the storage system is powered up.

A disk module must be inserted all the way or removed entirely. Do not leave a disk module partially removed except for periods when you are allowing it to spin down. When replacing multiple disks, observe the following:

- The RAID chassis configuration information is written to the first three disk modules. If all of these disk modules are replaced with new devices with the power supplies turned off, the information is lost. This condition is indicated by the SERVICE LED blinking at a high rate at chassis power up. Therefore, do not replace the first three disk modules with the power supplies turned off.
- When multiple disk modules are subject to replacement, they must be replaced with new disk modules one by one. Do not replace multiple disk modules simultaneously. After checking that the Ready LED on the front panel of the current disk module is lit, commence replacing the next disk module.
- Stick on the physical label indicating the installation position on each newly installed disk module.



CAUTION: Handle a disk module gently and use an ESD wristband. Do not remove a faulty disk module until you have a replacement module (with the same part number) or a filler module available.

Removing a disk module

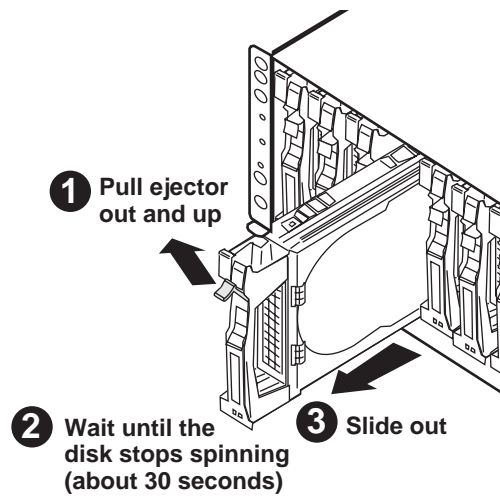
NOTE: If a disk module has been bound into a LUN, do not move it to another slot unless you do not care about the data on the LUN. Each module has LUN identifying information written when it is bound. Moving it to another slot can make information on the original LUN inaccessible.

Generally, you should not remove a disk module unless it is faulty. Refer to [“Interpreting front panel LEDs” on page 36](#) and [“Monitoring K2 Level 3 External RAID status using NetCentral” on page 35](#).

NOTE: If you wish to remove an operational disk module, use the Grass Valley Storage Utility to disable the disk before removing it.

To remove the disk module:

1. Confirm the location of the faulty disk module by checking its Fault LED. Also check NetCentral messages. NetCentral messages may report disk faults by disk module number.
2. Remove the disk module as illustrated in the following diagram.



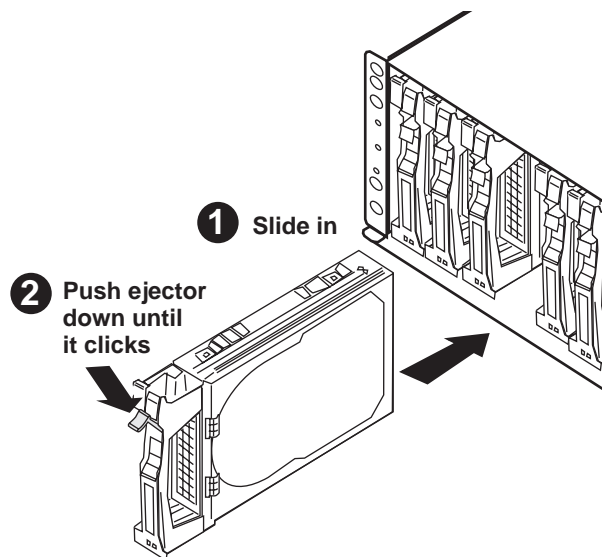
Installing disk module



CAUTION: *If the RAID chassis does not have the redundant controller option, when a replacement disk module is inserted there can be a 1.5 second disruption. Video record/play is not affected.*

To install a disk module:

1. Wait at least three minutes after removing the previous disk module.
2. Put a location label on the replacement disk drive, as appropriate for the slot into which it is installed.
3. Install the disk module as illustrated in the following diagram.



Upon installation the disk spins up automatically and data recovery begins.

Refer to [“Interpreting controller status LEDs” on page 39](#) for disk module LED

status during rebuild. Afterward, check disk module status using NetCentral or the Grass Valley Storage Utility.

Replacing a RAID controller or expansion adapter

Use the following instructions to replace a RAID controller or expansion adapter. It should be replaced while the chassis is powered up (hot-swapped).

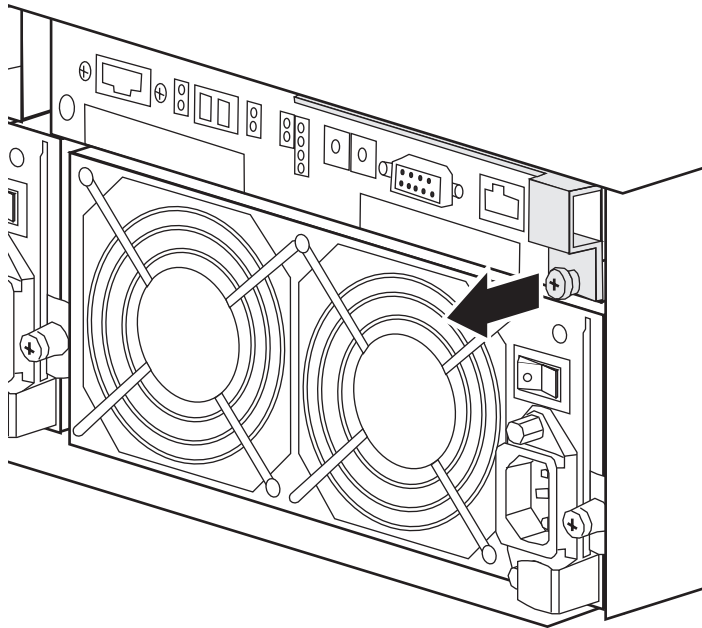
On a chassis with two controllers, if the controller microcode on the replacement controller is not the same as that on the other currently installed controller, the microcode on the replacement controller is automatically upgraded or downgraded to match that on the currently installed controller.

NOTE: A Level 3 RAID chassis must have at least one RAID controller installed. Do not remove both RAID controllers, even in an offline condition. Since the controllers store the configuration information of the RAID chassis or the product license unlock information, replacing the two controllers simultaneously loses the data.

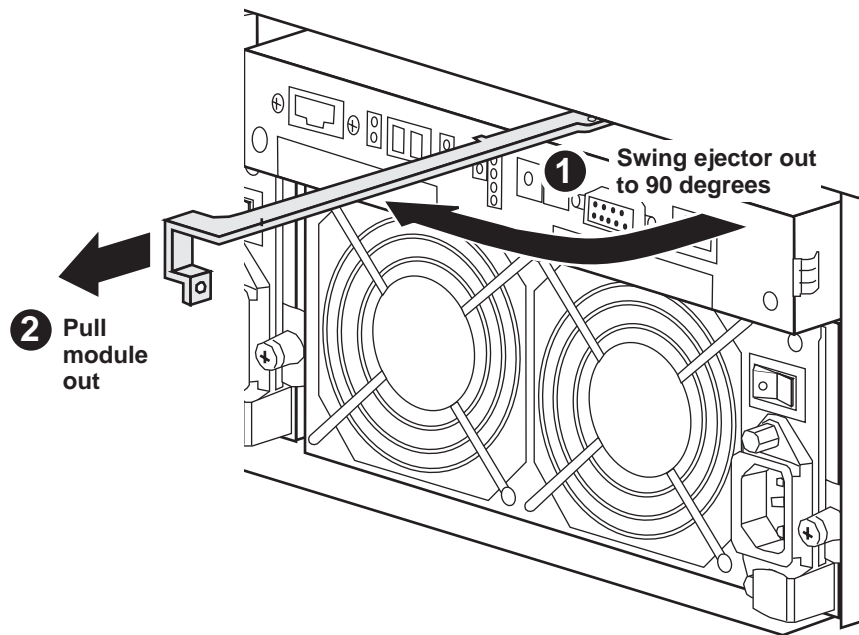
Removing a RAID controller or expansion adapter

To remove a RAID controller or expansion adapter:

1. Identify the module to be replaced using NetCentral or verify that the module's Fault LED is on. If you are removing an operational RAID controller, use the Grass Valley Storage Utility to disable the RAID controller.
2. Remove the cables connected to the module. Note where the cables connect to the module.
3. Loosen the ejector set screw.



4. Remove the module as illustrated in the following diagram.

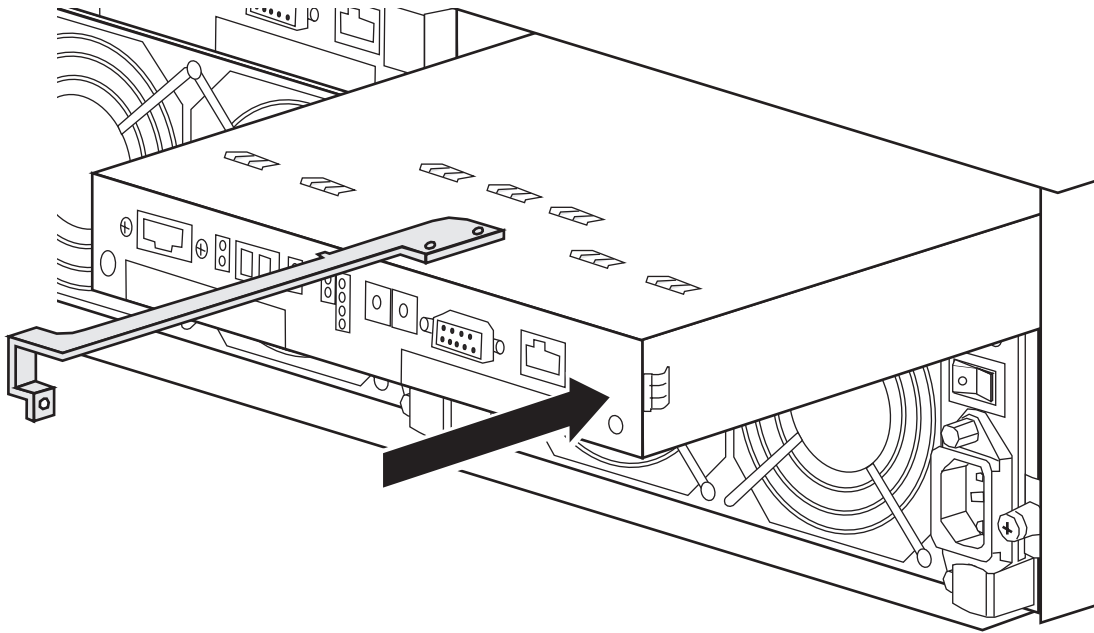


CAUTION: *The module might be hot.*

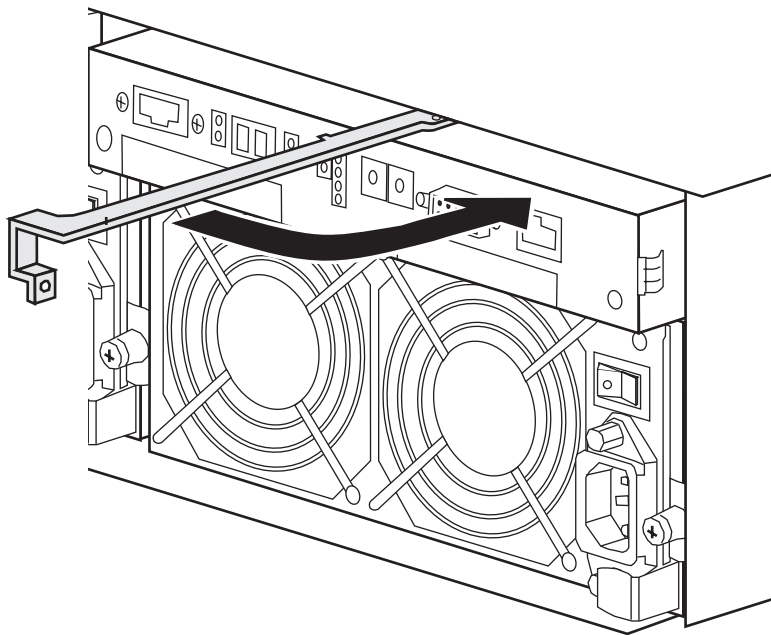
Installing a RAID controller or expansion adapter

To install a RAID controller or expansion adapter:

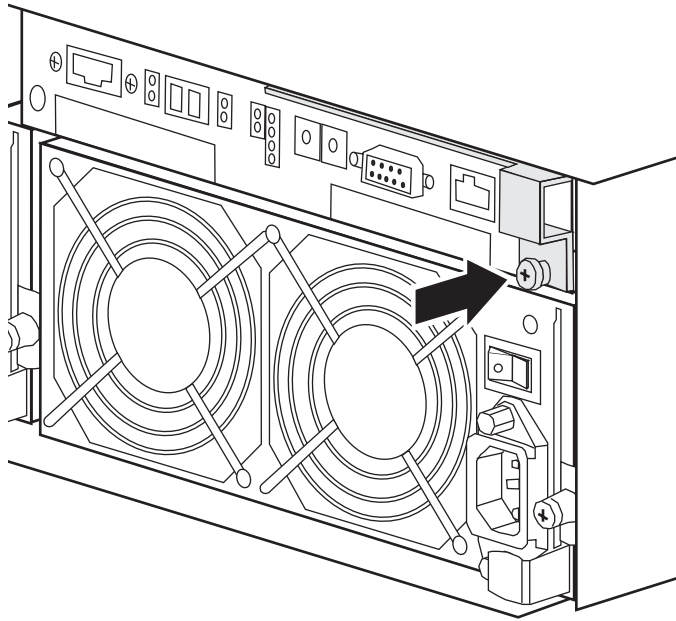
1. Set the chassis address switch on a replacement expansion adapter to be the same as that of the defective expansion adapter. For the switch locations, see [“Addressing requirements” on page 26](#).



2. With the ejector open, insert the replacement module into the empty bay. Make sure the module is seated.



3. Close the ejector lever to seat the module.



4. Tighten the set screw.
5. Reconnect cabling.
6. Verify RAID controller initialization as displayed by the module's Ready LED. Refer to [“Interpreting controller status LEDs” on page 39](#).
7. Check RAID controller status using NetCentral or the Grass Valley Storage Utility.
8. Configure network and SNMP settings. Refer to the *K2 Storage System Instruction Manual*.

Replacing a power supply



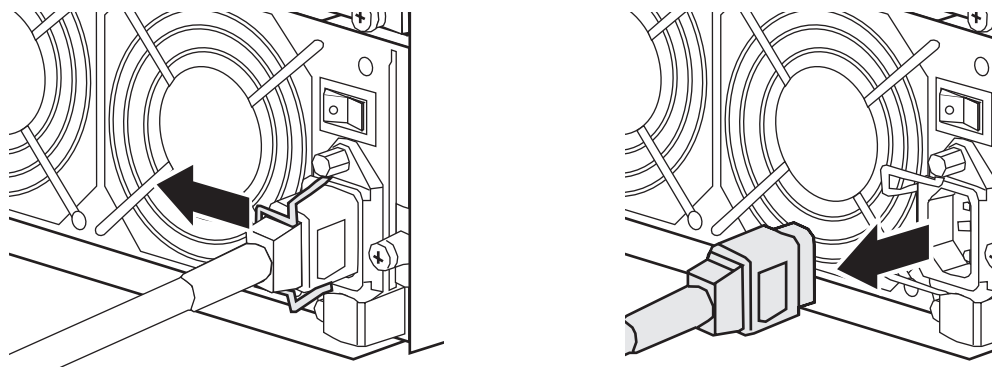
NOTE: Turn off the power supply before unplugging the power cord from the supply or removing the supply from the chassis.

The RAID chassis and the expansion chassis each have their own type of power supply. The two types are not interchangeable.

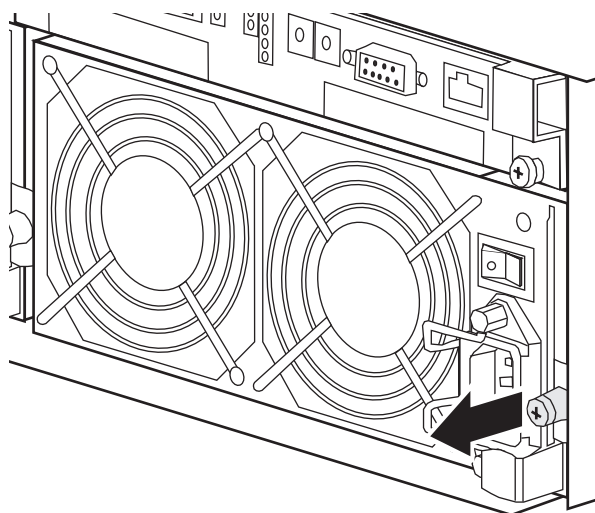
Make sure the correct type of replacement power supply is on hand and you are otherwise prepared to complete the procedure in less than five minutes. If the time exceeds five minutes, the protective feature of the RAID chassis triggers a shutdown sequence.

To replace the power supply:

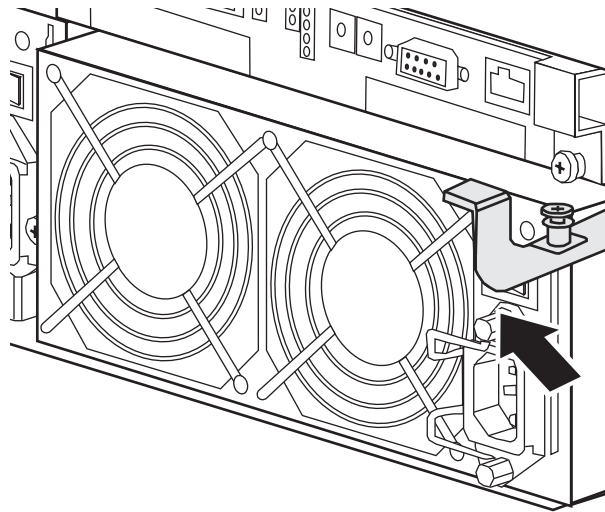
1. Identify the faulty power supply by verifying that its Fault LED is on.
2. Turn off the power switch on the faulty power supply.



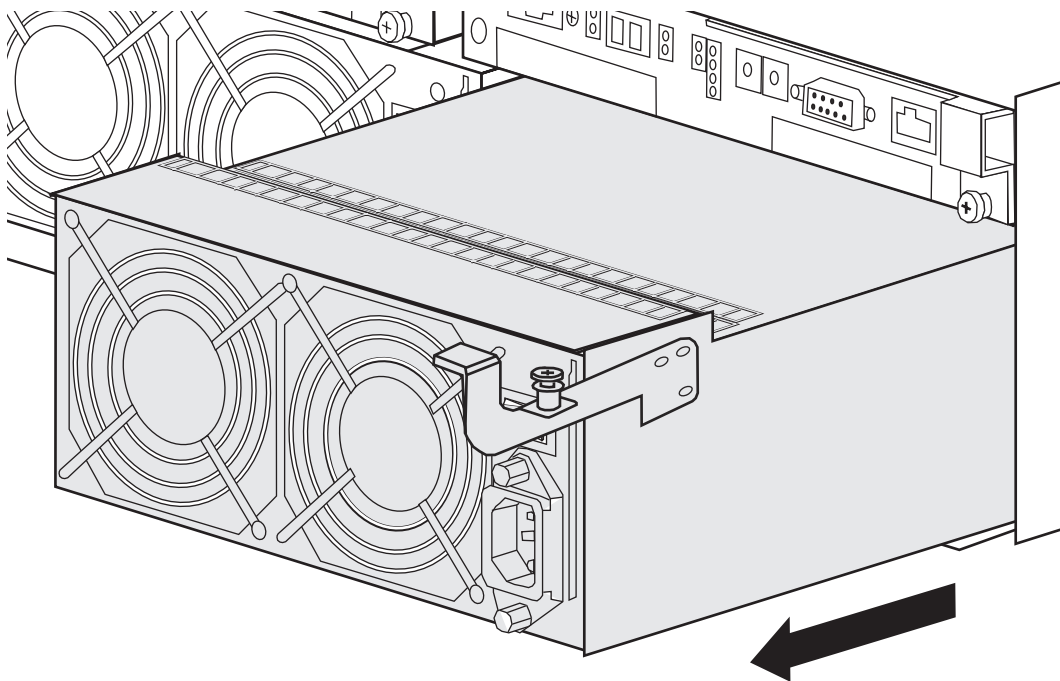
3. Unlatch the stopper to release and unplug the power cord.



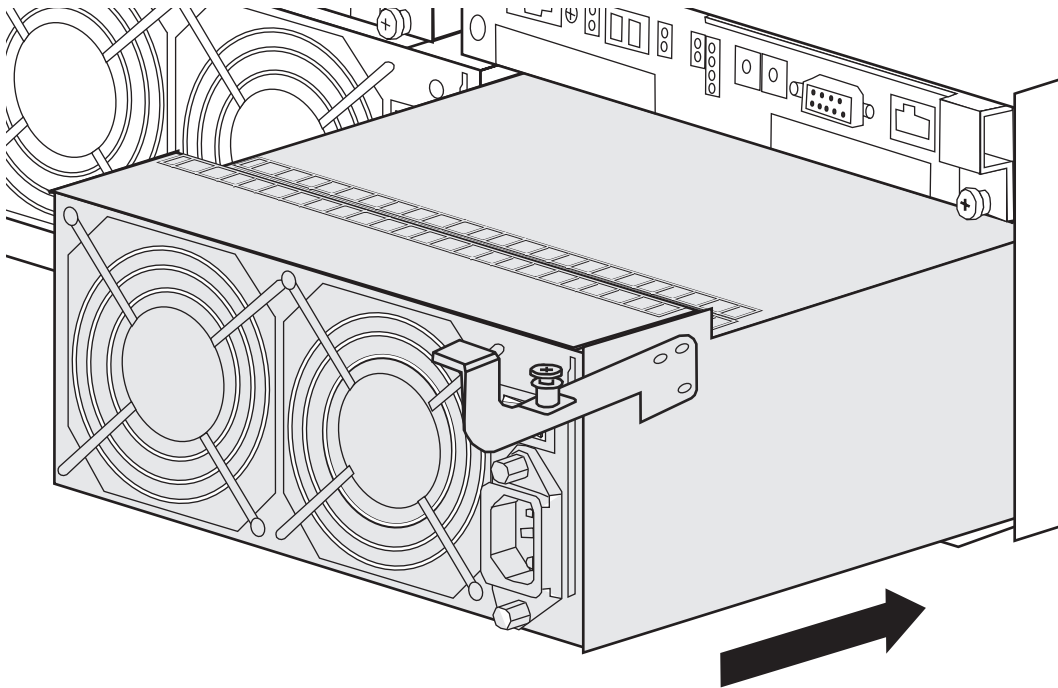
4. Loosen the set screw on the ejector.



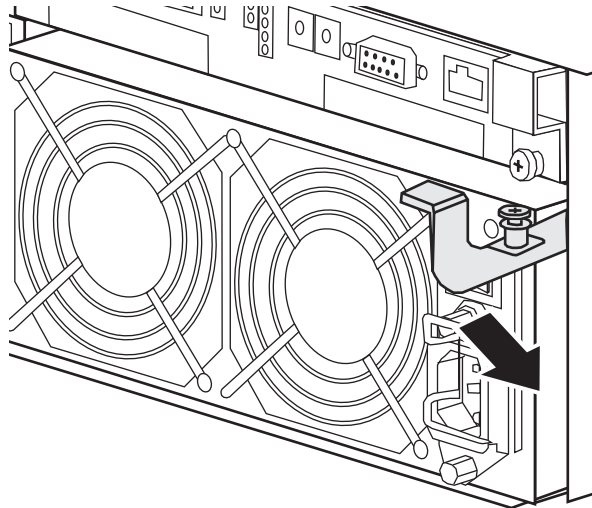
5. Pull the ejector out and up to 90 degrees.



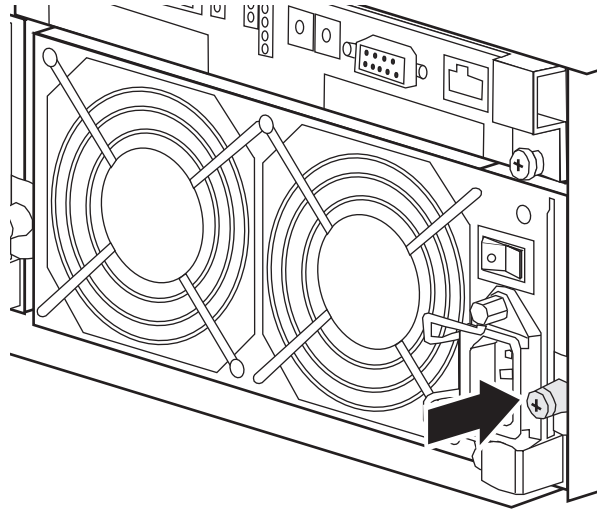
6. Slide the power supply out.



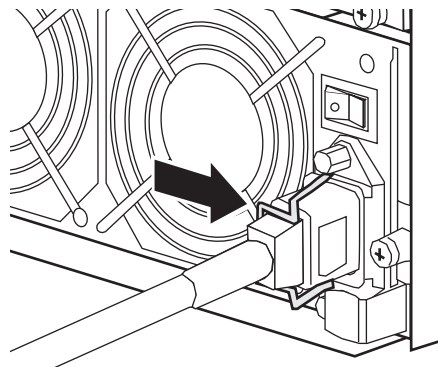
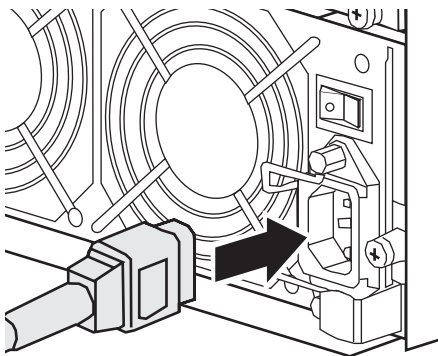
7. With the ejector open, insert the replacement power supply into the empty bay.



8. Push the protrusion of the ejector to turn the ejector and push in the new power supply.



9. Secure the ejector with the screw.



10. Plug the power cord in the new power supply and secure the power cord by firmly fitting the removal protection mechanism.

11. Turn on the power switch.

12. Check that the Good LED of the new power supply is on.

13. Monitor the status of the power supply using NetCentral.

Level 3 RAID Technical Specifications and Operating Limits

Data handling specifications

Characteristic	Specification
Host interface	Fibre Channel
Data transfer rate	350 MB/s max
Number of host ports	4 ports
Cache memory	2 GB

AC power requirements

Item	Measurement
Input voltage	100 to 240 VAC $\pm 10\%$ (x2), 50/60 Hz
Power consumption	680 to 1720 VA (For UPS choice, a safety allowance of 30% of the power consumption is necessary.)
Labeling according to the energy saving law	Class: G Energy consumption efficiency: 0.10

If one of the two power supplies fails, the remaining supply and cord must support the full load. Your rackmount cabinet must include AC power distribution that can handle these values.

Size and weight

Item	Measurement
Cabinet dimensions	482 mm (19 ") W x 596 mm (23.5 ") D x 131 mm (5.2 ") H (same for basic chassis and expansion chassis)
Weight	45 kg (99.2 pounds) or lighter (same for basic chassis and expansion chassis)

Cable lengths

It is recommended that you use the Fibre Channel cables shipped with your K2 Level 3 RAID Storage when making connections.

Optical cables must meet the appropriate standards for 2-Gb/s FC-AL loops. Such cables are duplex LC cables with lengths up to 300m on 50/125 μ m MMF, or up to 150m on 62.5/125 μ m MMF.

Copper cables are used to connect the RAID chassis with the expansion chassis. Copper cables must meet the appropriate standards for 1-Gbit FC-AL loops. Such cables are fully shielded, twin-axial, full-duplex cables. Cables greater than 10 meters must be equalized; cables equal to or less than 10 meters do not need to be equalized. Do not use copper cables longer than 2 meters.

Environmental limits

The system includes two temperature level sensors used to issue auto-warning and auto-shutdown in case the over temperature limit is reached.

Characteristic	Specification
Ambient temperature	Operating: 5°C to 40°C Halting: -10°C to 60°C
Relative humidity (without condensation)	Operating: 10% to 80% Halting: 5% to 80%
Wet bulb temperature	Operating: 0°C to 27°C Halting: -8°C to 29°C
Allowable vibration level	Operating: 0.25 G Halting: 0.5 G

Life expectancies of components

Item	Measurement
Battery backup unit (Nearline only)	5 years
Fan (power supply)	50,000 hours

Glossary

The terms and definitions listed below are related to the storage system described in this manual. Understanding them will aid your understanding of the storage system.

ALPA (arbitrated loop physical address)

An 8-bit address that uniquely identifies a device on an FC loop.

bind

In the context of a disk-array storage system, the procedure by which you hardware-format one or more disk modules into one LUN (logical unit) - usually as one of several types of RAID group.

BTU (British Thermal Unit)

A standard measure of a device's heat output.

cache

See storage-system caching.

CA (chassis address)

A number, set to 0 on a RAID chassis, that helps establish a unique address for each disk module on an FC-AL loop. You must set the CA on each RAID Expansion Chassis. Since the RAID chassis CA is 0, set the Expansion Chassis CA to 1.

disk-drive module

Another name for disk module.

disk unit

A short name for physical disk unit.

disk module

A self-contained disk drive that slides into one of the slots in the front of the storage system. It consists of the carrier assembly, which holds the disk drive and the regulator board. Also called disk-drive module.

DIMM (dual in-line memory module)

A type of memory module used in RC memory for write caching or RAID 3 memory.

EMI (electromagnetic interference)

Electronic radiation emitted by an electrical device. The levels of EMI are strictly controlled for data processing equipment. The EMI standards are explained after the Notice page near the beginning of the manual.

ESD (electrostatic discharge)

The discharge of an accumulated electrical charge (static). This can severely damage delicate electronic circuits and you should take steps to prevent this, as explained in the Chapter 3, "Servicing the PFR 600 Series RAID".

FC-AL (Fibre Channel arbitrated loop)

An arrangement of Fibre Channel stations such that messages pass from one to the next in a ring.

FC-AL address ID

A number that identifies a device as a node on a fibre channel loop. You select the FC-AL address ID using switches on the RAID controller.

Fibre Channel Disk board

The name for the printed-circuit board within the K2 Media Server that allows the server to access the Fibre Channel loop and thence the disk drives within a K2 Level 3 Expansion Chassis.

field-replaceable unit

See FRU (field-replaceable unit).

FRU (field-replaceable unit)

A hardware assembly that can be replaced on site, instead of at the point of manufacture.

hot repair

See replace under power.

hub

An FC_AL switching device that allows multiple servers and targets such as storage systems to connect at a central point. A single hub configuration appears as a single loop.

Level 3 RAID Storage

A storage system that includes a chassis, up to 15 disk modules, one or two RAID controllers, and one or two power supplies. A K2 Level 3 can support up to seven K2 Level 3 Expansion Chassis (with up to 15 disk modules each) in addition to its own 15 disk modules.

K2 Level 3 Expansion Chassis

A storage system that includes a chassis, up to 15 disk modules, one or two expansion adapters, and one or two power supplies.

LUN (logical unit)

One or more disk modules (each having a head assembly and spindle) bound into a group - usually a RAID group. The operating system sees the LUN, which includes one or more disk modules, as one contiguous span of disk space.

memory module

See RC memory module.

node

Any device with a Fibre Channel interface that connects to a Fibre Channel loop.

power supply

An essential element of the storage-system power supply. A storage system can have two power supplies. With two, it can survive failure of one supply. You can replace a power supply under power, without interrupting applications.

PLDA (private loop direct attach) profile

A standard for FC-AL disk drives.

RAID controller (RC)

See RC (RAID controller).

RC (RAID controller)

A printed-circuit board with memory modules and control logic that manages the storage-system I/O between the K2 Media Server FC adapter and the disk modules. For higher availability, a K2 Level 3R can use a second RC.

RC memory module

A memory module (DIMM or SIMM) that provides the local storage for an RC.

replace under power

The storage system provides replace under power capability, allowing you to replace, for example, a disk module or a power supply module without powering down the storage system. Applications continue while you replace the failed module.

SCSI (small computer system interface)

A well-known protocol and standard for connecting computers and peripheral devices.

SES (SCSI enclosure services)

A functional subset of SCSI III commands that allow a server to communicate with storage enclosures using their disk modules.

SFF

Small Form Factor Committee

server

In the context of storage systems, a processor that runs an operating system and uses a disk-array storage system for data storage and retrieval.

storage chassis

A storage device that includes a chassis, up to 15 disk modules, one or two RAID controllers, one LAN card, and one or two power supplies.

storage-system caching

The procedure of storing disk-based data in RAM memory (in this case, DIMM memory on an RC) temporarily to save time if the data needs to be accessed or changed again soon.

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