

Instruction Manual

071-0683-03
NOVEMBER 2000

PROFILE XP PFC 500/E
FIBRE CHANNEL RAID STORAGE SYSTEM

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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. |



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 can result in damage to the equipment or other property.

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

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 Tektronix 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.

Canadian Certified AC Adapter

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

EN55022 Class A Warning

For products that comply with Class A. 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 undesired operation. Testing was done with shielded cables. Therefore, in order to comply with the FCC regulations, you must use shielded cables with your installation.



**Manufacturer's
Declaration of
Conformity**

This equipment has been tested and found to comply with the requirements of European Community Council Directives 89/336/EEC and 73/23/EEC relating to electromagnetic compatibility and product safety respectively.

ATTENTION

This product has been designed and certified to comply with certain regulatory requirements pertaining to Information Technology Equipment. This product has not been designed for use as a medical device. Without limitation of the foregoing, this product is not intended and has not been certified for use in a hospital or clinical environment to diagnose, treat, or monitor patients under medical supervision, and is not intended and has not been certified to make physical or electrical contact with patients, nor to transfer energy to or from patients and/or to detect such energy transfer to or from patients.

Preface

About this manual

This manual explains how to install the Profile XP Fibre Channel RAID Storage Chassis and RAID Expansion Chassis (PFC500/E), and how to replace and add customer-replaceable units (CRUs).

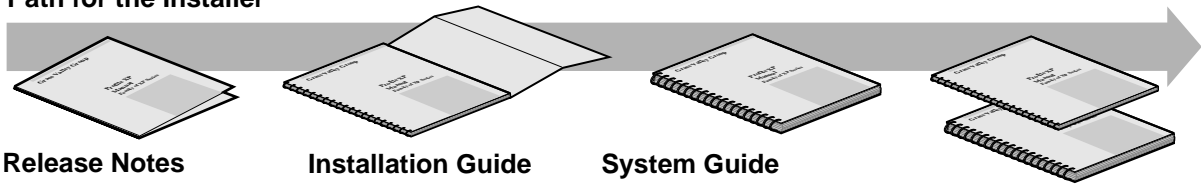
If you are a technical service person who will install and service the PFC500/E, you should read this manual. After reading it, you will be able to install a PFC500/E, replace any CRUs that may fail, and upgrade a PFC500/E by adding disk modules and redundant CRUs.

You must consult the Profile XP System Guide for information on connecting and configuring your PFC500/E to a Profile XP Media Platform.

Using the Profile XP Documentation Set

This manual is part of a full set of support documentation for the Profile XP Media Platform. The following illustrates how to use the Profile XP documentation depending on the task you are performing.

Path for the Installer



Release Notes

Contains the latest information about Profile XP hardware and software shipped with your system.

Installation Guide

Contains essential steps for installing your Profile XP system using factory default settings.

System Guide

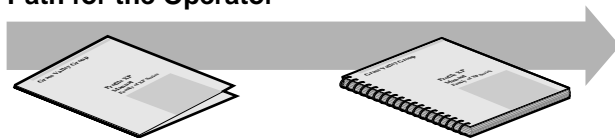
Contains the product description and step-by-step instructions for modifying system settings.

Other Manuals

These manuals include:
- *PFC500 Instruction Manu*
- *Profile XP Service Manua with NetCentral.*

Installers consult the User Manuals as needed.

Path for the Operator



Release Notes

Contains the latest information about Profile XP hardware and software shipped with your system.

User Manuals

Contains complete instructions for using Profile applications. These manuals include:
- *Profile XP User Manual*
- *ContentShare Explorer User Manual*
- Other user manuals you received with

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Manual Descriptions

- **Installation Guide** (for your Profile XP Model) This guide provides step-by-step instructions for installing the Profile XP Media Platform using factory default settings for all record/play channels. Factory default settings are indicated within the guide. After installing the Profile XP system using this installation guide, you can refer to this *Profile XP System Guide* to customize system settings for your installation.
- **Profile XP System Guide** This guide provides all the information you need to go beyond factory default settings and customize your system's configuration to meet your site-specific needs. This guide also provides an overview of your Profile XP system, and provides all the specifications you need to integrate the Profile XP Media Platform into your operation.
- **Profile XP User Manual** Contains complete instructions for using Profile applications to operate the Profile XP Media Platform.
- **Profile XP Service with NetCentral Manual** Contains information for servicing the Profile XP Media Platform, and includes procedures for the following tasks:
 - Problem analysis using symptom, problem, solution tables.
 - Running diagnostics locally and remotely
 - Set up and operation of Portals remote monitoring software.
 - Replacing field replaceable units.
- **Profile XP Release Notes** Contains the latest information about the Profile hardware and the software release shipped on your system. This information includes software specifications and requirements, feature changes from the previous releases, helpful system administrative information, and any known problems.
- *PFC500/E Instruction Manual* Contains information for servicing the Profile XP Fibre Channel RAID Storage Chassis (PFC500/E) including step-by-step procedures for replacing field replaceable units.

How this manual is organized

The *PFC500/E Instruction Manual* is organized around the tasks you'll be performing to install and service your Fibre Channel RAID 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 PFC500/E

Introduces the Profile XP Fibre Channel RAID Storage Chassis (PFC500) and the RAID Expansion Chassis (PFC500E). You can read this chapter to get familiar with the RAID Storage Chassis key features and components.

Chapter 2 - Installing a PFC500/E

Describes how to install a RAID Storage Chassis and RAID Expansion Chassis, including rack mounting. Refer to the *Profile XP System Guide* for connection and configuration information.

Chapter 3 - Servicing and upgrading a PFC500/E

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

Appendix A - Technical specifications and operating limits

This appendix consists of electrical and environmental specifications.

Glossary

The Glossary explains terms used throughout this manual.



Getting more information

In addition to printed documents, Profile XP product information is available in on-line manuals. Use these as additional sources for information.

On-line manuals

Electronic versions of the following manuals are located on the system drive of your Profile XP Media Platform and on the Profile XP software CD-ROM.

- *Installation Guide* (for your model)
- *Profile XP System Guide*
- *Profile XP User Manual*
- *Profile XP Service with NetCentral Manual*
- *PFC500/E Instruction Manual*
- *Profile XP Release Notes*

You can view these manuals using Adobe Acrobat Reader which is also pre-installed on your Profile XP system.

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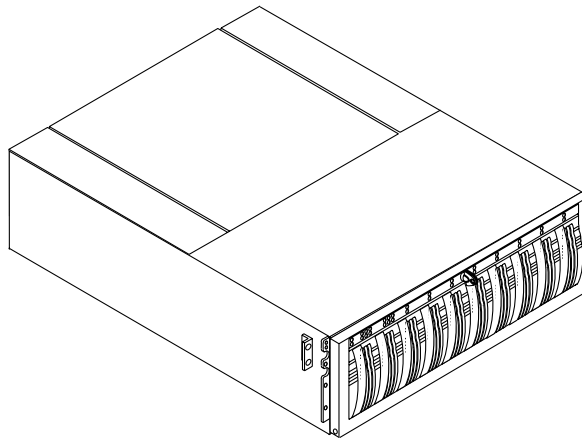


About the PFC500/E

This chapter introduces the Profile XP Fibre Channel RAID Storage Chassis. Topics are :

- PFC500/E components
- Enclosure
- RAID Controllers (RCs)
- Disk modules
- Power supplies
- Drive fan pack
- Configurations

The PFC500 is an intelligent, highly available, high performance, high capacity storage system that uses a Fibre Channel Arbitrated Loop (FC-AL) as its interconnect interface. Its modular, scalable design provides additional disk storage as your needs increase.



Using its FC-AL interface, with simple FC-AL serial cabling, a PFC500 can support up to two PFC500E RAID Expansion Chassis. A PFC500E is a basic chassis without a RAID controller (RC). The PFC500 and two PFC500Es support up to 30 disk modules in a single disk-array storage system. You can place the PFC500Es in the same cabinet as the PFC500, in a separate cabinet, or in two separate cabinets.

A PFC500 connects to a Profile XP Media Platform using the server's Fibre Channel Disk adapter (FC adapter).

Throughout this manual, the term PFC500/E is used to refer to either the PFC500 or the PFC500E interchangeably.



PFC500/E components

The PFC500/E components are:

- A sheet-metal chassis with a midplane and front door
- One or two RAID controllers (PFC500 only)
- One or two Link Control cards (PFC500E only)
- As many as ten Fibre Channel disk modules
- One or two power supplies
- One drive fan pack

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

The RCs, disk modules, power supplies, fan packs, and filler modules are customer-replaceable units (CRUs), which you can add or replace without tools while the PFC500/E is powered up.

The optional high availability features for a PFC500/E are

- second RC (PFC500 only)
- second power supply

A second RC provides continued access to the PFC500 and any connected PFC500Es if the first RC fails. Adding a second RC to the same chassis is not intended to increase performance, but rather to add redundancy. Refer to the *Profile XP System Guide* for detailed connection, configuration, and performance information.

The disk drives are FC-AL compliant and support dual-port FC-AL interconnects through the two RCs and their cabling.

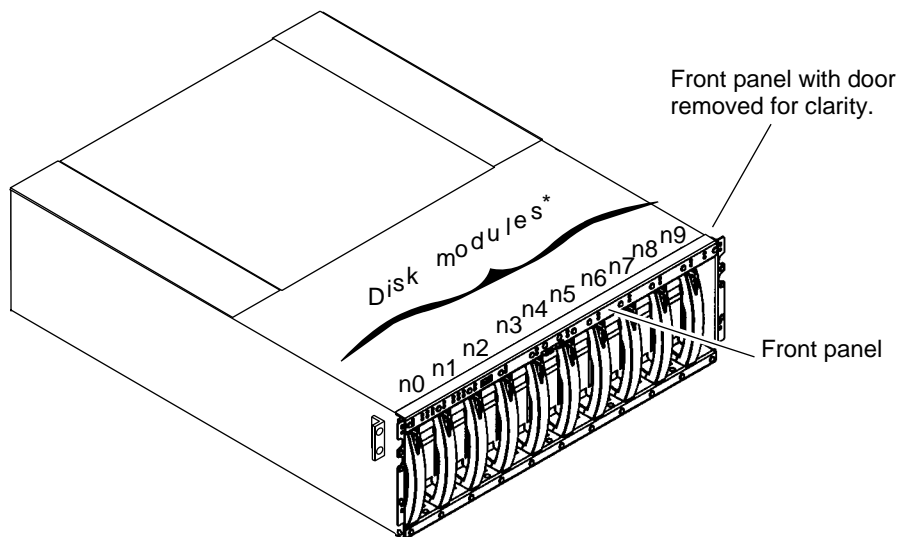
Chassis

The chassis is a sheet-metal housing with a front panel, a midplane, front door, and slots for the RCs, disk modules, power supplies, and the fan pack.

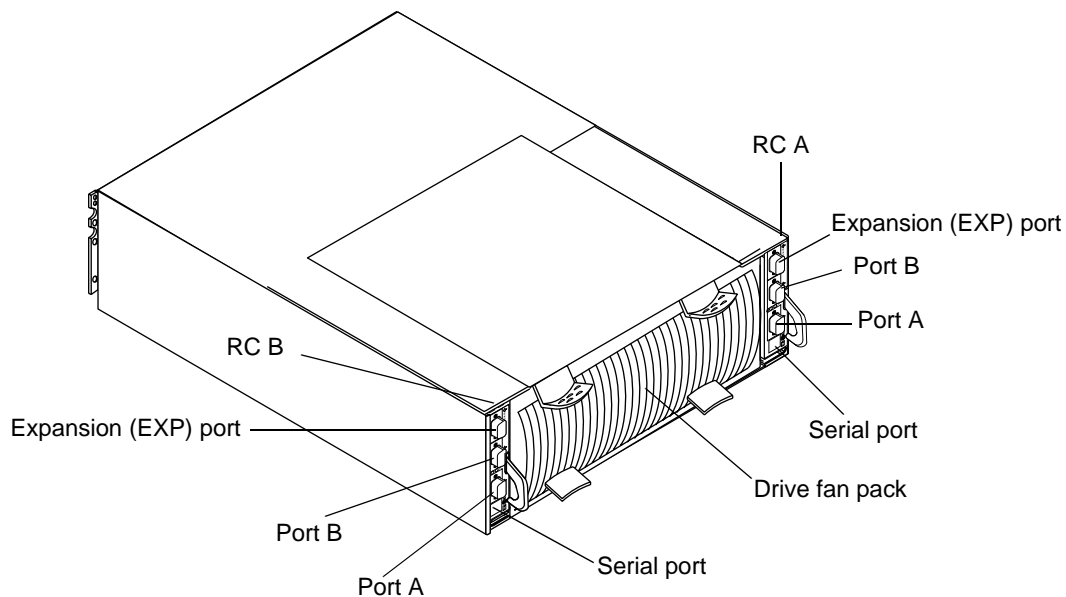
The following figures show the PFC500/E components. Details on each component follow the figures. If the chassis provides slots for two identical components, the component in slot A is called *component-name A*. If there is a second component, it is in slot B and is called *component-name B*, as follows.

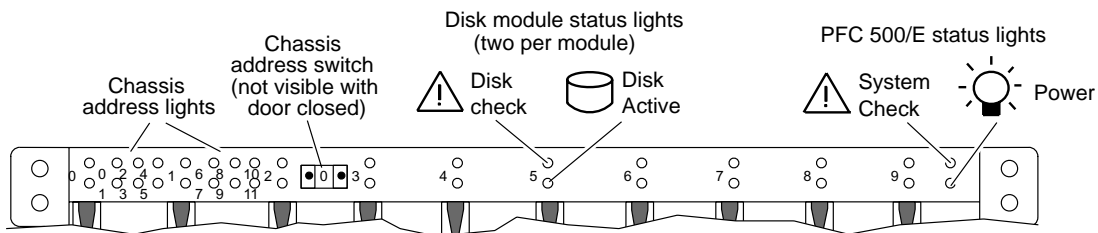
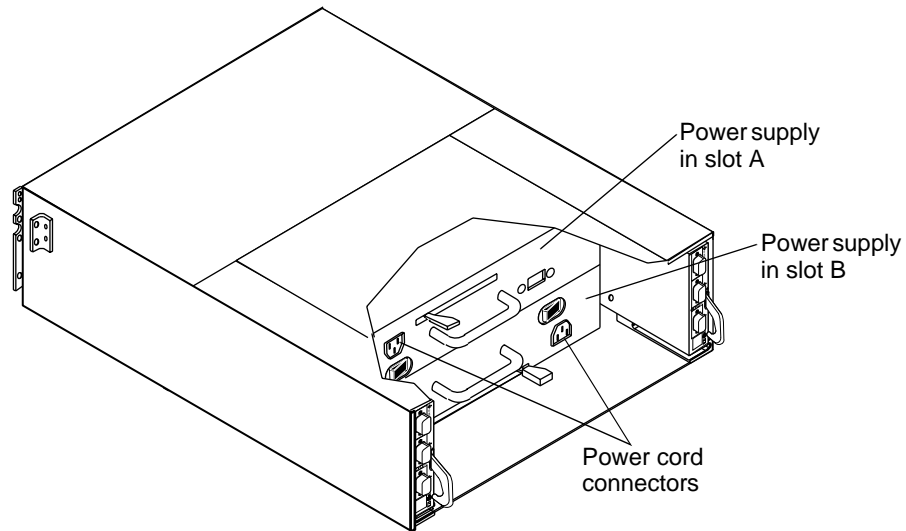
Component	Name in slot A	Name in slot B
RAID Controller	RC A	RC B
Power supply	PS A	PS B

If you have one power supply, it can be in either slot A or slot B. If you have one RAID controller, it can be in either slot A or B.



* n is the chassis address (CA) set on the front panel at installation. It must be set to 0 for a PFC500. All other CA values are invalid for a PFC500. The disk module ID is the chassis address and the module ID (0-9) within the chassis. In a PFC500, the ID for the right most disk module is 09.





The front panel contains the chassis address (CA) light, two status lights for each disk module slot, and two status lights. All lights are visible with the front door closed.

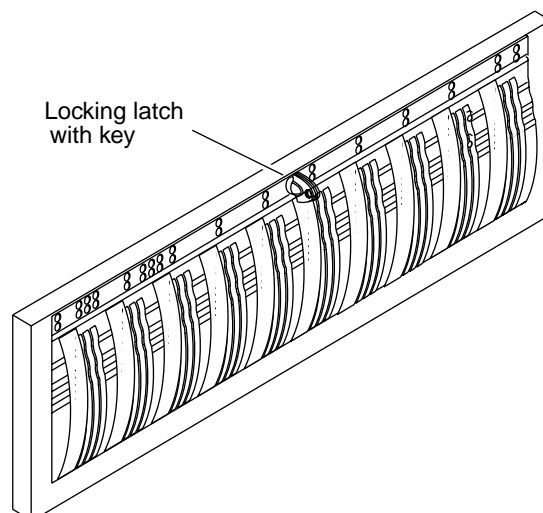
The chassis address light displays the chassis address setting for the PFC 500. The PFC 500 must have a CA of 0. You must set that CA using the chassis address switches, as explained in Chapter 2.

The status lights are described in the “Monitoring PFC 500/E status” on page 42.

Midplane

The midplane distributes power and signals to all the chassis components. All CRUs except the fan packs plug directly into midplane connectors.

Front door

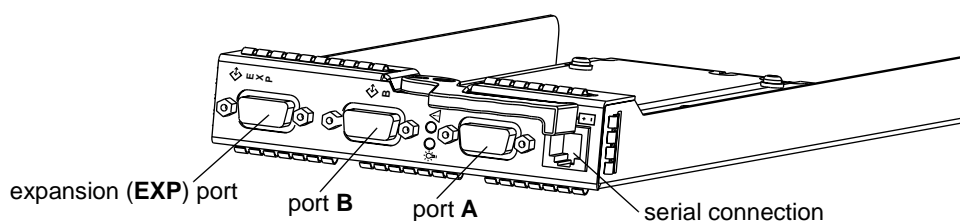


The front door has a locking latch and an EMI shield. The latch is a push button with a removable locking key that you can use in any PFC 500 or PFC 500E. When the door is open, you can remove or install disk modules.

IMPORTANT: *The front door must be closed for the PFC500/E to be EMI compliant. Opening the door to access the disk modules is a service procedure.*

RAID Controllers (RCs)

The RC is the PFC 500's intelligent component. It defines the PFC 500 and differentiates the PFC 500 from a PFC 500E. An RC is a printed-circuit board with one dual in-line memory module (DIMM), a bezel with status lights, and securing latches.



The RC has three Fibre Channel ports. Port A and Port B are for connecting to a Profile XP Media Platform. The expansion connector (EXP) is for connecting to a PFC 500E. The port interface is called the RC front end. It can connect to a Profile XP Media Platform's Fibre Channel storage board. You set an RC's FC-AL address ID using rotary switches.

The RC connects to disk modules in the same chassis via an internal FC-AL. The expansion port extends the internal FC-AL to the corresponding link control card (LCC) in the PFC 500E chassis. This FC-AL is referred to as the RC back end.

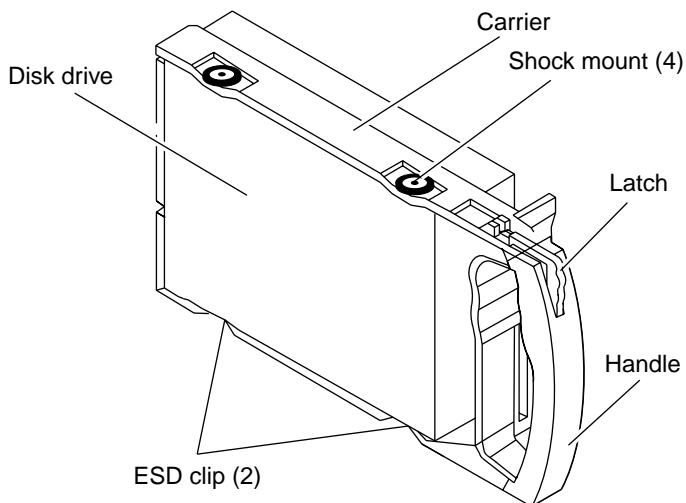
An RC also has an RJ-type connector for serial communications with a console.

Each RC has two status lights visible from the rear of the PFC 500/E. For the meaning of these lights, see "Monitoring PFC 500/E status" on page 42.



Storage-system read caching requires one RC, and mirrored storage-system write caching requires two RCs. If a PFC 500 has one RC, you can install a second one while the PFC500 is running. When both RCs are installed, you can replace either RC while the PFC500 is running. You should never attempt to replace any of the RC's components, except the memory modules.

Disk modules



Each disk module consists of a Fibre Channel disk drive in a carrier assembly. You can add or remove a disk module while the PFC500/E is powered up.

Disk drives

The disk drives are 3.5-inch FC-AL drives that conform to the following standards:

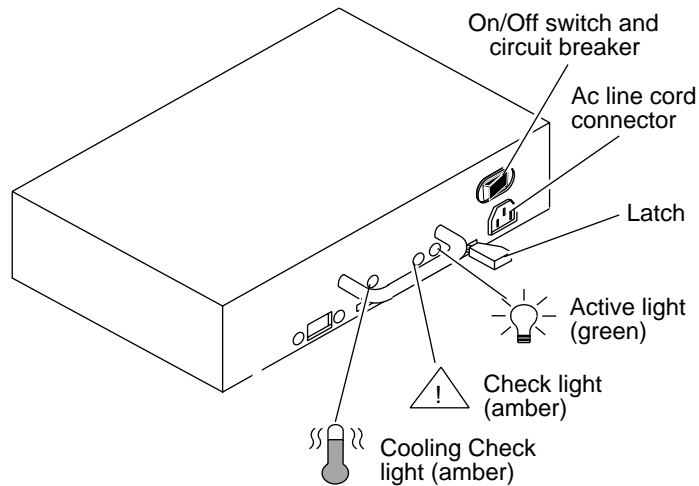
- SFF-8045
- Fibre Channel Arbitrated Loop (FC-AL)
- FC-AL Private Loop Direct Attach (PLDA) profile

The disk module slots in the chassis accommodate drives with heights of either 1.0 inch (2.54 cm) or 1.6 inches (4.06 cm). You can combine approved drives of either height, and from different manufacturers, within the same PFC500/E, subject to the restrictions imposed by the Licensed Internal Code (LIC) running in the PFC500's RCs.

Drive carrier

The disk-drive carrier is a plastic assembly that slides into the chassis slot guides and midplane connectors. It has a handle with a latch and electrostatic discharge (ESD) clips, which connect to the drive's head-disk assembly. The latch holds the disk module in place to ensure proper connection with the midplane.

Power supplies (PSs)



The power supplies are located behind the drive fan pack. With two power supplies, the top supply is installed inverted with respect to the bottom supply.

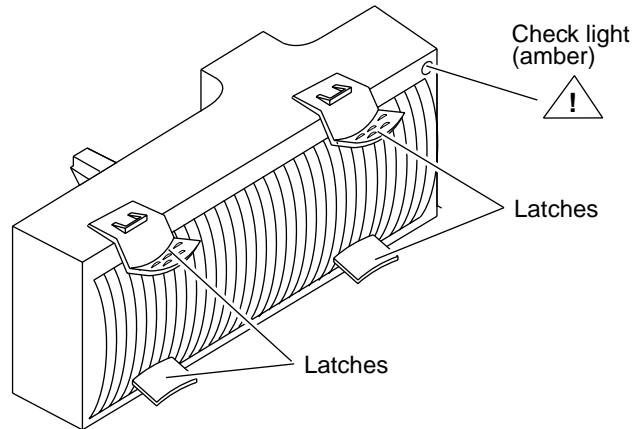
Each power supply is an auto-ranging, power-factor-corrected, multi-output, off-line converter with its own line cord and on/off switch. Each supply supports a fully configured PFC 500 and shares load currents with the other supply, if it is present. The drive voltage lines have individual soft-start switches that protect the disk drives if you install them while the PFC 500/E is powered up. A disk with power-related faults will not adversely affect the operation of any other disk.

Each power supply has status lights. These status lights are partially visible through the drive fan pack, and fully visible with the drive fan pack removed. The status lights are described in the “Monitoring PFC 500/E status” on page 42.

A latch on the power supply locks it into place to ensure proper connection to the midplane. You can add or remove one power supply in a highly available PFC 500/E while the PFC 500/E is powered up.



Drive fan pack



The drive fan pack cools the disk modules and RCs in the PFC500. The drive fan pack contains three fans that draw ambient room air through the front door, across the drive modules, and through the midplane and power supplies. The drive fan pack connects directly to both power supplies, and either supply can power it. The fans operate at a lower voltage and speed during normal operation to minimize acoustic noise. If a fan fails, the voltage and speed of the remaining fans increase to compensate, resulting in higher acoustic noise.

One status light on the drive fan pack indicates status. The status light is described in the “Monitoring PFC500 status” section of Chapter 3.

Latches on the drive fan pack hold the pack in place.

IMPORTANT: You can remove the drive fan pack while the PFC500 is powered up. While the pack is removed, the Cooling Check light on each power supply flashes. If the pack is removed for more than approximately two minutes, the disk modules power down and the RCs go into standby mode. When you re-install the drive fan pack, the disk modules power up and the RCs go into active mode.

Configurations

The PFC500 minimum and maximum configurations are as follows.

Configuration	RCs	Power Supplies	Disk Modules
minimum	1	1	5
	2	1	5
maximum	2	2	10

The maximum configuration provides the most redundancy, and therefore the highest degree of system availability. The fan pack provides redundant cooling for any configuration.

IMPORTANT: Grass Valley Group does not support mixing disk drives of differing capacities in any RAID chassis connected to a Profile XP media platform. All disk drives in any RAID chassis connected to a Profile XP media platform must be of the same capacity. For example, if a PFC500 and a PFC500E are connected to a Profile XP system, all the disk drives in both the PFC500 and the PFC500E must be of the same capacity.

What next?

Continue to the next chapter, which tells how to install a PFC500/E.



Installing a PFC500/E

This chapter describes the Profile XP Fibre Channel RAID Storage Chassis (PFC500/E) installation requirements and procedures. Major topics are:

- Requirements
- Rack mounting a PFC500/E
- PFC500/E powerup and initialization
- PFC500/E powerdown
- Binding disk modules into groups

Requirements

This section explains site, cabling, and addressing requirements.

Site requirements

For proper PFC500/E operation, the installation site must conform to certain environmental specifications. These are detailed below and in Appendix A.

Power

To determine a PFC500/E's power requirements, use the power rating on the chassis label. This rating is the maximum power required for a fully loaded chassis. The input current, power (VA), and dissipation for the PFC500/E are based on the maximum capability of the power supplies and cooling system to provide internally regulated power. Typical values will be less depending on the number and manufacturer of disk drives and activity level. These values represent either the values for the power cord of a PFC500/E with a single power supply, or the total values shared by the line cords of two power supplies in the same PFC500/E, 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 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 PFC500s and PFC500Es that you will interconnect.

Cooling

The ambient temperature specification is measured at the front door inlet. The site must have air conditioning of the correct size and placement to maintain the specified ambient temperature range. The air conditioning must be able to handle the BTU requirements of the PFC500s and any connected PFC500Es.



Cabling requirements

You must use copper cables for the FC-AL connections between the RCs and the server adapters or hubs. You should use a common ground distribution grid for all interconnected devices.

IMPORTANT: You must use a copper cable only (not an optical cable) to connect a PFC500 to a PFC500E.

Any copper cables you use must meet the appropriate standards for 1-Gbaud FC-AL loops. Such cables are fully shielded, twin-axial, full-duplex cables with DB-9 connectors. Cables greater than 10 meters must be equalized; cables equal to or less than 10 meters do not need to be equalized.

PFC500 and PFC500E interconnections should maintain LCC consistency. That is, one FC loop should connect the PFC500's RC A and each PFC500E's LCC A. The other FC loop should connect the PFC500/E's RC B and each PFC500E's LCC B.

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

Addressing requirements

There are two addresses for the PFC500: the Fibre Channel Arbitrated Loop address ID (FC-AL address ID) and the chassis address.

FC-AL address ID

Each node (such as an RC) on the Fibre Channel front-end loop must have a unique FC-AL address ID. The FC-AL protocol translates the FC-AL address ID into an 8-bit arbitrated loop physical address (ALPA). You set the RC FC-AL address ID using switches, as explained later in this chapter. If your PFC500 has a second, redundant RC, it should be set to a different FC-AL address ID than the primary FC.

Chassis address (CA)

Each PFC500 and PFC500E on a back-end loop needs a unique chassis address (CA) that identifies the chassis and determines disk module addresses. The PFC500 must have a CA of 0. You must set that CA using the chassis address switches, as explained later in this chapter. If you cable any PFC500Es to the PFC500, you might want to set the nearest PFC500E's CA to 1, and the next to 2. The chassis address is displayed in lights visible behind the front door.

Installing a PFC500/E in a cabinet

The cabinet in which you will install the PFC500/E(s) must have a full earth ground to provide reliable grounding. Also, the cabinet should have its own switchable power distribution. If any PFC500/E you will install has two power supplies, we suggest that you use a cabinet that has dual power distribution units, one on each side.

>>> **WARNING: The rack mount PFC500/E is heavy and should be installed into a rack by two people. To avoid personal injury and/or damage to the equipment, do not attempt to lift and install the PFC500/E into a rack without help from another person.**

We recommend that you use cabinet anti-tip devices, especially if you are installing or removing a PFC500/E in the upper half of the cabinet when the lower half is empty.

You install each PFC500/E on two L-shaped mounting rails connected to the cabinet's vertical channels. The PFC500/E mounting rails attach to the cabinet only, and do not have components which attach to the RAID chassis.

Rack-mounting the PFC500/E chassis consists of:

1. Determining the rail mounting positions in the cabinet.
2. Attaching the mounting rails to the cabinet.
3. Sliding the PFC500/E chassis onto the mounting rails.
4. Setting addresses and connecting cables.

The following sections describe these operations.

Determining the rail mounting positions

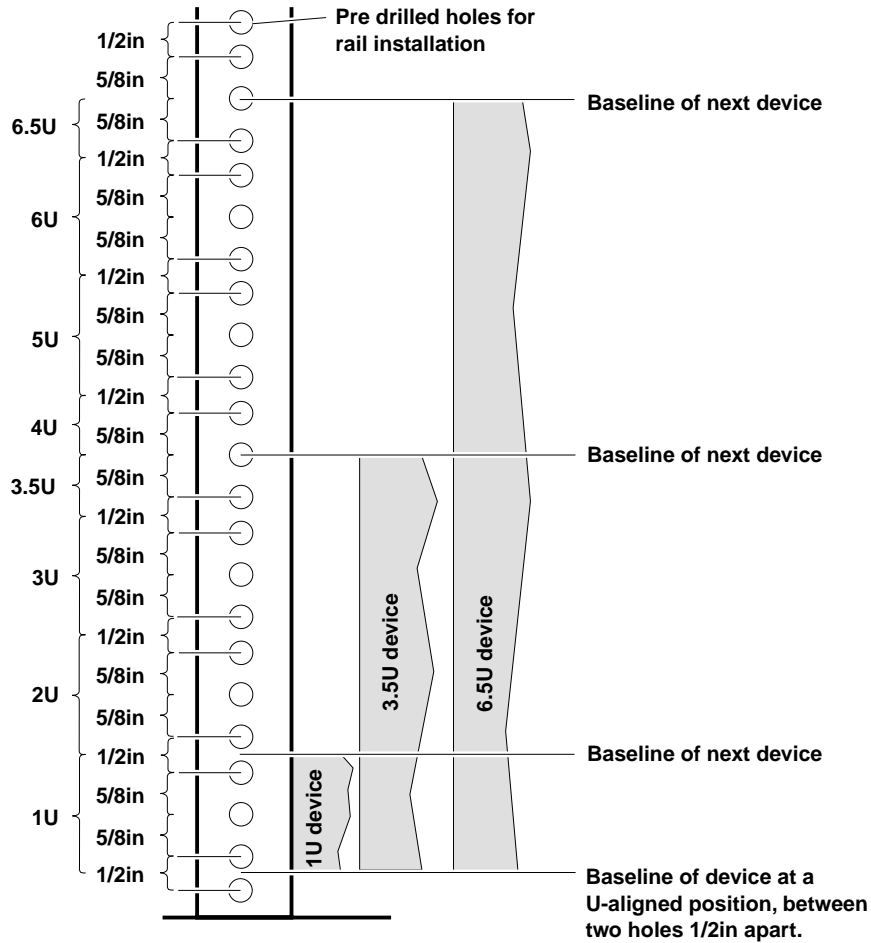
The following table lists the heights of the PFC500 and the PFC500E. Use these measurements to determine the position of your RAID devices in your cabinet.

Device	Height	Number of cabinet channel holes, starting U-aligned
PFC500 RAID Storage Chassis	3.5 U, 6-1/8 in, 15.6 cm	10
PFC500E RAID Expansion Chassis	3.5 U, 6-1/8 in, 15.6 cm	10

NOTE: Because the RAID storage units are each 3.5 U high, a 0.5 U open space is created if you install one of these units immediately below your Profile XP Media Platform. You can fill this gap with a 1/2 U filler, which attaches to the chassis, not to the cabinet channels.



The following illustration shows the baselines of different devices in a cabinet.

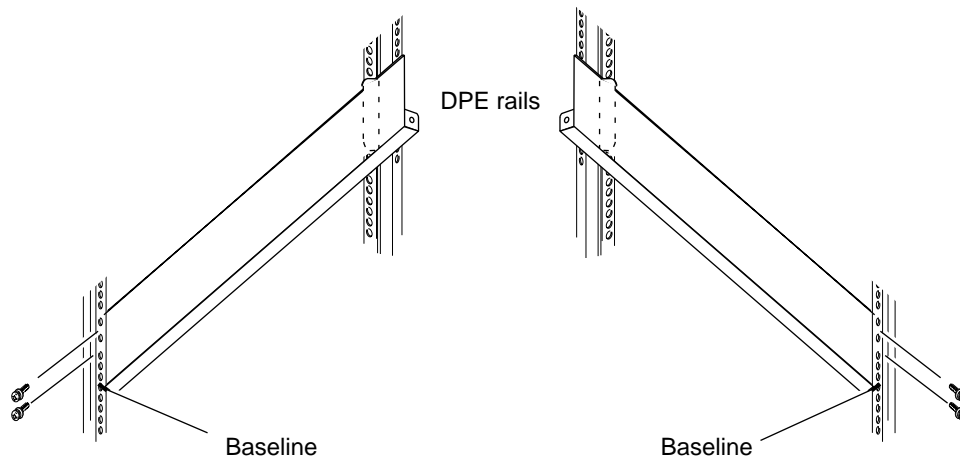


Review your plan to make sure all devices will fit in the cabinet and also review any requirements for filler panels.

Attaching the mounting rails

Once you have determined the positions for the mounting rails, you can attach them to the cabinet. Each rail has threaded nuts on its front flange. You can install any rail in a U-aligned or U-nonaligned position.

1. For each device, attach the rails to the front channels as follows.

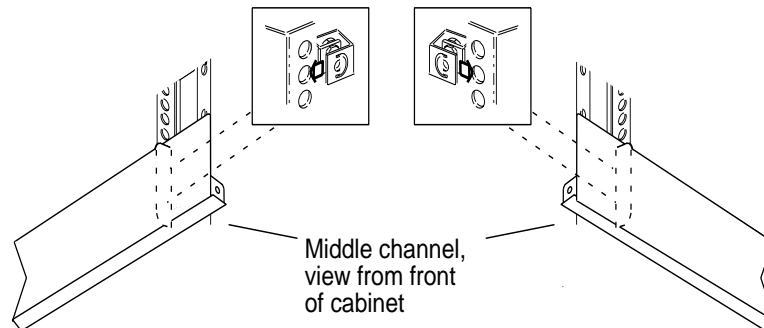


- A. Align the base of the left rail with the baseline and use two screws to attach the front of the left rail loosely to the cabinet's front channel.
- B. Align the base of the right rail with the baseline and use two screws to attach the front of the right rail loosely to the cabinet's front channel.

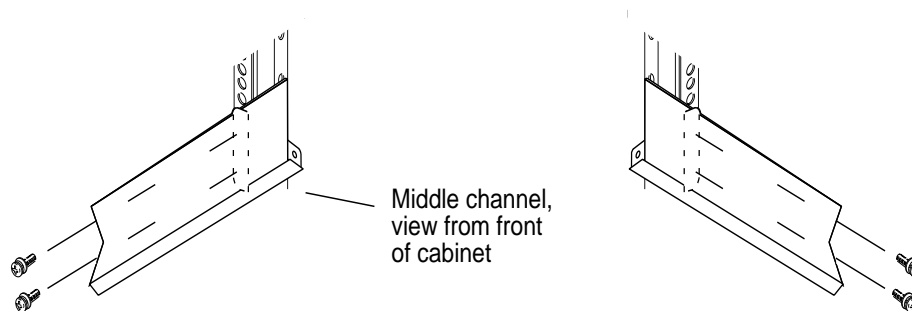


2. Attach the rails to the middle channel, as shown next.

- A. Push the rail away from the middle channel and slide clip nuts onto the channel, into the channel holes that align with the rail holes. The surface of the channel you use depends on the type of rail.



- B. Use two screws to fasten the back of the rail to the clip nuts.



- C. Tighten all screws that fasten the rails to the channels.

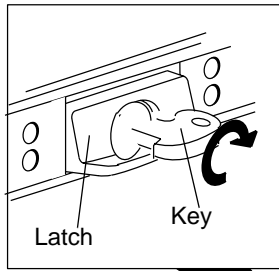
If you want to use one or more filler panels for esthetic purposes, attach them after installing the devices in the cabinet.

Sliding PFC500/E onto rails

To install PFC500/Es on the mounting rails in the cabinet

1. Attach the clip of the ESD wristband (strap) to bare metal on the cabinet, and put the wristband around your wrist with the metal button against your skin.
2. Lift the PFC500/E, and from the front of the cabinet, slide the PFC500/E onto the lowest rails. Brackets on the rear of the rails fit into cutouts on the PFC500/E.

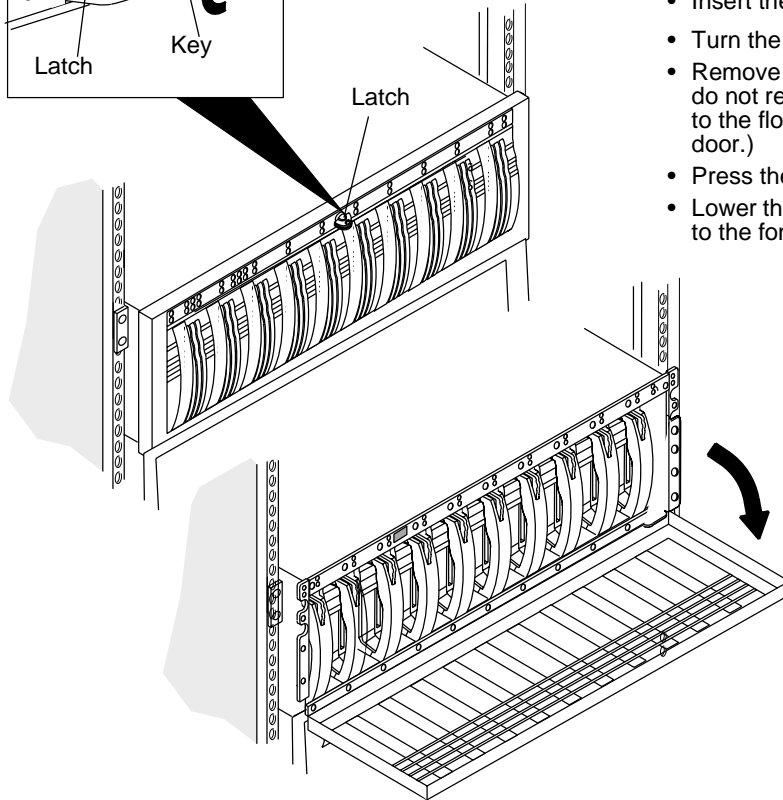
3. Open the PFC500/E front door as shown here.



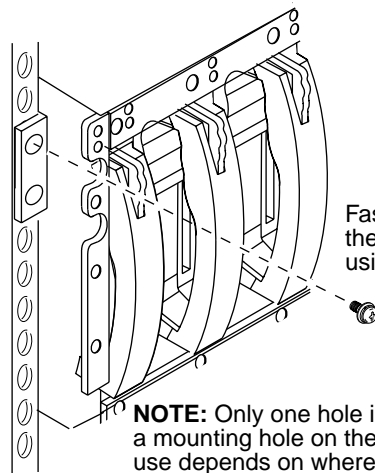
CAUTION: Do not force the door open.
If the door snaps off the hinges, re-install it by positioning it at a 45° angle to the chassis and snapping it into the hinge openings.

If the door is locked

- Insert the key in the door's latch.
- Turn the key 180° clockwise.
- Remove the key, if desired. (If you do not remove the key, it may fall to the floor after you open the door.)
- Press the door latch.
- Lower the door until it is perpendicular to the front of the chassis.



4. Secure the PFC500/E to the vertical channels of the cabinet as shown here.



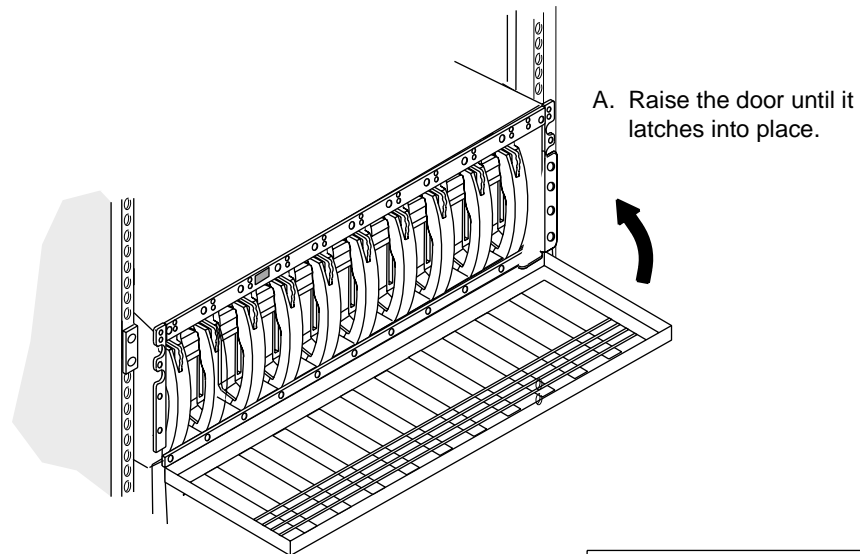
Fasten the front of the enclosure to the front mounting holes in the cabinet using two screws (one per side)

NOTE: Only one hole in the chassis bracket aligns with a mounting hole on the cabinet. The mounting hole you use depends on where the rails are mounted in the cabinet.



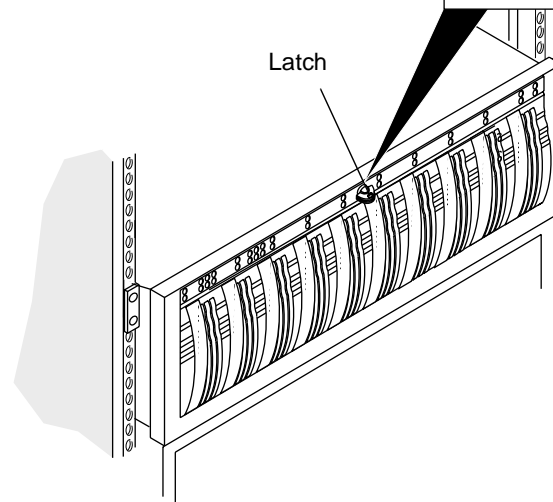
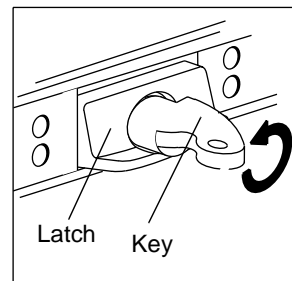
5. Close the PFC500/E front door, as shown here.

IMPORTANT: The door must be closed for EMI compliance. Open the door only to service the PFC500/E.



B. If desired, lock the door as follows:

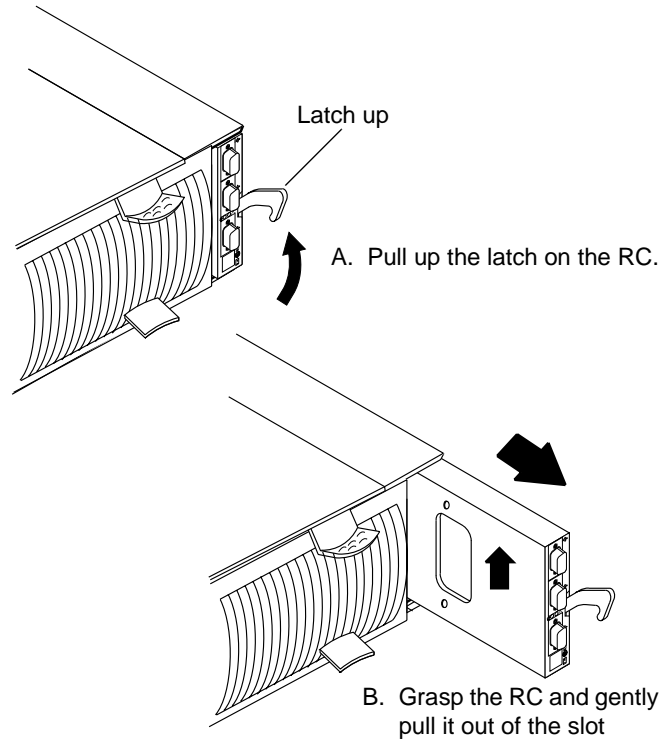
- Insert the key into the door latch.
- Turn the key 180° counterclockwise.
- Remove the key, if desired.



Setting addresses and connecting cables

You must now set FC-AL address ID on the RAID controllers, set the chassis ID, connect Fibre Channel cables, and connect power cables. Refer to the *Profile XP System Guide* for the settings required for your installation.

1. At the back of the PFC500 chassis, remove each RC from its slot as shown below.



2. For each RC, set the FC-AL address ID using the FC-AL ID switches on the RC printed circuit board.

Each node (such as an RC) on a Fibre Channel front-end loop must have a unique FC-AL address ID. The FC-AL protocol translates the FC-AL address ID into an 8-bit arbitrated loop physical address (ALPA).

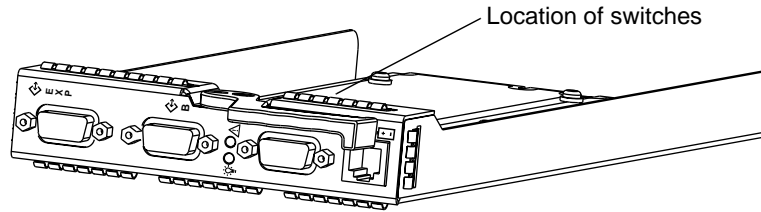
IMPORTANT: Each RC's FC-AL ID must be unique from all other FC devices on that same FC-AL loop.

When using redundant RCs, set the FC-AL ID on the RCs for all PFC500s connected as indicated in the following table.

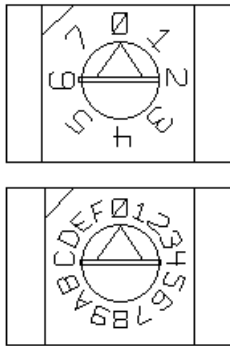
Number of PFC500s	PFC500 chassis	Primary RC's FC-AL ID	Redundant RC's FC-AL ID
1	First	0	1
2	First Second	0 1	2 3
3	First Second Third	0 1 2	3 4 5



The valid FC-AL address ID range is a number 0 through 125 decimal, which is 0 through 7D hexadecimal. The following figures and table locate the switches and show how to select ID numbers using them.



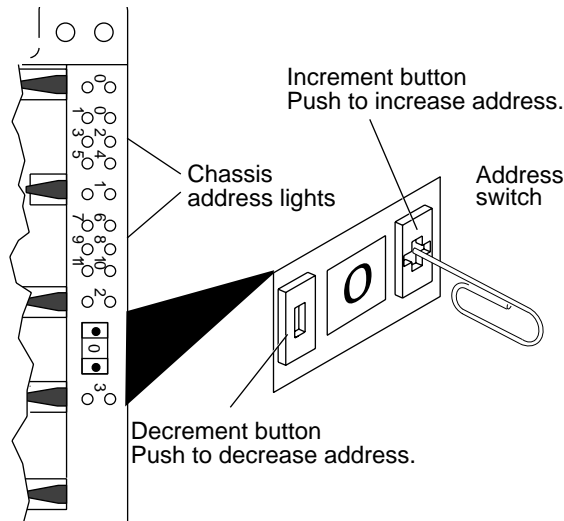
RC FC-AL address ID switches



For address ID	Set top switch to	Set bottom switch to
0	0	0
1	0	1
.	.	.
.	.	.
.	.	.
15	0	F
16	1	0
.	.	.
.	.	.
.	.	.
29	1	D

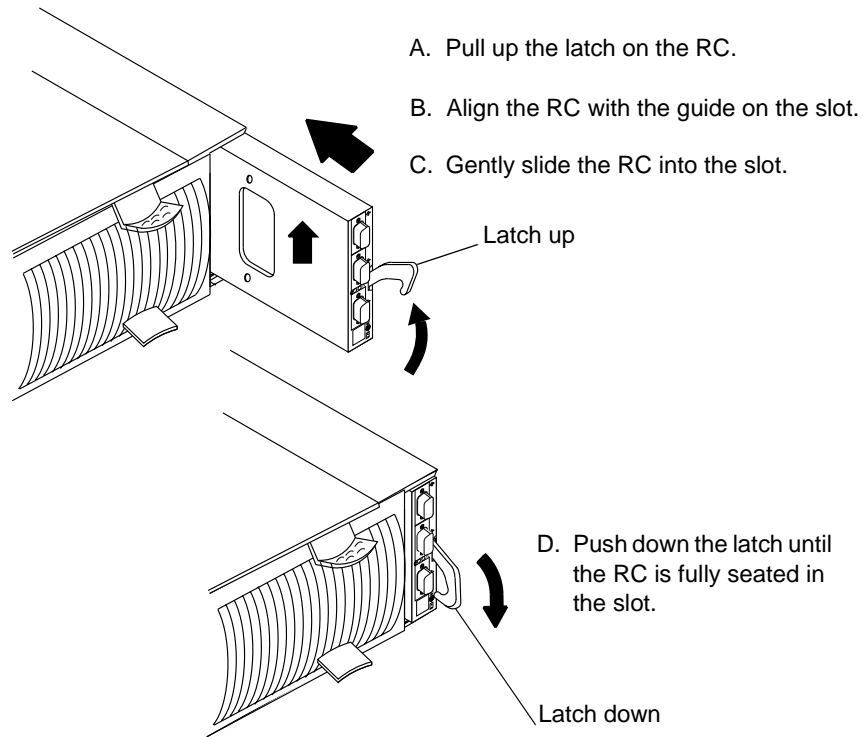
3. Set the PFC500's chassis address (CA) switch to 0 using the tip of a pen or a paper clip as shown in the following illustration.

To access the CA switch, you must open the PFC 500/E's front door. The chassis address, referred to as the back-end address, identifies the PFC500/E and determines disk module addresses. The PFC500 chassis address must be set to 0.

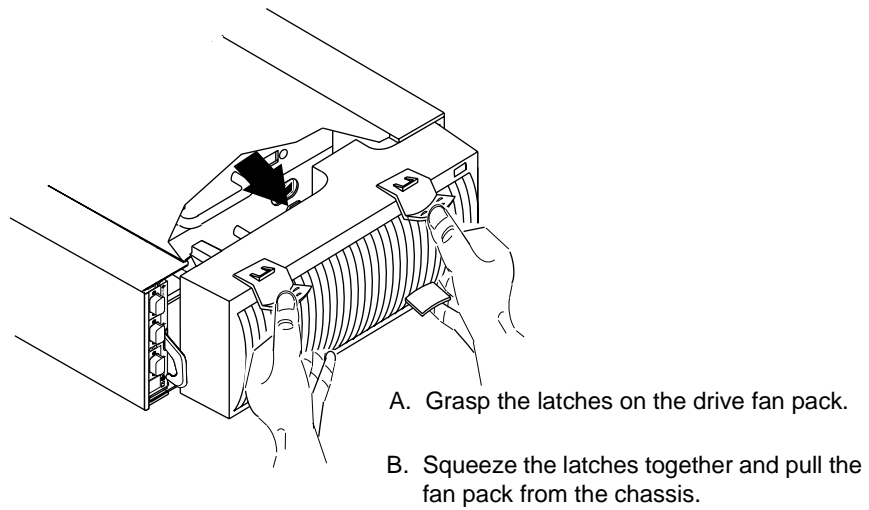


NOTE: The address switch has 16 positions, 12 are marked 0 through 11 and the remaining 4 are marked with a dash (-). A dash position is equivalent to the 0 position.

4. Reinstall each RC in its slot as shown below.

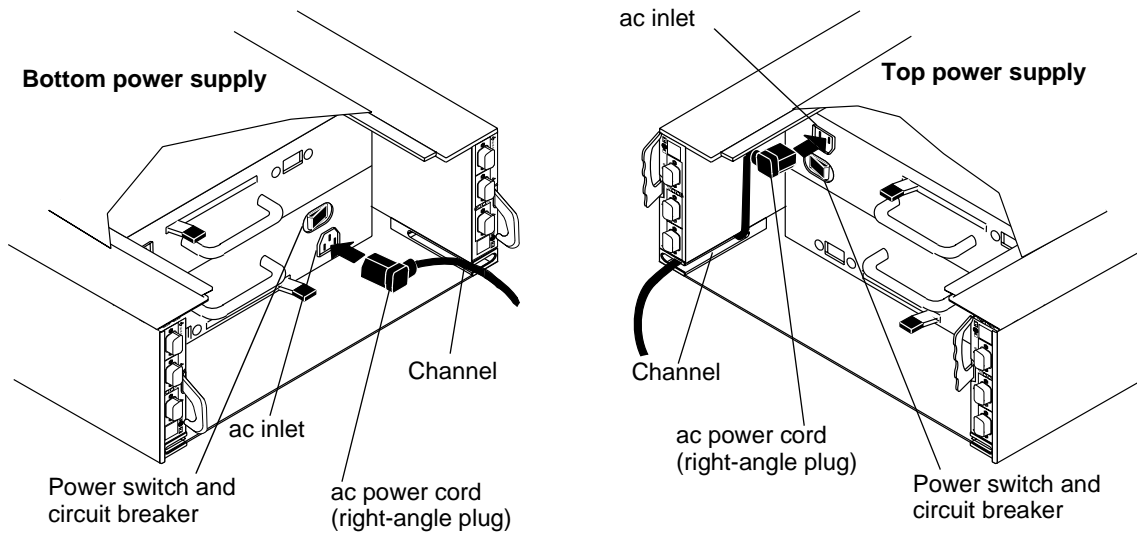


5. Remove the drive fan pack as shown below.





- From the back of the cabinet, plug the ac line cord into each power supply and turn on the supply's power, as shown next.



For each power supply:

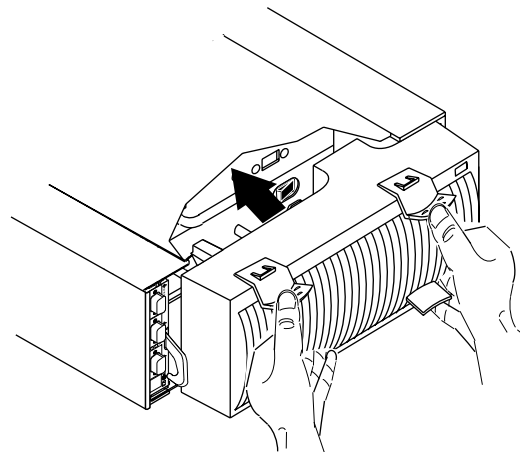
- Insert the right-angle plug on the ac line cord into the supply's ac inlet.
- Route the cord along the power supply to the side of the chassis.

IMPORTANT: The cord must not occupy the drive fan pack space.

- Bend the cord into a U shape and slide the U into the channel so the end of the cable comes out of the channel at the back of the chassis.
- Plug the end of the cord into one of the cabinet's power outlets.
- Set the supply's power switch to the on (1) position.

- Re-install the drive fan pack in the back of the PFC500/E.

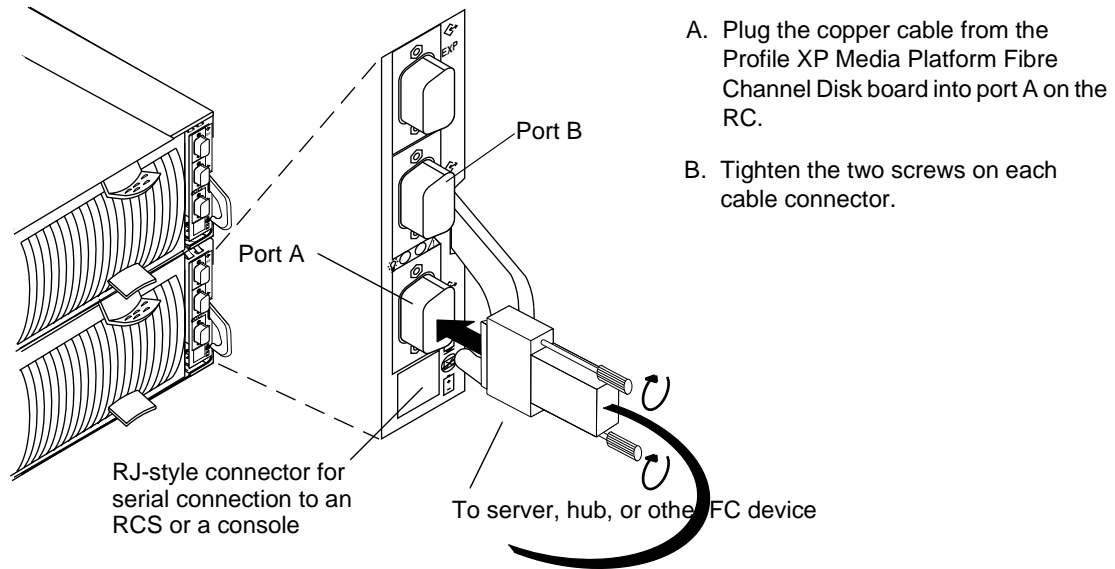
You can install the drive fan pack in either horizontal position. However, for a consistent image with all PFC500/Es, we recommend you install it with the status light in the upper right corner as shown below.



- Grasp the latches on the drive fan pack.
- Squeeze the latches together and gently push the fan pack into the chassis until it clicks in place.

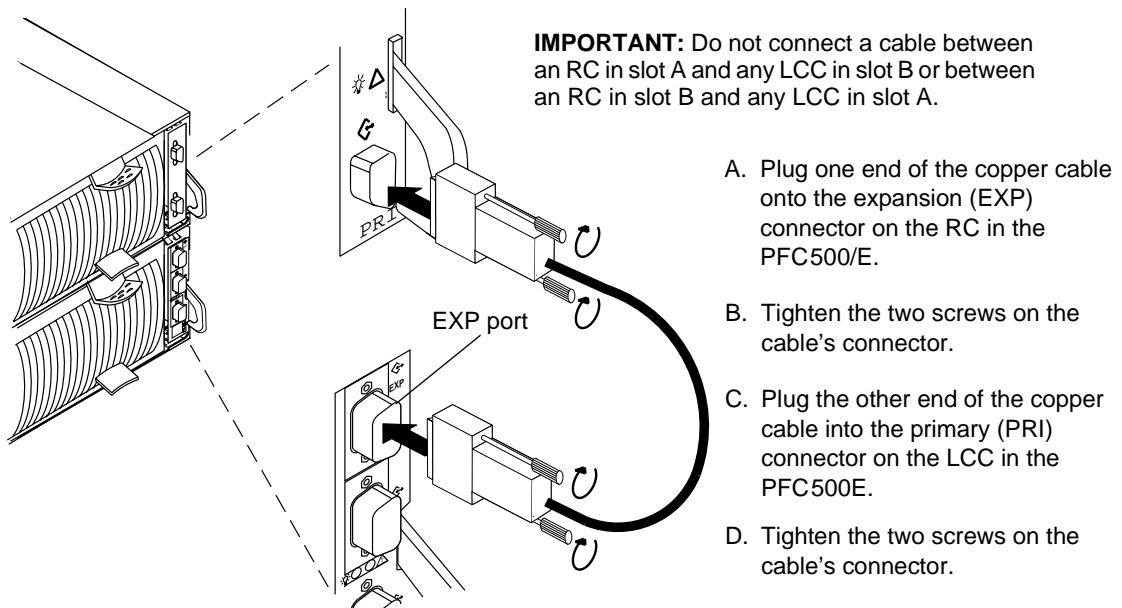
8. Attach the Fibre Channel cable from the Profile XP Media Platform Fibre Channel Disk board to the RC's A port. Use a copper cable as shown here

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



- A. Plug the copper cable from the Profile XP Media Platform Fibre Channel Disk board into port A on the RC.
- B. Tighten the two screws on each cable connector.

9. To expand this PFC 500, cable its EXP connector to the corresponding PFC 500E's PRI (primary) connector as shown here.



IMPORTANT: Do not connect a cable between an RC in slot A and any LCC in slot B or between an RC in slot B and any LCC in slot A.

- A. Plug one end of the copper cable onto the expansion (EXP) connector on the RC in the PFC 500/E.
- B. Tighten the two screws on the cable's connector.
- C. Plug the other end of the copper cable into the primary (PRI) connector on the LCC in the PFC 500E.
- D. Tighten the two screws on the cable's connector.

10. If the PFC 500 has another RC and PFC 500Es, connect the PFC 500's other RC and the PFC 500E's other LCCs as above.



11. To connect additional PFC500Es, attach a copper cable between the PFC500E's LCC EXP connector and the next PFC500E's PRI (primary) connector. If this PFC500E and the next PFC500E have a second LCC, repeat this step for the second LCC.
12. Make sure all the slots in the PFC500 and each PFC500E contain either CRUs or filler modules. At least three disk modules (in slots 0, 1 and 2) are required in the PFC500.
13. In the cabinet, set the main circuit breaker switches to the on position.
The PFC500 and any PFC500Es in the cabinet will power up.

PFC500/E powerup and initialization

The only power switches on a PFC500/E are those on the power supply, which are normally covered by the drive fan pack. As a result, a PFC500/E is always active.

When ac power is initially applied to a PFC500/E, the disk drives power up according to their specifications, and spin up in a specified sequence. The slot spin-up delays are multiples of 12 seconds. The maximum delay is 84 seconds. The same delays are used when you insert a drive while a PFC500/E is powered up.

NOTE: *Upon powerup, all LUNs are controlled by RAID Controller A if it is operational. RC B controls LUNs only if RC A fails, and continues to control LUNs until the next powerup.*

PFC500/E powerdown

To turn off power correctly

1. Stop any I/O activity to the PFC500/E.
2. Shut off power to the ac distribution strips that supply the PFC500/E.

The power in the distribution strips may be controlled by a circuit breaker located inside the cabinet (if the cabinet has such breakers) or may be controlled by a circuit breaker located externally to the cabinet.

To turn on power, reverse the steps to powerup the PFC500/E.

Binding disk modules into groups

After cabling a PFC500/E and any PFC500Es, you must bind disk modules into LUNs and create a file system using the Profile XP Disk Utility. Refer to the *Profile XP System Guide* for more information on configuring your storage system.

Servicing and upgrading a PFC500/E

This chapter describes how to monitor PFC500/E status, handle CRUs, and replace or add a CRU. Topics are

- Hot swapping components
- Monitoring PFC500/E status
- Handling CRUs
- Replacing or adding a disk module
- Replacing all disk modules in a PFC500/E
- Removing an RC or an RC filler module
- Installing or removing the RC memory module
- Installing an RC or RC filler module
- Replacing the drive fan pack
- Replacing or adding a power supply

Hot swapping components

The PFC500/E is designed for continuous operation, and it should always be powered up. You can replace any disk module, redundant RC, or fan pack while the PFC500/E is running.

During normal PFC500/E operation, all compartments should contain either a module or filler, and the front door should be closed. This ensures EMI compliance and proper air flow (cooling) within the unit.

The following CRUs are available from Grass Valley Group.

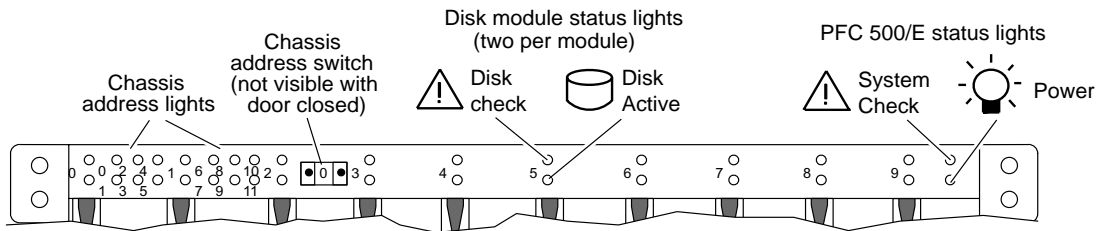
Description	Part Number
18GB replacement drive	PFC18G
36GB replacement drive	PFC36G
RAID Controller (RC)	039-0084-XX
Link Controller Card (LCC)	116-0942-XX
Power supply	119-6314-XX
Fan module	119-6315-XX
Rackmount kit	016-1863-00
Fibre Optic Cable, PFC500 to PFC500E	174-4409-00



Monitoring PFC500/E status

Status lights on the PFC500/E and its CRUs indicate error conditions. These lights are visible outside the PFC500/E. Some lights are visible from the front, and others from the back. The following figure and table describes the status lights.

IMPORTANT: The PFC500 chassis address must be set to 0 (zero).



Light	Quantity	Color	Meaning
PFC500/E Power	1	Green	On when the PFC500/E is powered up.
PFC500/E System Check	1	Amber	On when any fault condition exists.
Disk Active	1 per disk module slot	Green	Off when the disk module slot is empty or contains a filler module. Flashing (<i>mostly off</i>) when the drive is powered up but not spinning; this is a normal part of the spin-up sequence, occurring during the spin-up delay of a slot. Flashing (<i>at a constant rate</i>) when the disk drive is spinning up or spinning down normally. On when the drive is spinning but not handling any I/O activity (the ready state). Flashing (<i>mostly on</i>) when the disk drive is spinning and handling I/O activity.
Disk Check	1 per disk module slot	Amber	On when the disk module is faulty, or as an indication to remove the drive.
Chassis Address	12	Green	The chassis address for the PFC500 must be set to 0 (zero), the only chassis address that is valid for the PFC500.

Status lights visible at the back of the PFC500/E

Light	Quantity	Color	Meaning
Active	1 per RC	Green	On when the RC is powered up.
RC Check	1 per RC	Amber	On when either the RC or a Fibre Channel connection is faulty.
Power Supply Active	1 per supply	Green	On when the power supply is operating.
Power Supply Check	1 per supply	Amber	On when the power supply is faulty or is not receiving ac line voltage.
Cooling Check	1 per supply	Amber	Flashing when either multiple fans in the drive fan pack are faulty or the drive fan pack is removed. The RC powers down the disk drives and goes into standby mode when the fault persists for more than about two minutes.
Drive Fan Pack Check	1 on drive fan pack	Yellow	On when a fan in the drive fan pack is faulty.

If the RC Check light is on, you should look at the other Check lights to determine which CRU is faulty. If a check light on a CRU remains on, you should replace that CRU as soon as possible.

If a non-redundant CRU fails in a PFC500, the system may be inoperable while you replace the CRU. If a redundant CRU fails, high availability will be compromised until you replace the faulty CRU.



Handling CRUs

This section describes the precautions that you must take and the general procedures you must follow when removing, installing, and storing CRUs.

Power issues and CRUs

The PFC500/E is designed for continuous operation and to be hot repairable. It should always be powered up. You should replace any disk module, redundant RC, redundant power supply, or the fan pack while the PFC500/E is running.

Its front door should be closed and each of its compartments should contain a CRU or filler panel to ensure EMI compliance and proper air flow over the CRUs.

While the PFC500/E is powered up, you can service or replace any CRU. You should not remove a faulty CRU until you have a replacement available.

IMPORTANT: You can remove the drive fan pack while the PFC500/E is powered up. While the pack is removed, the Cooling check light on the power supply flashes. If the pack is removed for more than 2 minutes, the disk modules power down and the each RC goes into standby mode. When you reinstall the drive fan pack, the disk modules power up and each RC goes into active mode.

Since you can replace or add any CRU without sliding the PFC500/E out of the cabinet, you do *not* have to use cabinet anti-tip devices when you upgrade or service a PFC500/E.

If you need to power down a PFC500/E, refer to “PFC500/E powerdown” on page 40.

Avoiding electrostatic discharge (ESD) damage

When you replace or install CRUs, you can inadvertently damage the sensitive electronic circuits in the equipment by simply touching them. Electrostatic charge that has accumulated on your body discharges through the circuits. If the air in the work area is very dry, running a humidifier in the work area will help decrease the risk of ESD damage. You must follow the procedures below to prevent damage to the equipment.

IMPORTANT: Read and understand the following instructions.

- Provide enough room to work on the equipment. Clear the work site of any unnecessary materials or materials that naturally build up electrostatic charge, such as foam packaging, foam cups, cellophane wrappers, and similar items.
- Do not remove replacement or upgrade CRUs from their antistatic packaging until you are ready to install them.
- Gather together the ESD kit and all other materials you will need before you service a PFC500/E. Once servicing begins, you should avoid moving away from the work site; otherwise, you may build up an electrostatic charge.
- Use the ESD kit when handling any CRU. If an emergency arises and the ESD kit is not available, follow the procedures in the “Emergency procedures (without an ESD kit)” section.

- To use an ESD wristband, attach the clip of the ESD wristband (strap) to any bare (unpainted) metal on the PFC500/E chassis; then put the wristband around your wrist with the metal button against your skin.

Emergency procedures (without an ESD kit)

In an *emergency* when an ESD kit is not available, use the following procedures to reduce the possibility of an electrostatic discharge by ensuring that your body and the subassembly are at the same electrostatic potential.

IMPORTANT: These procedures are not a substitute for the use of an ESD kit. Follow them only in the event of an emergency.

- Before touching any CRU, touch a bare (unpainted) metal surface of the cabinet or chassis.
- Before removing any CRU from its antistatic bag, place one hand firmly on a bare metal surface of the chassis, and at the same time, pick up the CRU while it is still sealed in the antistatic bag. Once you have done this, *do not* move around the room or contact other furnishings, personnel, or surfaces until you have installed the CRU.
- When you remove a CRU from the antistatic bag, avoid touching any electronic components and circuits on it.
- If you must move around the room or touch other surfaces before installing a CRU, first place the CRU back in the antistatic bag. When you are ready again to install the CRU, repeat these procedures.

Precautions when removing, installing, or storing CRUs

Use the precautions listed below when you remove, handle, or store CRUs.

- Do not remove a faulty CRU until you have a replacement available.
- Handle a CRU only when using an ESD wristband as follows: attach the clip of the ESD wristband to the ESD bracket or bare metal on the PFC500/E chassis, and put the wristband around your wrist with the metal button against your skin.
- Handle CRUs gently. A sudden jar, drop, or vibration can permanently damage a CRU.
- Never use excessive force to remove or install a CRU.
- Store a CRU in the antistatic bag and specially designed shipping container in which you received it. Use that container if you need to return the CRU for repair.
- Maintain the location where you store CRUs within the limits specified in Appendix A.



Replacing or adding a disk module

IMPORTANT: Grass Valley Group does not support mixing disk drives of differing capacities in any RAID chassis connected to a Profile XP media platform. All disk drives in any RAID chassis connected to a Profile XP media platform must be of the same capacity. For example, if a PFC500 and a PFC500E are connected to a Profile XP system, all the disk drives in both the PFC500 and the PFC500E must be of the same capacity.

>>> **CAUTION:** You can destroy a storage system beyond recovery if you move the wrong drive. The system operator or service person can move a disk module with the following cautions:

- The disk module must be unbound.
- Moving a 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. A disk module being inserted or removed may be damaged by a partially removed adjacent module.

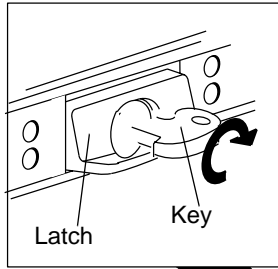
When replacing multiple disks, observe the following:

- After removing a disk module, wait for the activity lights on the other disk modules to resume a steady flicker before removing the next module. The activity lights show that the LIC (licensed internal code) has rediscovered the FC loop.
- After inserting a disk module, wait for the activity lights on the other drives to resume a steady flicker before inserting the next module. As with module removal, the activity lights show that the LIC has rediscovered the FC loop.

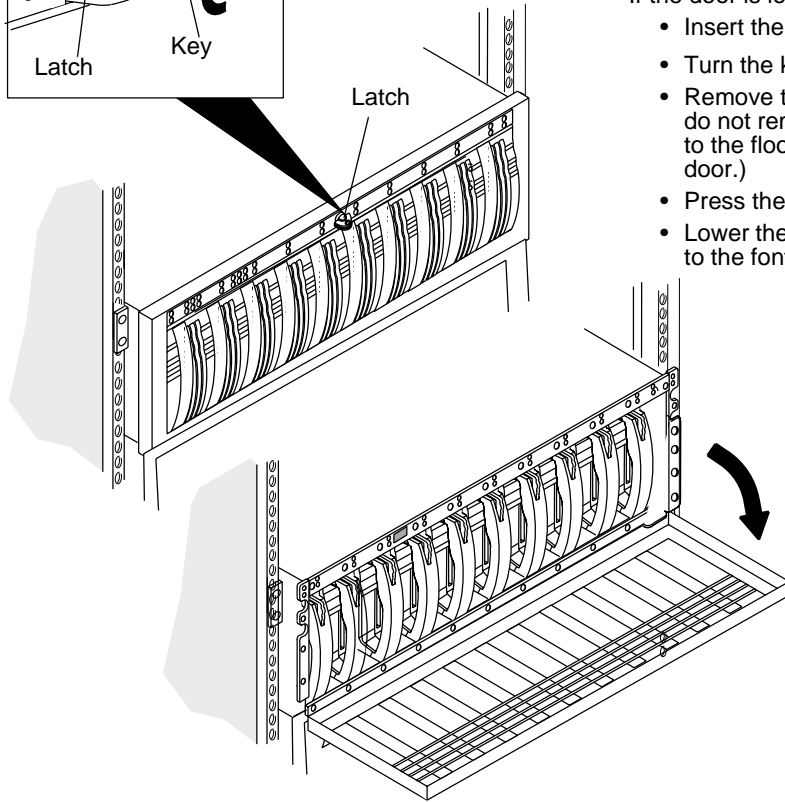
>>> **CAUTION:** Handle a disk module gently and use an ESD wristband. Do not remove a faulty disk module until you have a replacement module (with the same part number) or a filler module available. The part number appears on the top or bottom of the module. A replacement or add-on disk module should have the same format (520- or 512-byte sectors) and the same capacity as the other modules in the chassis.

IMPORTANT: You must open the PFC500/E's front door to access the disk modules. The door must be closed for EMI compliance when the PFC500/E is powered up. Open it only to replace or add a disk module.

3. To unlock and open the front door



CAUTION: Do not force the door open.
If the door snaps off the hinges, re-install it by positioning it at a 45° angle to the chassis and snapping it into the hinge openings.



If the door is locked

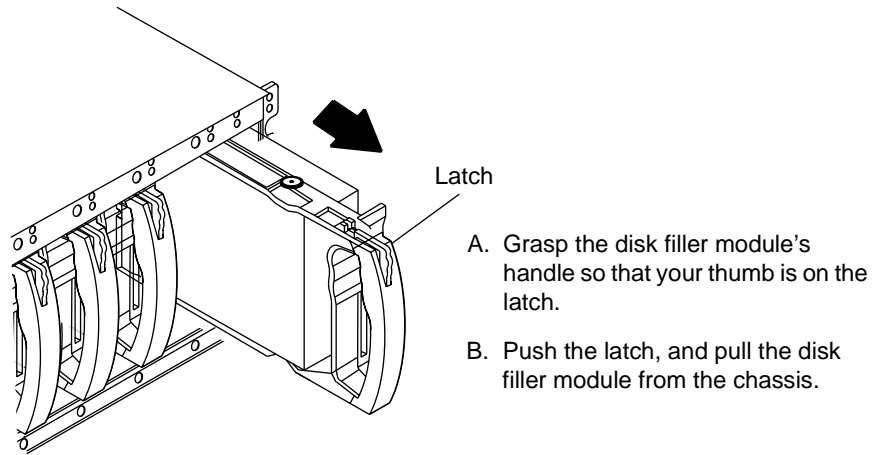
- Insert the key in the door's latch.
- Turn the key 180° clockwise.
- Remove the key, if desired. (If you do not remove the key, it may fall to the floor after you open the door.)
- Press the door latch.
- Lower the door until it is perpendicular to the front of the chassis.

If you are adding a new disk module, continue to the disk filler module removal procedure that follows. If you are replacing a faulty disk module, proceed to the disk module removal procedure.



To remove a disk filler module

Locate the slot where you want to install the disk module, and remove the filler module, as shown next.

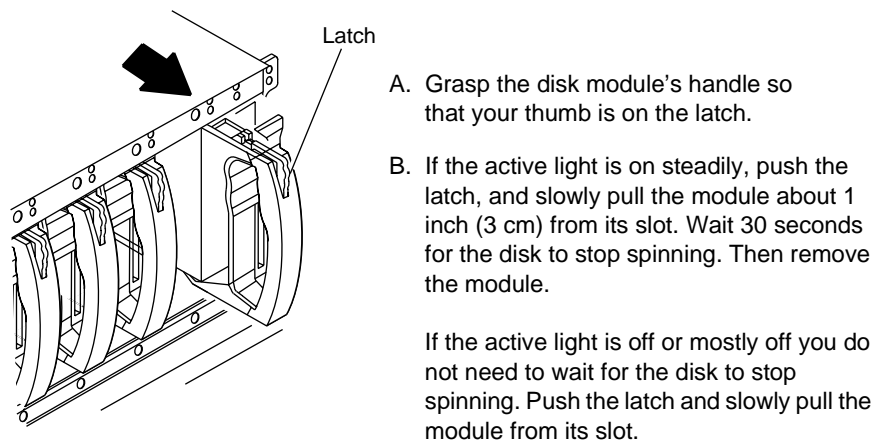


Skip to the disk installation procedure (page 49) to install the add-on disk module in the slot you just emptied.

To remove a disk module

IMPORTANT: 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.

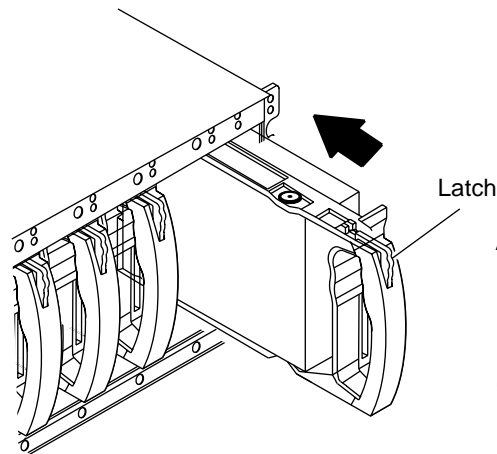
Generally, you should not remove a disk module unless its amber check light is on. Remove the disk module from the slot, as shown next.



Continue to the next section to install the replacement disk module.

To install a disk or filler module

1. *Gently* insert the disk module as follows:



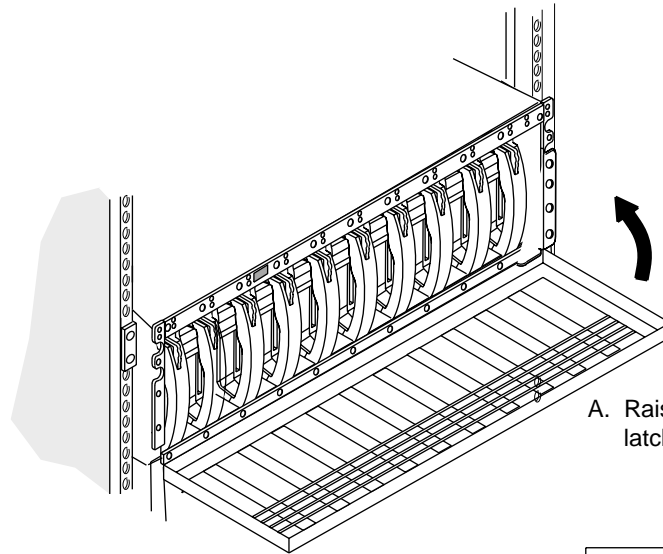
- A. Grasp the disk or filler module's handle.
- B. Align the module with the guides in the slot.
- C. Gently push the module into the slot until the latch engages.

The disk module's Active light flashes to reflect the disk's spin-up sequence. (No lights flash with a filler module.)

2. Remove and store the ESD wristband and continue to the next section to close the front door.



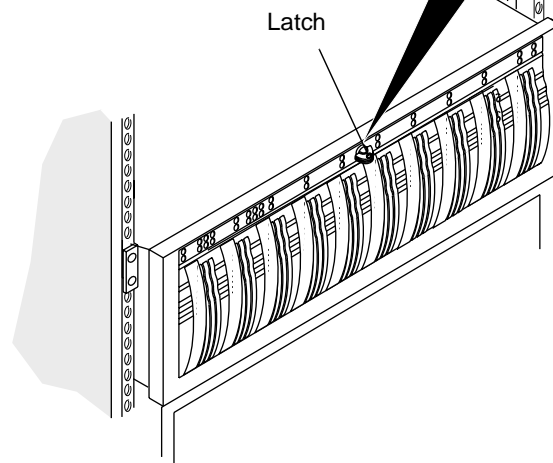
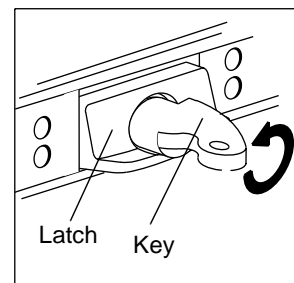
To close and lock the front door



A. Raise the door until it latches into place.

B. If desired, lock the door as follows:

- Insert the key into the door latch.
- Turn the key 180°



Replacing all disk modules in a PFC500/E

IMPORTANT: Grass Valley Group does not support mixing disk drives of differing capacities in any RAID chassis connected to a Profile XP media platform. All disk drives in any RAID chassis connected to a Profile XP media platform must be of the same capacity. For example, if a PFC500 and a PFC500E are connected to a Profile XP system, all the disk drives in both the PFC500 and the PFC500E must be of the same capacity.

In most cases, you will not need to replace more than one disk module at a time, and you do so while the PFC500/E is in operation without removing power. However, if you are upgrading your PFC500/E to use higher capacity or higher performance disk modules, it is necessary to power down the system.

To power down a PFC500/E, refer to “PFC500/E powerdown” on page 40.

Disk modules 0, 1, and 2 in the PFC500 RAID Storage Chassis each store a copy of the licensed internal code (LIC), which is the operating system and executable code for the RCs. This code is not installed on replacement disk modules, but must be transferred to the new disk modules. The following procedure guides you through the installation, making sure that the LIC is safely transferred to the new disk modules.

IMPORTANT: Unbinding the LUNs in the PFC500/E renders all data on the disk modules inaccessible. If you wish to preserve the data stored on the disk modules prior to replacing them, be sure to transfer the data to another storage location before you unbind the LUNs.

1. Unbind the LUNs in the PFC500/E that contain the disk modules you are replacing.
2. Power down the Profile XP system.
3. Power down the PFC500/E.
4. Remove the disk modules numbered 1 through 9 from the PFC500 Storage Chassis leaving disk module 0 with the LIC installed, and remove all the disk modules from the PFC500/E RAID Expansion Chassis.
5. Install the replacement disk modules into slots 1 through 9 in the PFC500 Storage Chassis, and into all slots in the PFC500/E RAID Expansion Chassis.
6. Power up the PFC500/E; allow disk module 0 in the PFC500 Storage Chassis to copy the LIC to disk modules 1 and 2.
7. When the copy operation is complete, power down the PFC500/E.
8. Remove the disk module from position 0 in the PFC500 Storage Chassis and replace it with the remaining replacement disk module.
9. Power up the PFC500/E; allow disk modules 1 and 2 in the PFC500 Storage Chassis to copy the LIC to disk module 0.
10. When the copy operation is complete, power down the PFC500/E.
11. Power up the PFC500/E again, then power up the PVS1000.
12. Using the Profile disk utility described in the *Profile XP System Guide*, bind the new disk modules in the PFC500/E into LUNs and create a new file system.



Removing an RC or an RC filler module

>>> **CAUTION:** Handle an RC gently and use an ESD wristband. Do not remove a faulty RC until you have a replacement module or filler module available.

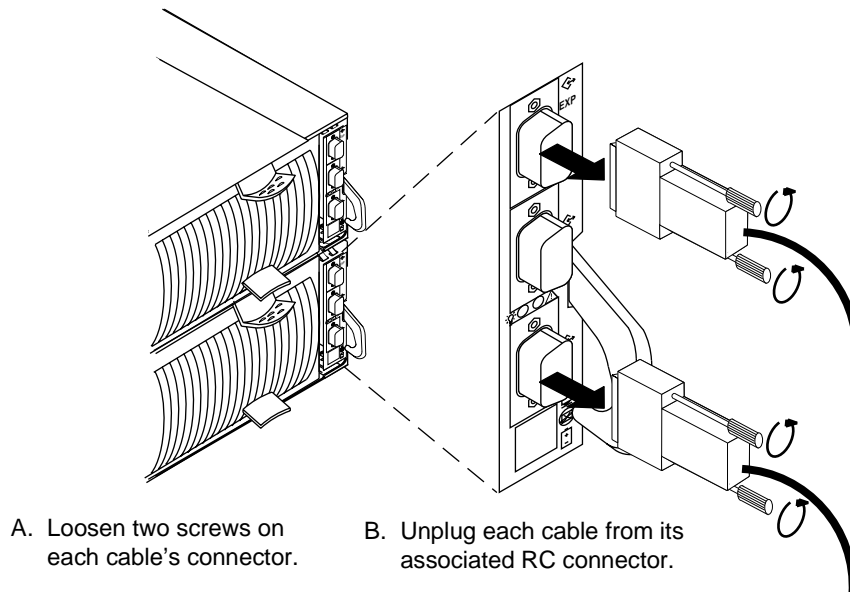
IMPORTANT: A PFC500 must have at least one RC installed while it is powered up. Do not remove both RCs while the PFC500 is powered up.

Before removing an RC from a storage system that has caching enabled, you should disable the storage-system cache using a utility described in the server setup manual.

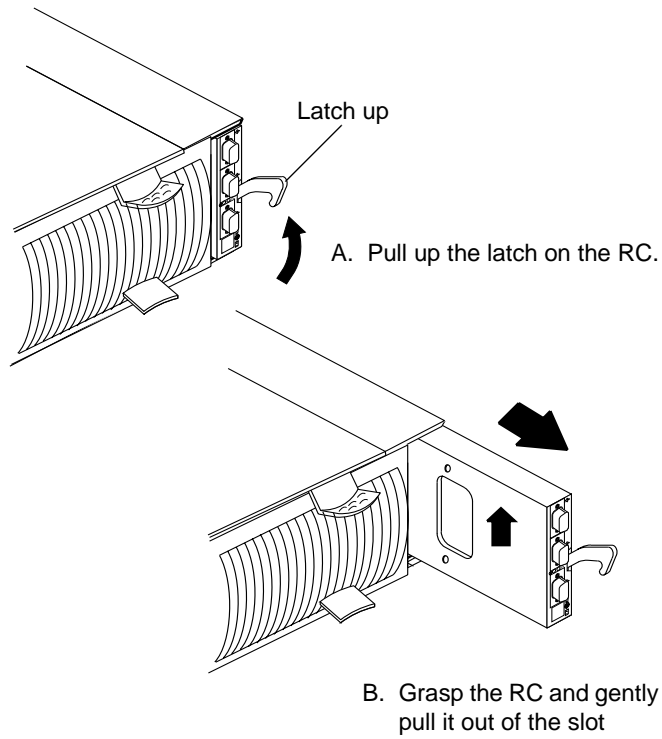
To remove an RC or an RC filler module

1. If you are removing an RC filler module, ignore this step and proceed to step 2 on the next page; otherwise, remove the cables connected to the RC, as shown here.

IMPORTANT: Note where the cables connect to the RC.



2. Remove the RC or RC filler module from its slot as shown here.



Continue to the next section to install the memory on the RC.



Installing or removing the RC memory module

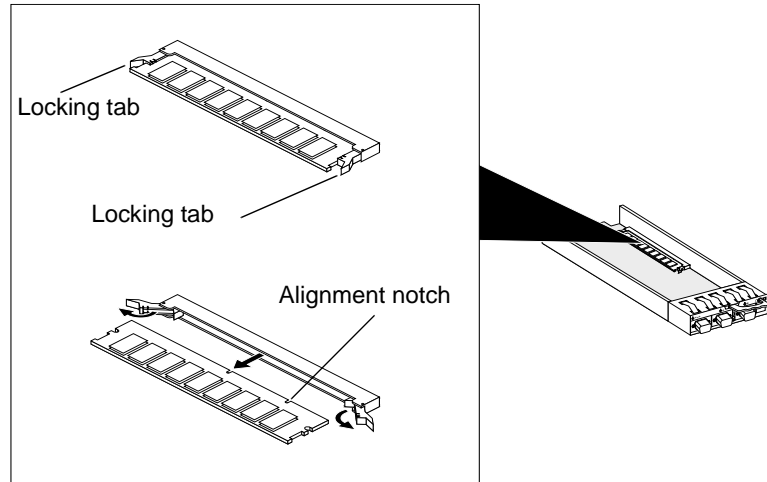
Although you RC is equipped with the required amount of memory, you may need to upgrade the memory in the future. Use these instructions to remove or add memory modules.

To install or remove an RC memory module

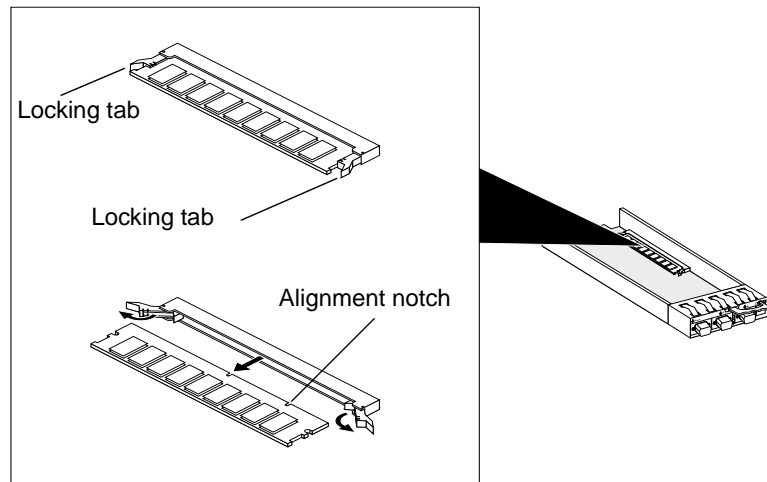
1. Read the “Avoiding electrostatic discharge (ESD) damage” section (page 44).
2. Attach the clip of the ESD wristband to any bare (unpainted) metal on the PFC500/E chassis; then put the wristband around your wrist with the metal button against your skin.
3. Remove the memory module (or the new RC board and memory module) from its packaging, and place it on a static-free work surface.
4. If you are upgrading an RC, remove the RC from the chassis (page 52) and place it on a static-free work surface.
5. On the RC, remove and/or install the DIMM in the appropriate connector as shown next.

IMPORTANT: A memory module has a notch on its edge near pin 1 so that you can insert it only one way.

- A. Use your thumbs to push out on the locking tabs, and use your fingers to push the DIMM forward until it releases from the tabs.
- B. Lift the module out of the connector, and place it in its own antistatic packaging.



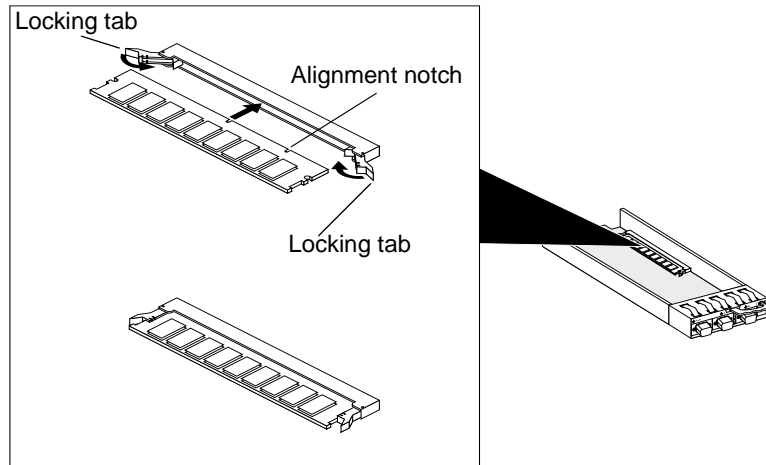
- A. Use your thumbs to push out on the locking tabs, and use your fingers to push the DIMM forward until it releases from the tabs.
- B. Lift the module out of the connector, and place it in its own antistatic packaging.



IMPORTANT: Depending on the memory size (in megabytes), the PFC500/E RC memory module can contain chips on only one side or on both sides.



- A. Lift the module out of its antistatic packaging and place the module into the connector.
- B. Ensure that the alignment notch is correctly oriented.
- C. Use your fingers to push out on the locking tabs, and use your thumbs to push the module in until seated. Then engage the tabs.



6. If you want to install the RC, continue to the next section.

If you want to ship the RC, store it in its antistatic bag and special shipping package. Then remove and store the ESD wristband.

Installing an RC or an RC filler module

IMPORTANT: If you are installing a new/add-on/replacement RC, ensure that the RC memory has been installed before proceeding to install the RC.

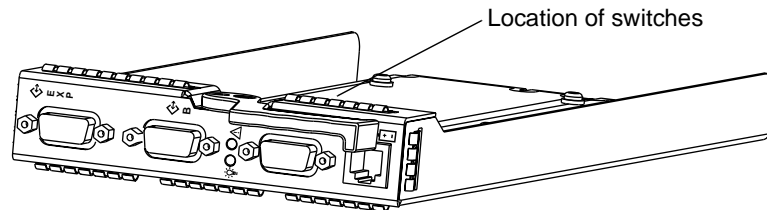
Each RC requires a unique FC-AL address ID on the loop to communicate with the Profile XP Media Platform. If you are installing a replacement RC, set its address to be the same as that of the RC you removed. If you are installing an add-on RC, set the address to a different setting than the address of any other RC on the loop. The FC-AL protocol translates the FC-AL address ID into an 8-bit arbitrated loop physical address (ALPA).

IMPORTANT: Each RC's FC-AL ID must be unique on the FC-AL loop. If you have two FC-AL loops, we suggest a unique FC-AL address ID for each RC on both loops.

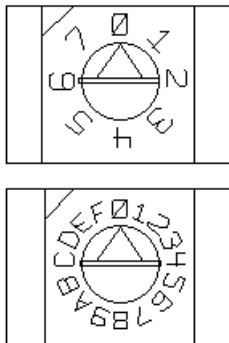
The valid FC-AL address ID range is a number 0 through 125 decimal, which is 0 through 7D hexadecimal. The following figures and table locate the switches and show how to select ID numbers using them.

IMPORTANT: You must set the FC-AL address ID on the RC before you install it. If you are installing an RC filler module, ignore step 1 and proceed to step 2 on the next page.

- Using the RC FC-AL ID switches, set the FC-AL address ID as shown below. Refer to the table on page 35 for address settings in a redundant system.



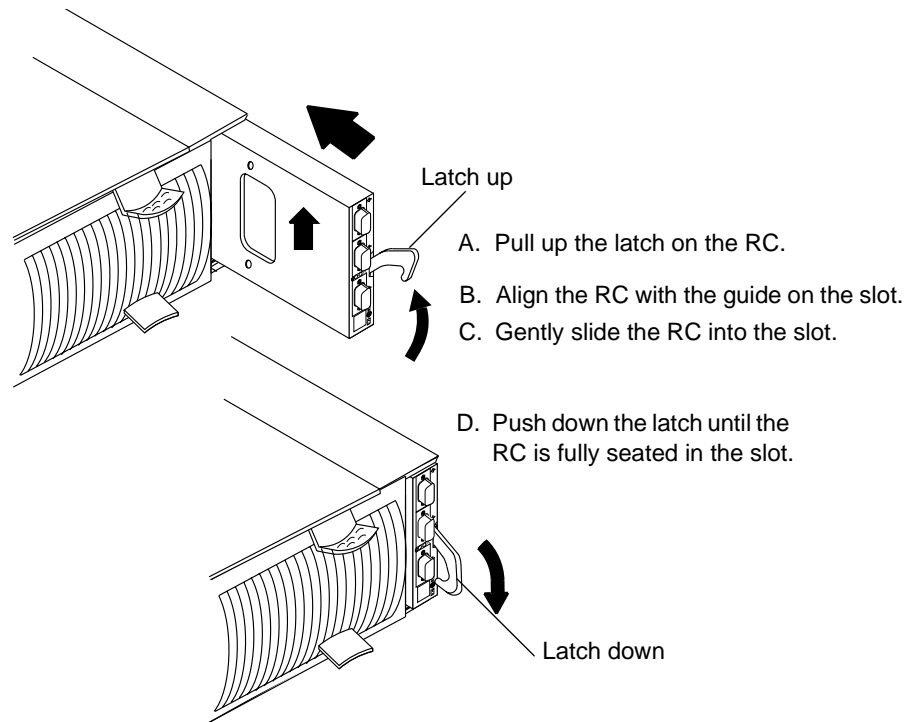
RC FC-AL address ID switches



For address ID	Set top switch to	Set bottom switch to
0	0	0
1	0	1
.	.	.
.	.	.
.	.	.
15	0	F
16	1	0
.	.	.
.	.	.
.	.	.
29	1	D



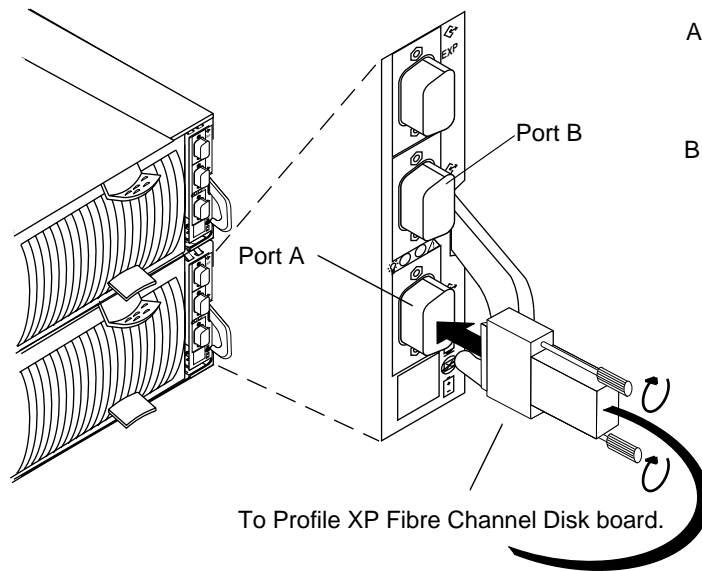
2. Gently insert the RC or RC filler module as shown below.



If you just installed an RC filler module, you are done. Remove and store the ESD wristband.

If you just installed a replacement or add-on RC, the RC Active light turns on. Continue to step 3.

3. Install the cables connected to the RC:



- A. Plug the copper cable(s) from the server, hub, or other FC device into port(s) A and/or B on the RC.
- B. Tighten the two screws on each cable connector.

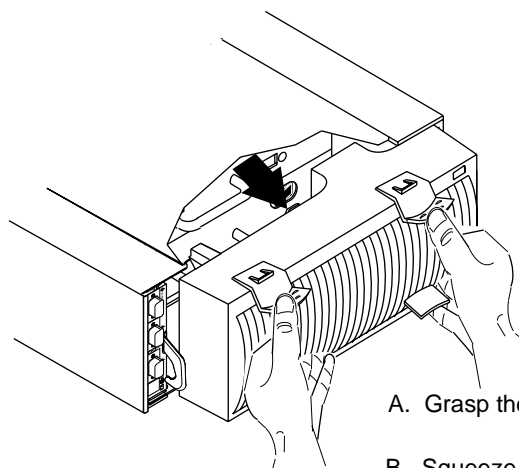
4. Remove and store the ESD wristband.



Replacing the drive fan pack

>>> **CAUTION:** Handle a drive fan pack gently and use an ESD wristband. Do not remove a faulty drive fan pack until you have a replacement unit available. You can remove the drive fan pack while the PFC500/E is powered up. While the pack is removed, the Cooling Check light on the power supply flashes. If the pack is removed for more than two minutes, the disk modules power down and the RC(s) go into standby mode. The disk modules power up when you reinstall the drive fan pack.

To remove the drive fan pack

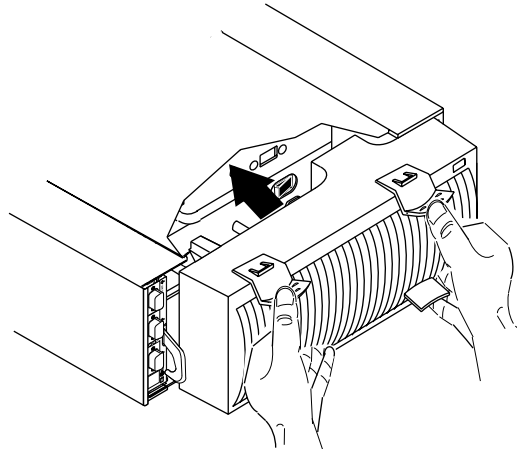


- A. Grasp the latches on the drive fan pack.
- B. Squeeze the latches together and pull the fan pack from the chassis.

As soon as the pack is disconnected from each power supply, the drive fan pack Check light turns off, if it was not already off; the PFC500/E Check light on the front panel turns on, if it was not already on; and the Cooling Check light on each power supply flashes.

To install the drive fan pack

You can install the drive fan pack in either horizontal orientation. However, we recommend that you install it with the status light in the upper right corner.



- A. Grasp the latches on the drive fan pack.
- B. Squeeze the latches together and gently push the fan pack into the chassis until it clicks in place.

As soon as the pack is in place, the fans start spinning; the PFC 500/E Check light turns off if no other CRUs are faulty, and the Cooling Check light on each power supply turns off.



Replacing or adding a power supply module

>>> **CAUTION:** *To access the power supplies, you must remove the drive fan pack. If the drive fan pack is removed for more than approximately two minutes, the disk modules power down and the RC(s) go into standby mode. The disk modules power up when you reinstall the drive fan pack.*

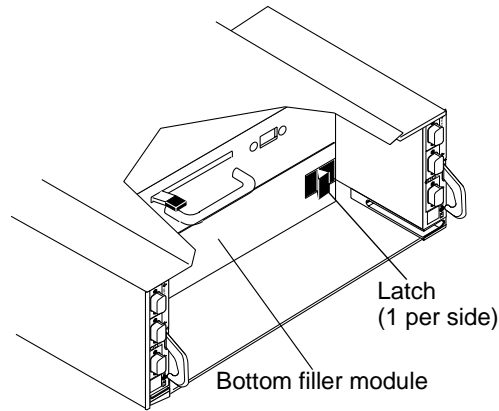
Handle a power supply gently and use an ESD wristband. Do not remove a power supply until you have a replacement supply or filler module available.

IMPORTANT: *If one power supply is off and the other is on, do not turn one on and immediately turn off the other. Instead, turn one on and wait five seconds before turning the other off.*

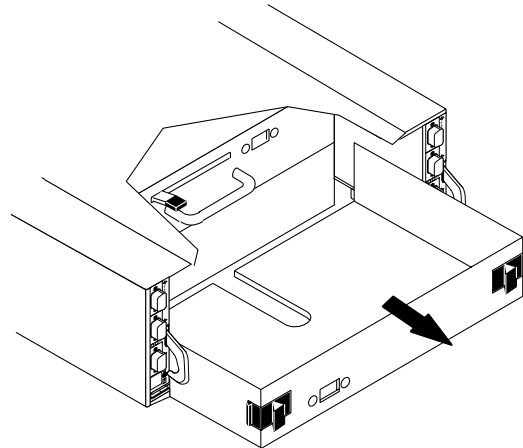
If you are adding a new power supply, continue to the procedure that follows. If you are replacing a faulty power supply, proceed to the power-supply removal procedure as shown on page 64.

To remove a power supply filler module

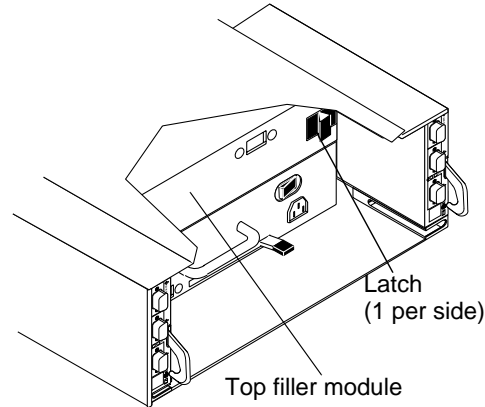
1. Remove the drive fan pack as shown on page 60.
2. Remove the power supply filler module as shown.



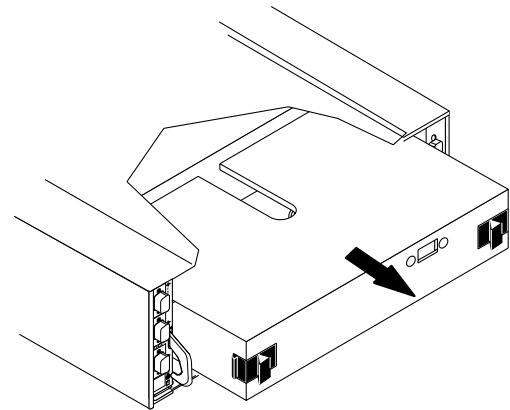
A. Push the latches on both sides of the filler module towards the center of the module.



B. Pull the filler module from the slot.



A. Push the latches on both sides of the filler module towards the center of the module.



B. Pull the filler module from the slot.

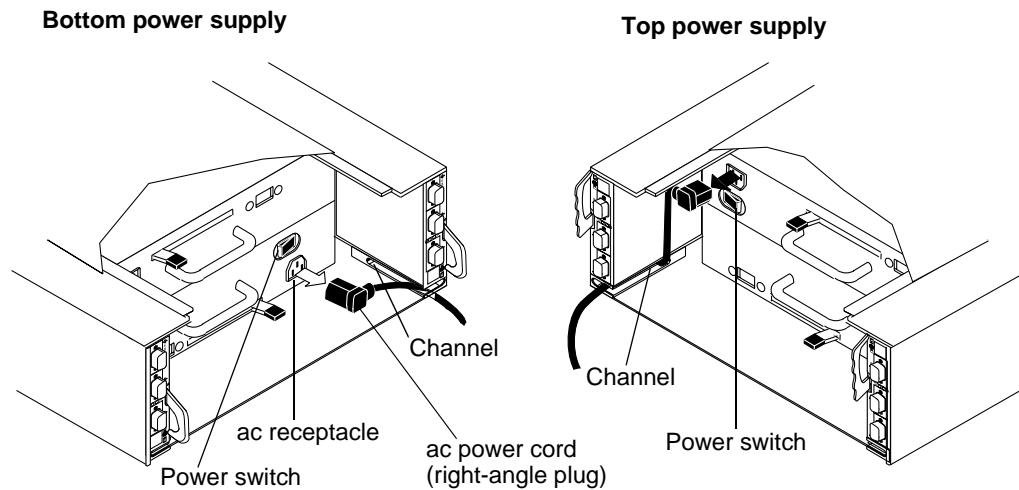
Continue to the power supply installation procedure (page 67) to install the add-on power supply in the slot from which you removed the filler module.



To remove a power supply

>>> **CAUTION:** Turn off the power supply before unplugging the power cord from the supply or removing the supply from the chassis.

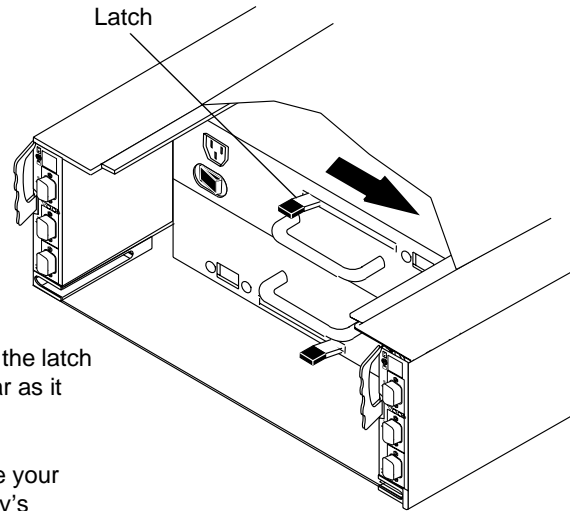
1. Remove the drive fan pack as shown on page 60.
2. Turn off the power supply and unplug its ac line cord as shown.



For the power supply to be removed:

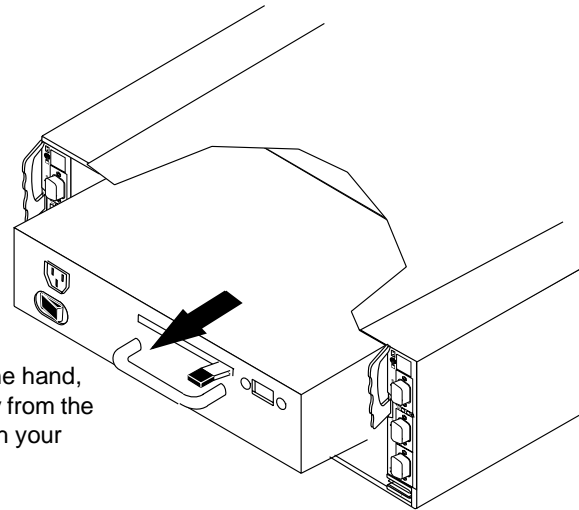
- A. Set the supply's power switch to the off (0) position.
- B. Unplug the ac power cord from the supply's receptacle.
- C. Remove the cord from the chassis.

3. Remove the power supply as shown here.

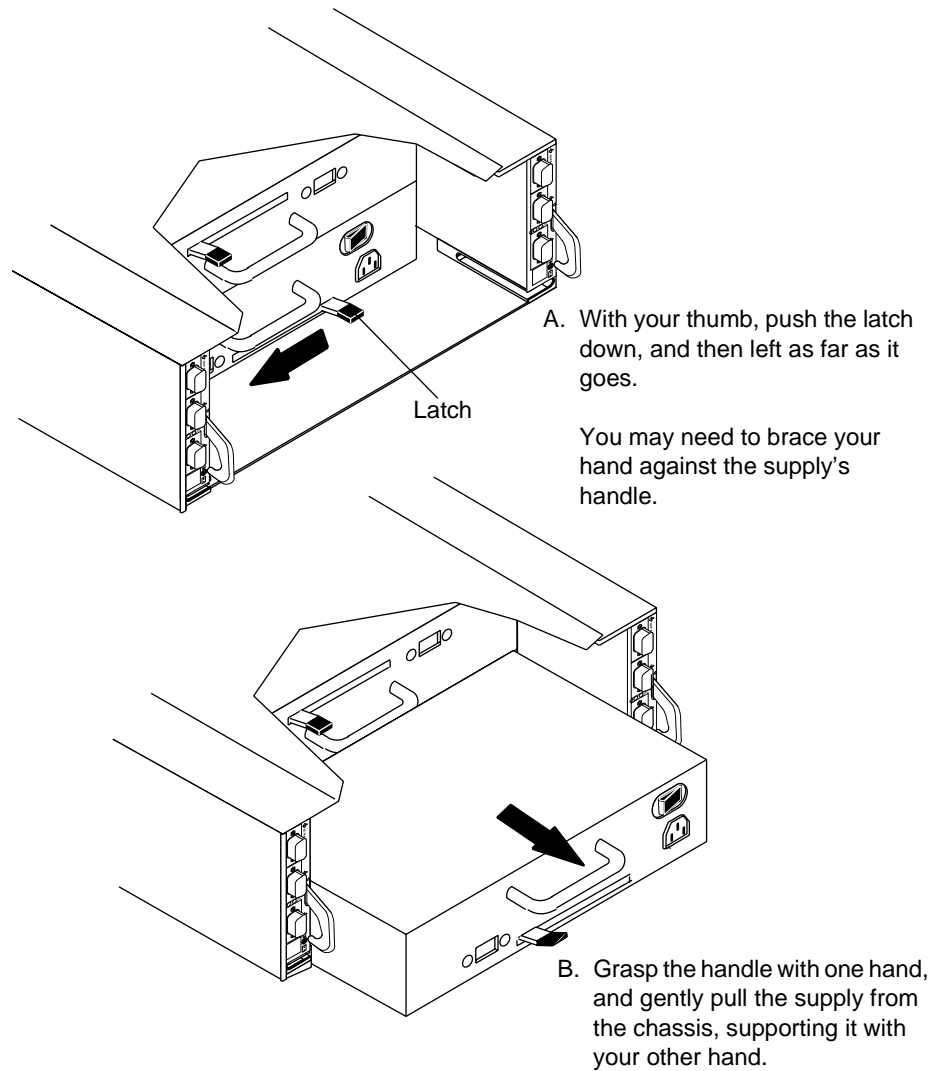


A. With your thumb, push the latch up, and then right as far as it goes.

You may need to brace your hand against the supply's handle.



B. Grasp the handle with one hand, and gently pull the supply from the chassis, supporting it with your other hand.



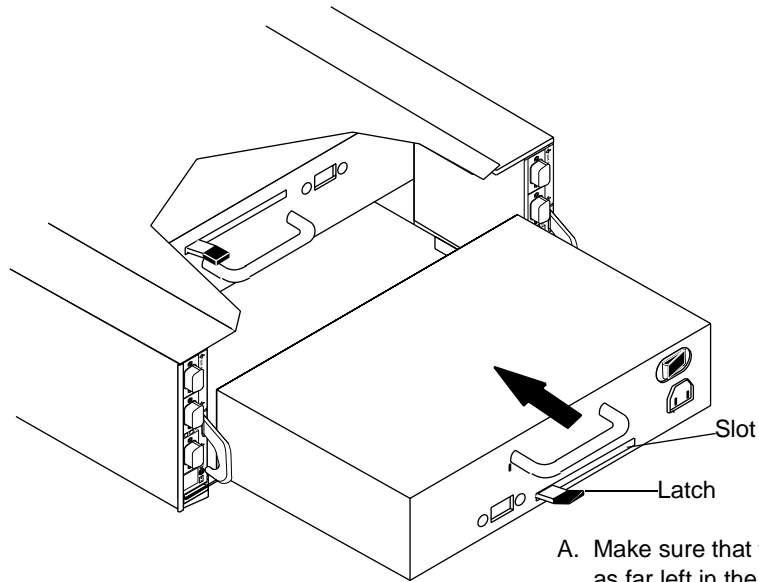
Continue to the power supply installation procedure that follows to install the replacement supply.

To install a power supply

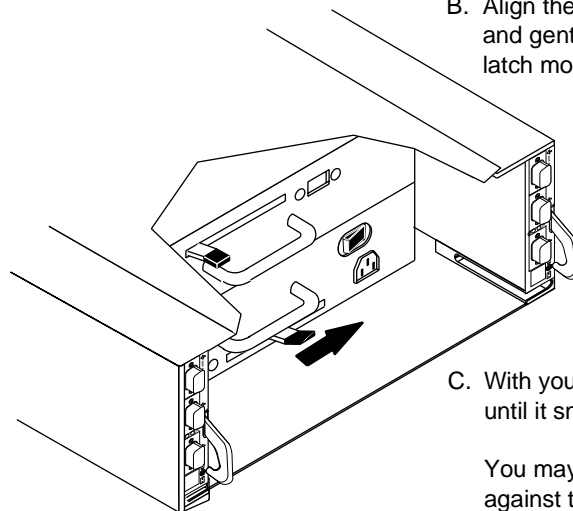
1. Gently insert the new power supply into the chassis, as shown below.

IMPORTANT: The power supply in the top slot is inverted with respect to the power supply in the bottom slot.

Installing the bottom power supply



- A. Make sure that the supply's latch is as far left in the slot as possible.
- B. Align the supply with the chassis slot and gently push into the slot until the latch moves to the middle of the slot.

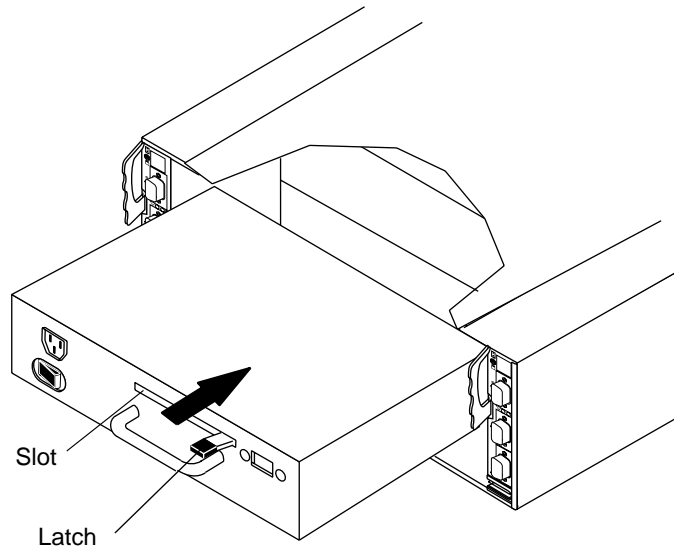


- C. With your thumb, push the latch right until it snaps up.

You may need to brace your hand against the supply's handle.



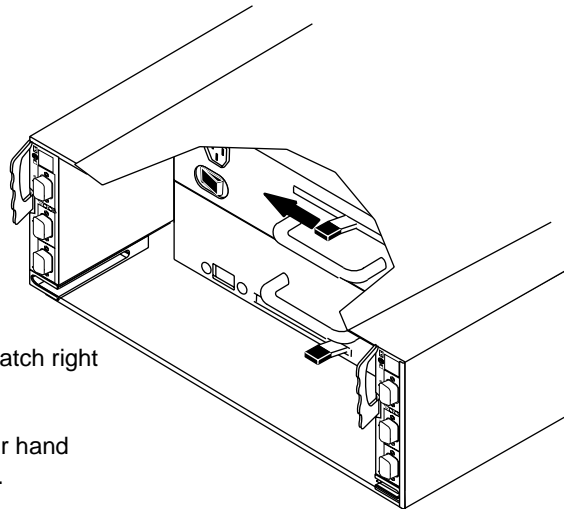
Installing the top power supply



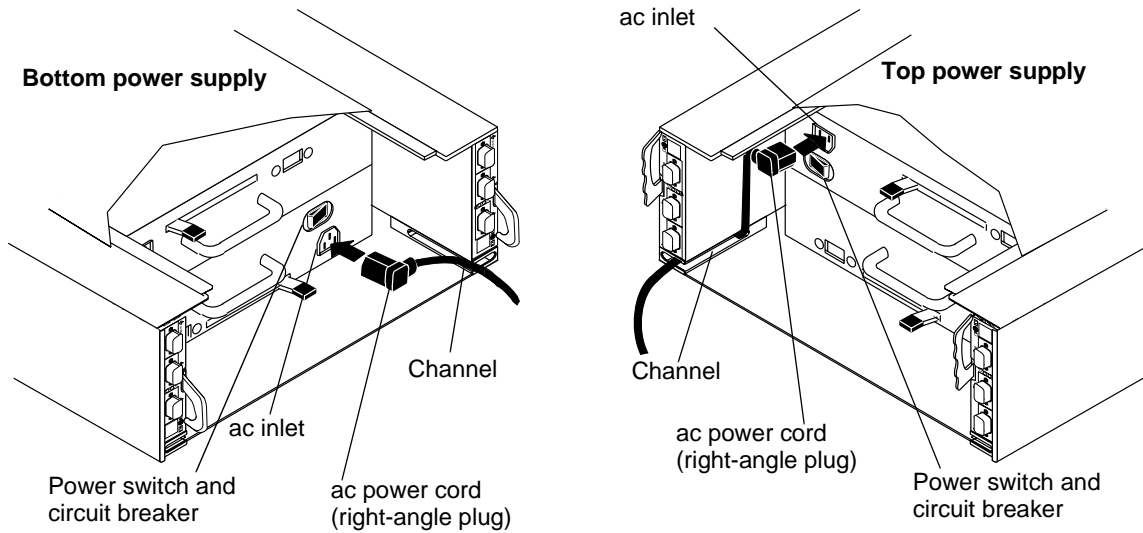
- A. Make sure that the supply's latch is as far right in the slot as possible.
- B. Align the supply with the chassis slot and gently push into the slot until the latch moves to the middle of the slot.

- C. With your thumb, push the latch right until it snaps down.

You may need to brace your hand against the supply's handle.



2. Plug the ac power cord into the new supply, and turn on the power supply as shown here.



For each power supply:

- A. Insert the right-angle plug on the ac line cord into the supply's ac inlet
- B. Route the cord along the power supply to the side of the chassis.
IMPORTANT: The cord must not occupy the drive fan pack space.
- C. Bend the cord into a U shape and slide the U into the channel so the end of the cable comes out of the channel at the back of the chassis.
- D. Plug the end of the cord into one of the cabinet's power outlets.
- E. Set the supply's power switch to the on (1) position.

3. Reinstall the drive fan pack as shown on page 60.



Technical specifications and operating limits

This appendix describes the PFC 500/E technical specifications, operating limits, and shipping and storage requirements.

Technical specifications

Technical specifications include power requirement, size, drive, interface, and standards information.

ac power requirements

The input current, power (VA), and dissipation per PFC 500/E are based on the maximum capability of the power supplies and cooling system to provide internal regulated power. Typical values will be less, depending on the number and manufacturer of disk modules. These values represent either

- the values for the line cord of a PFC 500/E with a single power supply, or
- the total values shared by the line cords of two power supplies in the same iDAE, with the division between the line cords and supplies at the current sharing ratio.

A failure of one of the two power supplies in the iDAE results in the remaining supply and cord supporting the full load. You must use a rackmount cabinet with ac power distribution, and have main branch ac distribution that can handle these values for each iDAE in the cabinet.

Requirement	Description
ac line voltage	100 to 240 Vac \pm 10%, single phase, 47 to 63 Hz
ac line current	4.0 A max estimate at 100 V (fully configured)
Power consumption	400 VA max estimate (fully configured)
Power dissipation	392 W max estimate (fully configured)
Power factor	0.98 min at full load, low voltage
Heat dissipation	1411×10^3 J/hr (1340 BTU/hr) max estimate
In-rush current	25 A max estimate for 1/2 line cycle, per power supply
ac protection	8 A thermal circuit breaker on each power supply
ac inlet type	IEC320-C14 appliance coupler
Hold-up time	20 ms min at 50 Hz
Current sharing	60% max, 40% min



Size and weight

Item	Measurement
Height	5.41 cm (6.07 in) 3.5 NEMA units including mounting hardware
Width	44.5 cm (17.5 in)
Depth	63.27 cm (24.91 in) front door to back of drive fan pack 60.43 cm (23.79 in) chassis front to back of drive fan pack 57.25 cm (22.54 in) rail front to back of drive fan pack
Weight	36.0 kg (80.0 lbs) highly available max 1.05 kg (2.3 lbs) disk module 0.68 kg (1.5 lbs) RAID controller or link control card 3.8 kg (8.5 lbs) power supply 1.8 kg (4.0 lbs) drive fan pack

Drive type

3.5-inch drives, Fibre Channel interface, 1.0-inches (2.54 cm) or 1.6-inches (4.06 cm) tall.

Disk module address

Each disk module on a Fibre Channel loop has a unique physical address. This address is derived from the enclosure address (EA, which must be set to 0 for an iDAE) as follows:

Fibre Channel loop physical address = (10 multiplied by EA) + (slot address)

where the slot address is number of the slot (0-9) containing the disk module (numbered from left to right, as viewed from the front of the enclosure).

RC FC-AL interface

Connector - shielded DB-9 receptacle with pinouts as follows.

Connector diagram	Pin	Signal	Defined by
	1	+fc_out	FC standard
	2	5V	MIA consortium
	3	n_mia_fault(active LO)	MIA consortium
	4	key	MIA consortium
	5	+fc_in	FC standard
	6	-fc_out	FC standard
	7	mia_output_disable	MIA consortium
	8	gnd	MIA consortium
	9	-fc_in	FC standard

Copper cabling

Type: Shielded, 75Ω twin-axial, shield bonded to DB-9 plug connector shell (360°)
FC-AL Standard, Revision 4.4 or higher

Length: 0.3 m (1 foot) min., 10 m (33 feet) max. PFC500 to PFC500E,
30 m (99 feet) max PFC500 to Profile XP Media Platform;
≤ 10 m (33 feet) unequalized; > 10 m (33 feet) equalized

Standards certification and compliance

A stand-alone iDAE complies with the international environmental and safety specifications listed below. Each iDAE will be marked to indicate such compliance and certification as required.

Safety standards

Standard	Description
CSA 22.2 No. 950	Safety of Information Technology Equipment including Electrical Business Equipment.
EN 60950	Safety of Information Technology Equipment including Electrical Business Equipment.
UL 1950	Safety of Information Technology Equipment including Electrical Business Equipment.

EMI standards

Standard	Description
FCC Part 15	Class B, Radio Frequency Device Requirements
ICES-003	Class B, Interference-Causing Equipments Standard - Digital Apparatus
CISPR22	Class B, Limits & Methods of Measurement of Radio Interference Characteristics of ITE
CE Mark	European EMC Directive & Low Voltage Directive Requirements
VCCI	Class B, Voluntary Control Council for Interference
AS/NZS 3548	Class B, Electromagnetic Interference - Limits & Methods of Measurement of ITE
CNS13438	BCIQ EMC Requirements

Fibre Channel related standards

Standard	Description
Fibre Channel	Physical and signaling interface, FC-PH, Revision 4.4
Fibre Channel	Arbitrated Loop (FC-AL), Revision 4.5
Fibre Channel	Private Loop Direct Attach (PLDA), Revision 1.10
SCSI III	SCSI Enclosure Services (SES), Revision 8a



Operating limits

The ambient temperature specification is measured at the front door inlet. The site must have air conditioning of the correct size and placement to maintain the specified ambient temperature range. The air conditioning must be able to handle the BTU requirements of the PFC 500/Es.

Requirement	Description
Ambient temperature	10°C to 40°C (50°F to 104°F)
Temperature gradient	10°C/hr (18°F/hr)
Relative humidity	20% to 80% noncondensing
Elevation	2438 m (8,000 ft) at 40°C, 3077 m (10,000 ft) at 37°C
Drive module power	25 W drive slot maximum (seeking)

IMPORTANT: The operating limits for temperature and humidity must not be exceeded inside the closed cabinet in which the PFC 500/Es are mounted. Mounting equipment in a cabinet directly above or below a PFC 500/E does not restrict air flow to the PFC 500/E, because air flows through the PFC 500/E from front-to-back. Cabinet doors must not impede the front-to-back air flow.

Shipping and storage requirements

Requirement	Description
Ambient temperature	-40°C to 65°C (-40°F to 149°F)
Temperature gradient	-40°C to 65°C (-40°F to 149°F)
Relative humidity	10% to 90% noncondensing
Elevation	7625 m (25,000 ft.)

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, selectable on a PFC500/E front panel, set to 0 on a PFC500, 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 (PFC500E). Since the PFC500 CA is 0, you might set the first PFC500E CA to 1 and the second to 2.

CRU (customer-replaceable unit) — A hardware component, like a disk module, that anyone can install or replace.

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 and upgrading a PFC500/E".

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 for an SP using switches on the RC. The default FC-AL address ID for RC A is 0; the default FC-AL address ID for RC B is 1.

Fibre Channel Disk board — The name for the printed-circuit board within the Profile XP Media Platform that allows the server to access the Fibre Channel loop and thence the disk drives within a PFC500/E.

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.

LCC (link control card) — A CRU in an enclosure that connects Fibre Channel signalling to the disk modules. The LCC receives and electrically terminates the incoming FC-AL signal. Then it passes the input signal to the disk drives in the PFC500E, and drives the output signal via cables to the next device (if any) in the loop.

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.

media interface adapter — *See* MIA (media interface adapter).

memory module — *See* RC memory module.

MIA (media interface adapter) — A device for connecting an optical cable to a DB9 copper connector.

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, PS A and PS B. With two, it can survive failure of one supply. You can replace a power supply under power, without interrupting applications.

PFC500 RAID Storage Chassis — A storage system that includes a chassis, up to 10 disk modules, one or two RCs, and one or two power supplies. A PFC500 can support up to two PFC500E RAID Expansion Chassis (each with up to 10 disk modules) in addition to its own 10 disk modules, for a total of 30 disk modules.

PFC500E RAID Expansion Chassis — A storage system that includes a chassis, up to 10 disk modules, one or two LCCs, and one or two power supplies.

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 Profile XP Media Platform FC adapter and the disk modules. The RC in a PFC500/E storage system sends the multiplexed fibre channel loop traffic through a link control card (LCC) to the disk units. For higher availability, a PFC500 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 fan 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 10 disk modules, one or two Fibre Channel LCCs, 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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