Freeway® 3414/3414R Hardware Maintenance Guide

DC 900-2031A

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September 2019

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Freeway 3414/3414R Hardware Maintenance Guide

Printed in the United States of America

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Preface

Purpose of Document

This manual describes the maintenance and repair procedures for Protogate's Freeway 3414 and Freeway 3414R.

Intended Audience

This manual is intended primarily for qualified field support technicians. System administrators and system integrators might find it useful as well. It can also serve as a reference guide for manufacturers who incorporate Freeways into their networking products.

Required Equipment

You may need a number one Phillips-head screwdriver or a straight-blade screwdriver.

Organization of Document

The "Safety Precautions" section on page 15 describes important safety guidelines that you should review before starting the installation.

Chapter 1 is an overview of the Freeway hardware.

Chapter 2 explains the startup and shutdown procedures, anti-static precautions, how to open the Freeway cabinet, and how to replace the fans and fan filters.

Chapter 3 describes the system indicators and power supplies.

Chapter 4 describes how to replace an ICP board, disk drive, CDROM drive, or CPU battery.

Chapter 5 describes how to install a new ICP or Ethernet board.

Appendix A lists the hardware specifications.

Appendix B describes how to pack the Freeway for shipping.

References

- *Freeway 3414 Hardware Installation Guide* DC 900-2028
- *Freeway User Guide* DC 900-1333

Document Conventions

The term “Freeway” refers to both of the Freeway models, 3414 and 3414R.

Revision History

The revision history of the *Freeway 3414/3414R Hardware Maintenance Guide*, Protogate document DC 900-2031A, is recorded below:

Document Revision	Release Date	Description
DC 900-2031A	September 2019	Original release

Customer Support

If you are having trouble with any Protogate product, call us at (858) 451-0865 Monday through Friday between 8 a.m. and 5 p.m. Pacific time.

You can also email your questions to us at support@protogate.com.

We are always interested in suggestions for improving our products. You can use the report form in the back of this manual to send us your recommendations.

Safety Precautions

Be sure to take the following safety precautions during installation and maintenance of the Freeway:

- Observe the warnings and directions printed on the Freeway and its associated equipment.
- Check the electrical rating label on the Freeway chassis. Be sure that the voltage of your power source matches this rating.
- The Freeway must be plugged into a grounded, three-wire power outlet. Do not use an adapter that permits a three-wire electrical cord to be plugged into a two-wire power outlet.
- Use appropriately rated extension cords or power strips only.
- To ensure proper cooling, always operate the Freeway with its covers in place. Do not cover or block any of the openings on the Freeway chassis. Do not place the unit near a heater.
- Do not insert objects through openings in the Freeway chassis. Doing so could result in a short circuit that might cause a fire or an electric shock.
- Do not modify the Freeway equipment in any way. Protogate, Inc. is not responsible for regulatory compliance of any Freeway that has been modified. Altering the Freeway enclosure in any way other than the installation of Protogate-provided options may invalidate Freeway's safety certifications.
- Always unplug the Freeway AC power cord before removing the top or bottom covers for servicing.

Chapter

1

Introduction

This chapter covers the following topics:

1.1 Maintenance Philosophy

The Freeway 3414 is designed to be repaired in the field, in a repair depot, or at Protogate's manufacturing facility. A qualified technician must perform all repairs because many of the devices inside the Freeway are sensitive to static; also, removing or inserting a printed circuit board must be done very carefully to prevent damage to the connectors and avoid causing incorrect power distribution due to a misaligned board.

Later chapters include basic information that will be needed before performing any maintenance operation:

- Shutdown and Startup Procedures (Section 2.1 on page 28)
- Anti-Static Precautions (Section 2.2 on page 31)
- Opening the Top Cover (Section 2.3 on page 32)

The following units can be replaced in the field:

- Fan filters (Section 2.5 on page 36)
- Cooling fans (Section 2.4 on page 33)
- Hard or flash drive (Chapter 4.2 on page 46)
- CPU CMOS Battery(Section 4.5 on page 52)
- ICP board (Section 4.4 on page 50)

The following units can be added in the field:

- ICP board (Section 5.1 on page 55)
- Ethernet board (Section 5.2 on page 61)

Protogate does not recommend replacing the CPU board or single power supply (3414 only) in the field, therefore they are not documented in this manual. Replacing the CPU board requires multiple cable connections and specific BIOS settings. To replace the single power supply, you must remove most of the internal components. Because of this complexity, it is recommended that these two items be replaced only at the repair depot or at the Protogate factory.

1.2 Preventative Maintenance

The following are the recommended preventative maintenance actions for the Freeway:

1. Check and clean the fan filter every three months as described in Section 2.4 on page 33.

2. Replace the CPU CMOS battery every 5 to 10 years as described in Section 4.5 on page 52.

1.3 Freeway Overview

The Freeway enables client applications to access specialized wide-area networks (WANs). It is user programmable and communicates in real time. It provides multiple data links and a variety of network services to LAN-based clients in financial, defense, telecommunications, and process-control applications. To maintain high data throughput, the Freeway uses a multi-processor architecture to support the LAN and WAN services. Figure 1–1 shows a block diagram of the Freeway configuration in a typical application.

The LAN interface is managed by the server processor (on the CPU board). This single-board computer uses the FreeBSD operating system to provide layered services needed by the Freeway.

The WAN interface is managed by one or more intelligent communications processors (ICPs). These boards communicate with the CPU board through a Peripheral Compo-

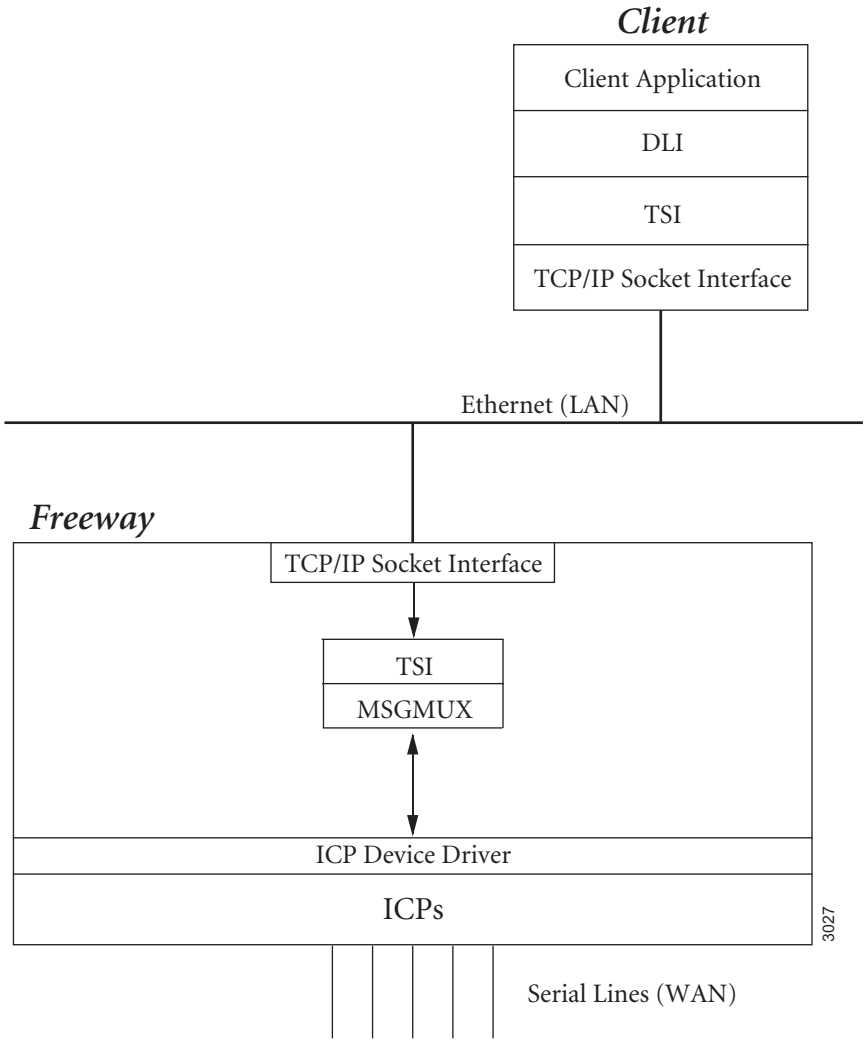

Figure 1–1: Freeway Configuration

nent Interconnect (PCI) bus and use Protogate's OS/Protogate real-time operating system to run the protocol software.

1.4 Hardware Overview

The 3414 series Freeway is a 4U height 14-slot rack mount chassis designed for building mission-critical applications. The unit includes an 11-slot passive-backplane (8 PCI and 3 PCIe) to support ICP2432B, ICP2432Be, and Ethernet cards. A fault detection and alarm notification system monitors the system status, including power supply, HDD, temperature and cooling fans to minimize the system down time. A wide range of standard computing peripherals can be integrated with the chassis to meet different application development under mission-critical environment 24 hours a day, 7 days a week.

The Freeway 3414 and 3414R share the same hardware options, basic configuration, and operating system. The major physical difference is that the 3414 has a single high-efficiency 400W power supply, and the 3414R has two redundant hot-swap 400W power supplies. Hardware specifications are listed in Appendix A.

1.5 Major Functional Features and Components

The Freeway's major features and components are as follows:

- Multiple serial electrical interfaces in a single server, including EIA-232, EIA-449, EIA-530, and V.35
- Standard support of TCP/IP over Ethernet includes SNMP management facilities
- Freeway operating system (OS) based on the FreeBSD OS to support communications applications
- Server run-time software that handles the LAN/WAN communications and server management functions

1.6 Multi-Processor Architecture

The Freeway features a multi-processor architecture that separates serial protocol processing from server management and LAN processing. Serial protocol processing is handled by Protogate's ICP2432B Intelligent Communications Processors (ICPs). The ICPs are off-the-shelf PCI or PCIe bus serial I/O boards, each containing a Coldfire 5407 processor. The Freeway server processor (CPU board) is a single-board computer based on an Intel processor.

1.7 CPU Board

The standard Freeway uses a Protogate model CPU-49 single-board computer with 2 gigabytes of memory.

1.7.1 CPU

The CPU-49 board takes up two slots on the Freeway backplane. Its major features include:

- Intel LGA 1155 processor
- Up to 2 gigabytes of on-board memory
- PCI and PCIe bus support
- SATA port for disk and DVD support
- Standard video (SGVA adapter)
- PS2 or USB Keyboard interface
- Real time clock with battery backup.
- 9-pin serial console port
- Dual 10/100/1000 Ethernet ports

1.7.2 PCI/PCIe Bus Interface

The Freeway's PCI bus architecture is based on a 32-bit data path and 32-bit addressing. There are 3 PCIe slots that are 1X compatible to support ICP2432Be cards.

1.7.3 LAN Interface

The Freeway has two 10/100/1000 Ethernet ports on the CPU board. Optionally, additional Ethernet ports (copper or fiber) may be added to the system.

1.7.4 Serial I/O

The Freeway has a single (9-pin) serial I/O port that is compatible with standard COM1 PC ports. This port is used as the Freeway console

1.8 WAN Processors (ICP Boards)

The Freeway uses Protogate's ICP2432B Intelligent Communications Processor. The ICPs are programmable, front-end I/O boards for the PCI or PCIe bus that provide high-speed data communications processing, off-loading low-level tasks that are traditionally performed on the host CPU.

The ICP2432B CPU is a Coldfire 5407 processor. It includes:

- 32-bit address and 32-bit data bus structures
- Pipelined architecture with a high degree of internal parallelism
- 32 megabytes of main memory operating at zero wait state

The ICP2432B has a console port for debugging purposes that is provided by an integrated USART within the 5407 processor. The port supports asynchronous transmit and receive data at 9600 bits/second.

The ICP2432B (PCI bus) is available in three versions that support the following electrical interfaces:

- 8-port EIA-232 only
- 4-port EIA-232, EIA-449, EIA-530, or V.35 (software selectable)
- 2-port EIA-232, EIA-449, EIA-530, or V.35 (software selectable)

The ICP2432Be (PCIe bus) is available in two versions that support the following electrical interfaces:

- 8-port EIA-232 only
- 4-port EIA-232, EIA-449, EIA-530, or V.35 (software selectable)

1.9 Freeway Cabinet

The unit is encased in a black, 4U rackmount-type sheetmetal chassis which is 17 inches wide (19 inches to the outside of the rack-mount ears), 19 inches deep, and 7 inches tall. Airflow is from front to back, with three internal 50 CFM fans pulling filtered air into the case from the front and blowing it out of the case at the back.

A half-width door at the front of the unit swings downward (or can be removed) to expose the reset and power switches and to give access to the DVD/CDROM drive. Power, hard-disk-activity, and system health LEDs on the front panel are visible when the door is closed. The power and reset switches and the DVD/CDROM drive are accessible only when the door is opened.

Connectors for a VGA monitor, a keyboard, a serial console, and two 10/100/1000BaseTX Ethernet cables are available at the back of the chassis. The serial (WAN) connectors or additional Ethernet connectors are also at the back of the chassis.

1.10 Front Panel

Figure 1–2 shows the front panel of a Freeway 3414/3414R. The right side is covered by an access door (not shown) that hinges at the bottom and is fastened by a keylock at the top.

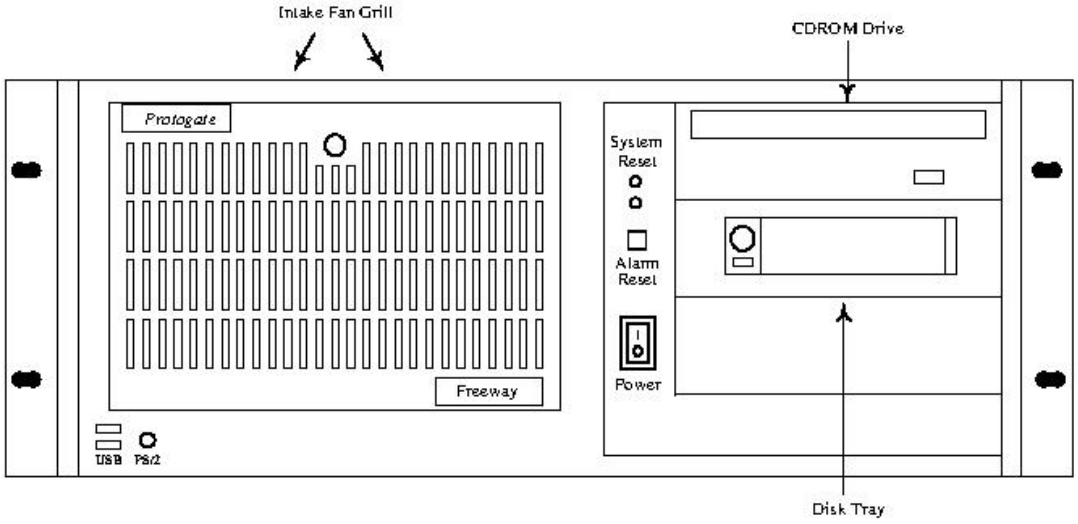

Figure 1–2: Front View of the Freeway 3414/3414R (access door not shown)

1.11 Back Panel

Figure 1–3 shows an example back view of a Freeway 3414 and Figure 1–4 shows an example back view of a Freeway 3414R. Unused slots are covered by metal plates

Figure 1–3: Example Back View: Freeway 3414

Figure 1–4: Example Back View: Freeway 3414R

Chapter

2 Maintaining the Freeway Cabinet

This chapter covers the following topics:

Caution

Before opening the top cover or removing any component, be sure the Freeway is powered down and the power cord is unplugged.

2.1 Shutdown and Startup Procedures

The following sections describe the typical sequence of steps used to shutdown and startup the Freeway. Because shutdown and startup requirements can vary, check with your system administrator to establish the best procedures for your site. Note that the Freeway is designed for continuous operation. Most sites leave the Freeway on-line twenty-four hours a day, seven days a week, shutting down only to perform maintenance or install upgrades.

2.1.1 Preparing for Shutdown

Inform all users that you will be shutting down the Freeway and they should stop any devices that are currently sending messages to it. Next determine which type of Freeway you will be shutting down. A *Standard Freeway* is a Freeway with no Server Resident Application (SRA) running on it. An SRA is additional software that runs on the Freeway itself and is not part of the standard Freeway software distribution. An example of an SRA is Protogate's Monitor Software product which is distributed on a CDROM separate from the Freeway software. If your Freeway is using an SRA, you need to use a the shutdown procedure outlined in Section 2.1.3 in order to avoid possible disk corruption.

2.1.2 Shutdown Procedure (Standard Freeway)

1. Open the access door on the front of the Freeway cabinet (right side).
2. Locate the ON/OFF power switch as shown in Figure 2–1.
3. Power down the Freeway by pressing and holding the power switch in the direction of the "0" symbol until you hear the system power off.
4. Unplug the power cord(s) from the rear of the Freeway cabinet if you plan to do any hardware maintenance on the Freeway.

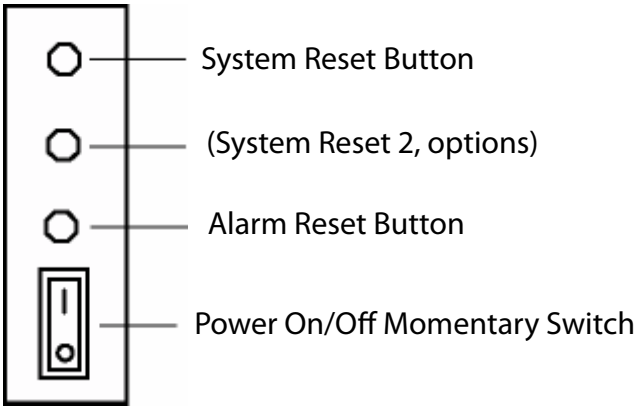

Figure 2–1: Freeway Power Switch (front)

2.1.3 Shutdown Procedure (Freeway with SRA)

1. Log into the Freeway as described in the Freeway User Guide (DC 900-1333).
2. From the Freeway Main Menu choose 6 “Run FreeBSD Shell”.
3. At the shell prompt type “`shutdown -p now`”. The Freeway will power itself down after several seconds. There is no need to use the power ON/OFF switch.
4. Unplug the power cord(s) from the rear of the Freeway cabinet if you plan to do any hardware maintenance on the Freeway.

2.1.4 Startup Procedure

1. Plug the AC power cord into the power supply on the rear of the cabinet. For the 3414R, plug AC power cords into both power supplies to avoid sounding the power alarm.
2. Turn on the switch at the bottom rear of each power supply.
3. Open the front access door and push and release the momentary power switch shown in Figure 2–1.

4. Startup proceeds automatically and usually takes between 1 to 2 minutes. The Freeway will boot up whether or not there is a VGA or serial console attached. If you do have a console attached during startup, the following login prompt is displayed at the console when startup is complete:

```
Freeway User Login:
```

2.2 Anti-Static Precautions

An *anti-static strap* (sometimes called a *wrist* or *grounding strap*) is used to prevent electric charges from damaging the Freeway's internal components, it is very important that you use an anti-static strap while working on the unit.

Most anti-static straps consist of a wrist band that is connected by wire to a metal alligator clip. To use the anti-static strap, slip it around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.

Caution

If you do not use the anti-static strap, electric discharges might damage the internal components of your Freeway.

2.3 Opening the Top Cover

To open the top cover of the Freeway cabinet, use the following procedure:

1. Shutdown the Freeway using the procedures described in Section 2.1.
2. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
3. Loosen the two thumb-screws holding the cover at the top rear of the cabinet.
4. Using the handle at the rear of the cover, pull the cover straight back about one inch, then lift the cover from the cabinet as shown in Figure 2–2.

Figure 2–2: Freeway 3414 with top cover open

2.4 Replacing the Cooling Fans

There are two (2) cooling fans located inside the Freeway cabinet. The cooling fans are easy to maintain and provide adequate cooling to the system by blowing air inward. When a cooling fan breaks down, the system sounds a continuous alarm. To disable the alarm, press the Alarm Reset Switch on the front panel and replace the failing fan immediately.

The two fans are located in an easily removable fan tray. To remove the fan tray, first disconnect the two power cables located on each side of the fan tray as shown in Figure 2–4 . On each connector, press the release tab and pull the connectors apart.

Figure 2–3: Fan Tray and Power Connectors

Using a flat screwdriver, unscrew the thumb screw in the canter of the fan tray assembly as shown in Figure 2–5.

Figure 2–4: Fan Tray Thumb Screw

Then lift the fan assembly straight up from the cabinet as shown in Figure 2–5.

Replace the fan tray assembly in reverse order, making sure that the two pins on the bottom of the assembly fit into the two holes in the bottom of the Freeway chassis.

Figure 2–5: Fan Tray Assembly

2.5 Maintaining the Fan Filters

Check the fan filters every three months. The fan filters are located behind the two access doors at the front of the cabinet as shown in Figure 2–6. Filters with light dust can be cleaned with a can of compressed air. If a filter is dirty, rinse it off with water and let it dry before putting it back into the Freeway.

Figure 2–6: Fan Filters

Chapter

3 System Indicators and Power Supply

This chapter covers the following topics:

3.1 LED Indicators

A fault detection and alarm notification system monitors the Freeway status in order to minimize the system down time. The system monitors power supply, disk drive, internal temperature and cooling fans. The status LEDs are located on the front of the access door that covers the power switch and disk drives as shown in Figure 3–1.

Figure 3–1: LED Indicators

3.1.1 System Status LEDs

Table 1 shows the system status LED indicators. If any of the conditions monitored by the system is anything except normal, an audible alarm is activated. To stop the alarm buzzer, press the Alarm Reset button.

When the PWR LED is RED, it indicates a redundant power supply failure. Inspect the redundant power supplies immediately and determine which power supply has failed. The GREEN LED at the bottom of the power supply will be RED or OFF on a failed

Table 3–1: System Status LEDs

LED	Description	RED	GREEN	Alarm
PWR	System power	Failure	Normal	YES
HDD	Disk drive activity	N/A	Data access	NO
FAN	Cooling fan status	Failure	Normal	YES
TEMP	Cabinet temperature	Abnormal	Normal	YES

unit. Also, the cooling fans will not be turning. Replace the failed power supply module as described in Section 3.2 on page 41.

When the HDD LED is blinking GREEN, it indicates disk read/write disk activity. When there is no disk activity, the LED is off (not RED). There is no alarm for the HDD indicator.

When the FAN LED is RED and blinking, it indicates a failed cooling fan. Inspect and replace the cooling fans as described in Section 2.4 on page 33.

If the TEMP LED is RED and blinking, the system detects rising temperature inside the cabinet. Inspect the rear section for any blockage.Make sure airflow inside the cabinet is smooth and not blocked by dust or other obstructions. Then inspect the fan filter and clean or replace if needed as described in Section 2.5 on page 36.

3.1.2 Power Status LEDs

Table 2 shows the power status LED indicators. When a LED fails to light, it indicates a problem with one of the voltage signals and an audible alarm is sounded. To stop the alarm buzzer, press the Alarm Reset button. Check to make sure that the power supply connector is properly attached to the backplane. If the problem persists, consult an experienced technician.

Table 3–2: Power Status LEDs

LED	Description	Light	No light
+3.3V	+3.3V signal	Normal	No or low output
+5V	+5V signal	Normal	No or low output
+12V	+12V signal	Normal	No or low output
-5V	-5V signal	Normal	No or low output
-12V	-12V signal	Normal	No or low output

3.2 Replacing a Power Supply

Protogate does not recommend replacing the single power supply on the Freeway 3414 in the field. If a single power supply fails, please return the entire Freeway system to Protogate for repair.

Dual redundant power supplies on the Freeway 3414R are designed to be replaced in the field while the power to the system is still on. To replace a redundant power supply, use the following procedure:

1. Press the Alarm Reset button to deactivate the audible alarm.
2. Look at the rear of the Freeway cabinet and determine which power supply has failed. The GREEN LED at the bottom of the power supply will be RED or OFF on a failed unit. Also, the cooling fans on the failed supply will not be turning.
3. Press the rocker switch at the bottom of the failed supply in the direction of the “0” symbol.
4. Unplug the power cord from the rear of the failed supply.
5. Using a Phillips head screwdriver, remove the retaining screw at the top of the failed power supply.
6. Using the metal handle, carefully pull the failed power supply unit straight back and out of the Freeway cabinet. While removing the failed supply, be careful not to disturb the power cord and rocker switch on the good supply. Figure 3–2 shows an example of how the power supply slides out of the cabinet.
7. Take the replacement power supply and insert it into the empty socket. make sure the replacement supply is pushed firmly all the way into the cabinet.
8. Using a Phillips head screwdriver, insert the retaining screw at the top of the replacement power supply.

Figure 3–2: Removable Power Supply

9. Plug the power cord into the bottom of the replacement power supply. Then press the rocker switch at the bottom of the replaced supply in the direction of the “1” symbol.

At this point you should be able to see the GREEN LED and fans spinning on both power supplies.

Chapter

4 Replacing Freeway Components

This chapter covers the following topics:

Caution

A qualified technician must perform all repairs because many of the devices inside the Freeway are sensitive to static; also, removing or inserting a printed circuit board must be done very carefully to prevent damage to the connectors or cause incorrect power distribution due to a misaligned board.

4.1 Freeway Hardware Configuration

4.1.1 Front View

The disk drive and CD/DVD drive are located in the front of the Freeway cabinet behind the access door. Both drives are connected to the CPU board with SATA cables. Figure 4–1 shows the front view of the Freeway cabinet with the access door removed.

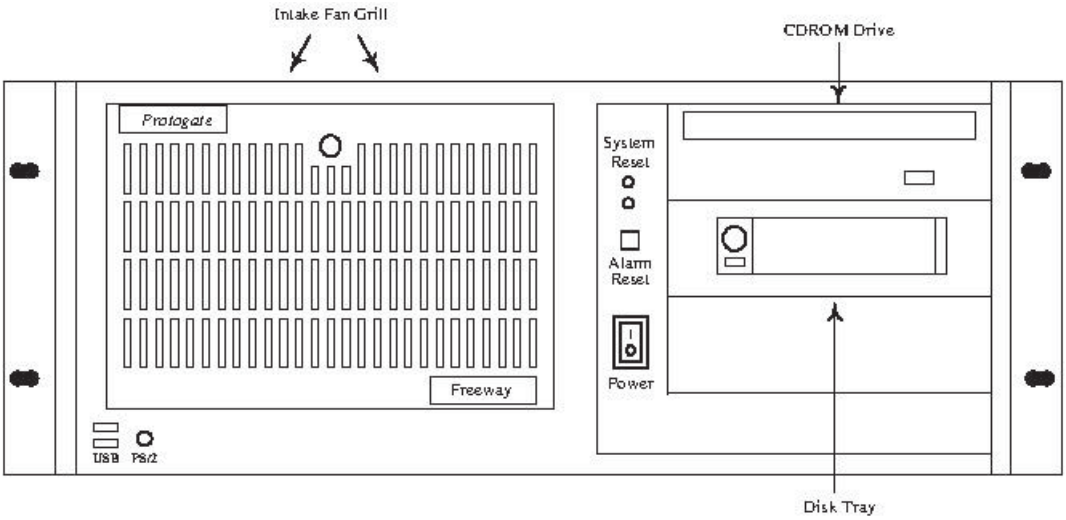

Figure 4–1: Freeway 3414/3414R Front View

4.1.2 Rear View

The Freeway 3414/3414R has eight available PCI slots and 3 available PCIe slots at the rear of the cabinet. These slots may used by ICP2432B/ICP2432Be boards or by additional Ethernet boards. Unused slots are covered by metal plates. Figure 4–2 shows the rear view of a Freeway 3414R.

Figure 4–2: Freeway 3414R Rear View

4.2 Replacing a Disk Drive

To replace a drive, use the following procedure:

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.

2. Insert the disk drive key into the round lock on the disk drive tray (see Figure 4–3). Turn the key one quarter turn to unlock the tray. Remove the key.

3. Push the eject tab below the lock until it pops out (see Figure 4–3). Push the tab back in to eject the drive tray. You may have to push the tab in a few times until you feel it “catch” on the drive tray.

Figure 4–3: Disk Drive Tray

4. Remove the drive tray then push the eject tab back in to it is flush with the front of the drive.

5. Insert the new drive tray into the opening and push it all the way in so it is flush with the front of the Freeway.

6. Insert the disk drive key into the round lock on the disk drive tray. Turn the key one quarter turn to lock the tray. Remove the key.

7. Power up the Freeway as described in section Section 2.1.4 on page 29.

4.3 Replacing a CD/DVD drive

To replace a CD/DVD drive, use the following procedure:

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.
2. Unplug the power cord(s) from the back of the Freeway cabinet.
3. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
4. Remove the top cover of the cabinet as described in Section 2.3 on page 32.
5. Unplug the SATA power and cables from the rear of the CD/DVD drive.
6. Locate and remove the four mounting screws that hold the metal drive bay to the cabinet as indicated with arrows in Figure 4–4. Three screws are on top of the drive bay, and one is at the bottom near the backplane.
7. Carefully lift the entire drive bay straight up from the Freeway cabinet. Watch out for any power cables that may catch on the drive bay.
8. Remove the four screws from the each side of the CD/DVD drive. These are the screws that hold the CD/DVD drive to the metal drive bay.
9. Remove the CD/DVD drive and insert the replacement drive in the same position. Fasten the new drive to the drive bay using the four screws on each side.
10. Carefully return the drive bay to its original position and fasten it to the cabinet with the four mounting screws.
11. Plug the SATA power and cables into the rear of the CD/DVD drive.
12. Replace the top cover and power up the Freeway as described in section Section 2.1.4 on page 29.

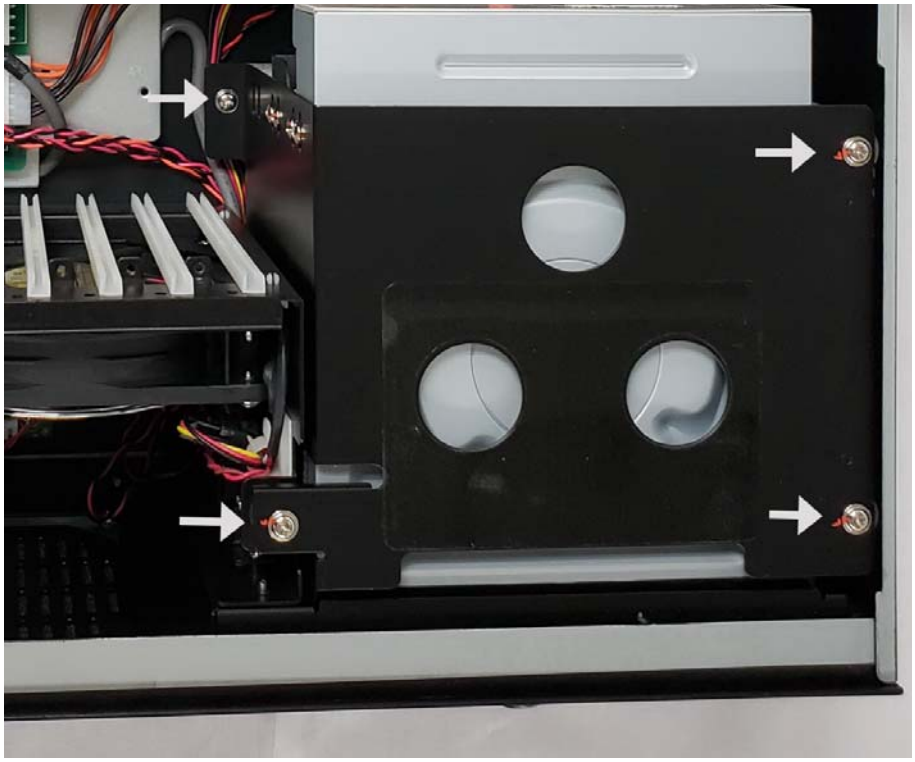

Figure 4–4: CD/DVD Drive Bay

4.4 Replacing an ICP Board

To replace an ICP board, use the following procedure:

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.
2. Unplug the power cord(s) from the back of the Freeway cabinet.
3. Disconnect the WAN cable(s) on the rear of the cabinet that are connected to the ICP board you want to replace.
4. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
5. Remove the top cover of the cabinet as described in Section 2.3 on page 32.
6. Remove the board support bar by removing the screw at each end of it that holds it to the cabinet and lifting the bar out of the way.
7. Remove the screw near the ICP board's face plate that holds it to the cabinet.
8. Carefully pull the board straight up and out of the backplane.
9. Place the board in static protection packaging.
10. Remove the new ICP board from its static protection packaging. Slide the new board into the slot from which you removed the old board.
11. Seat the board by applying pressure evenly to the top of the board.
12. Replace the screw near the ICP board's face plate.
13. Replace the board support bar and tighten the screws that secure it in place.
14. Replace the top cover on the cabinet and tighten the screws that secure it in place.

15. Connect the WAN cable(s) that you removed in Step 3 to the ICP board.

Caution

Be very careful when replacing the ICP board's cables on the rear of the Freeway. These are high density connectors and may short together if the pins are bent.

16. Plug in the power cord(s) at the rear of the cabinet.

17. Power up the Freeway by opening the front door, then pressing the rocker switch on the front panel in the direction of the "1" symbol. Startup proceeds automatically as described in Section 2.1.4 on page 29.

4.5 Replacing a CPU CMOS Battery

The CPU board has a coin cell battery (BR2032) that maintains the CMOS memory where the BIOS and Real Time Clock (RTC) values are kept when the Freeway system is powered down and unplugged. On a Freeway system that is normally powered on, or at least plugged in, the lifetime of this battery is over 10 years. If a system is regularly unplugged, you can expect to replace the battery every 3 to 5 years.

Protogate recommends that the battery be replaced with a BR2032. The CR2032 is a compatible replacement, but it may need to be replaced more often since it does not have the same thermal range and lifetime stability as the BR2032.

Note

In order to retain the BIOS and RTC settings, you must replace the CPU battery while the Freeway is plugged in.

To replace a CPU battery, use the following procedure:

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.
2. Do not unplug the power cord(s) from the back of the Freeway cabinet. Also, make sure that the power switch on the power supply is turned on.
3. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
4. Remove the top cover of the cabinet as described in Section 2.3 on page 32.
5. Remove the board support bar by removing the screw at each end of it that holds it to the cabinet and lifting the bar out of the way.
6. Locate the CMOS battery holder near the center of the CPU board as shown in Figure 4–5. You may have to move a few wires to get clear access to the holder.

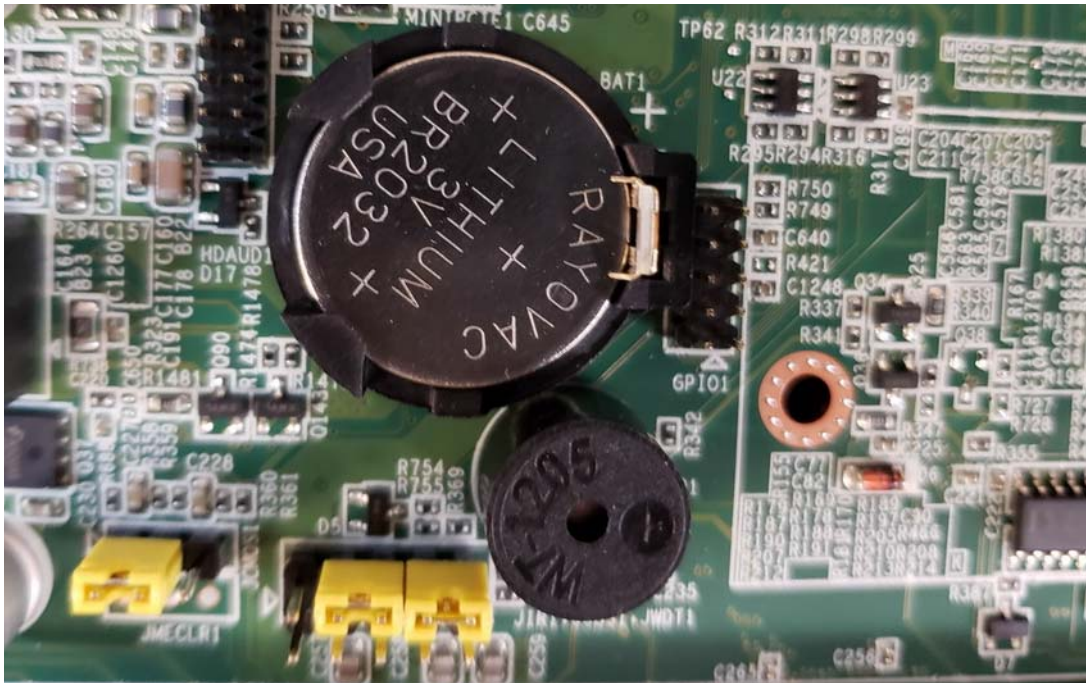

Figure 4–5: CPU CMOS Battery

7. If your Freeway has ICP boards in the PCIe slots, you may have to remove these in other to access the battery.
8. Use a small flathead screwdriver to pop the old battery from the holder.
9. Insert the new battery into the holder with the plus (+) side facing out.
10. Replace any ICP cards that were removed in Step 7.
11. Replace the board support bar and tighten the screws that secure it in place.
12. Replace the top cover on the cabinet and tighten the screws that secure it in place.
13. Power up the Freeway by opening the front door, then pressing the rocker switch on the front panel in the direction of the “1” symbol. Startup proceeds automatically as described in Section 2.1.4 on page 29.

Chapter

5 Installing New Components

This chapter covers the following topics:

- Installing a New ICP Board (Section 5.1)
- Installing an Additional Ethernet Board (Section 5.2)

Caution

A qualified technician must perform all installations because many of the devices inside the Freeway are sensitive to static; also, inserting a printed circuit board must be done very carefully to prevent damage to the connectors or cause incorrect power distribution due to a misaligned board.

5.1 Installing a New ICP Board

Installing a new ICP board is a bit more complex than just replacing a board. This is because you also need to update the **bootcfg** file on the Freeway in order to access the ICP card later.

5.1.1 Installing the Hardware

To install a new ICP board, use the following procedure:

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.
2. Unplug the power cord(s) from the back of the Freeway cabinet.

3. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
4. Remove the top cover of the cabinet as described in Section 2.3 on page 32.
5. Remove the board support bar by removing the screw at each end of it that holds it to the cabinet and lifting the bar out of the way.
6. Remove the new ICP board from its static protection packaging.
7. Slide the new ICP board into the empty slot.

Caution

Be very careful when inserting a printed circuit board to prevent damage to the connectors and avoid causing incorrect power distribution due to a misaligned board.

8. Seat the board by applying pressure evenly to the top of the board.
9. Tighten the screw near the ICP board's face plate.
10. Replace the board support bar and tighten the screws that secure it in place.
11. Replace the top cover on the cabinet and tighten the screws that secure it in place.
12. Connect the WAN cable(s) to the rear of the ICP board.

Caution

Be very careful when replacing the ICP board's cables on the rear of the Freeway. These are high density connectors and may short together if the pins are bent.

13. Plug in the power cord(s) at the rear of the cabinet.

14. Power up the Freeway by opening the front door, then pressing the rocker switch on the front panel in the direction of the “1” symbol. Startup proceeds automatically as described in Section 2.1.4 on page 29.

5.1.2 Updating the bootcfg file

Each ICP board on the Freeway is assigned a unit number and allocated to a specific PCI bus number and slave address number. This information is kept in the **bootcfg** file (described in detail in the *Freeway User Guide*) which is located on the Freeway hard or flash drive. The **bootcfg** file is created by Protogate and is customized for each individual Freeway. When you add a new ICP board to the Freeway, you must edit this file to add information about the new ICP board.

Note

When adding a PCIe ICP board to the Freeway, you may also need to change the bus address numbers of existing ICP boards.

Use the following procedure to update the **bootcfg** file:

1. Locate the bootcfg file on the Freeway disk drive. The file is a text file in the /tmp/boot directory of the Freeway. You can edit the file right in this directory using the vi or ee editor. You can also use FTP to copy this file from the Freeway to your PC and edit the file there.

2. Determine the appropriate bus and slave address numbers for the slot into which you installed the new ICP board. Figure 5–1 shows the slot numbering for the Freeway 3414 and 3414R. Table 5–1 shows the corresponding bus numbers and slave addresses for each of the slots.

3. Determine which ICP number you want to assign to the new ICP board. As a general rule, Protogate assigns ICP numbers starting at 0 from the leftmost slot (slot 0) and increasing toward the right. You are not required to follow this rule, but the

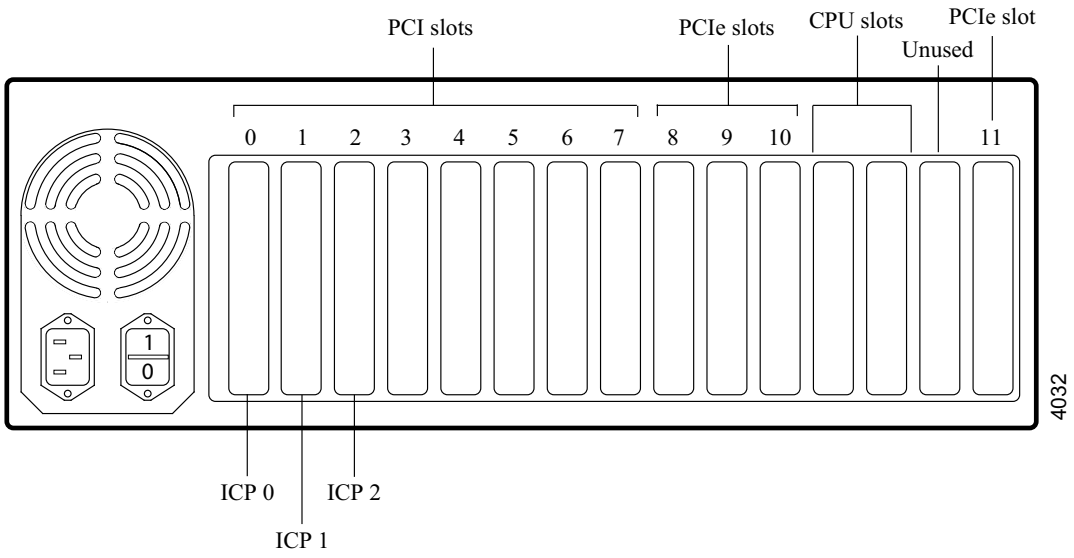

Figure 5–1: Slot Numbering: Freeway 3414/3414R

number you choose must be a number that is not already used by an existing ICP board.

4. Determine which protocol software you will load into the new ICP board. If the protocol software is already loaded on another ICP board, the load file for that protocol will already be on the Freeway disk drive. If you have purchased a new protocol software license from Protogate, load the software onto the Freeway using the instructions on the installation CDROM for that protocol.

5. Edit the bootcfg file and add the section with information about your new ICP board. The section will include ICP number, bus address, slave address, and load file as shown in the example below. If you have installed a PCIe ICP board, you will need to also change the bus numbers of any existing PCI ICP boards in accordance with the footnotes in Table 5–1.

Table 5–1: Bus Numbers: Freeway 3414/3414R

Slot Number	Slot Type	Bus Number	Slave Address	Comment
0	PCI	2	0xc	see footnote[1]
1	PCI	2	0xd	
2	PCI	2	0xe	
3	PCI	2	0xf	
4	PCI	4	0xc	
5	PCI	4	0xd	
6	PCI	4	0xe	
7	PCI	4	0xf	
8	PCIe	2	0x4	x16 - see footnote[2]
9	PCIe	4	0x4	x1 - see footnote[3]
10	PCIe	4	0x4	x1 - see footnotes[4] [5]
11	PCIe	4	0x4	x1 - see footnotes[6] [7]

[1] The PCI bus numbers listed in the table for slots 0 to 7 are used only if there are no boards in any PCIe slot. If there are boards in one or more PCIe slots, then follow the rules below to adjust the bus numbers of the PCI slots and other PCIe slots. All bus number changes are cumulative.

[2] If a board is placed in PCIe slot 8, add 2 to bus numbers of slots 0 to 7 and slots 9 to 11.

[3] If a board is placed in PCIe slot 9, add 2 to bus numbers of slots 4 to 7 and slot 11.

[4] If a board is placed in PCIe slot 10, add 2 to bus numbers of slots 4 to 7 and slots 9 and 11.

[5] An ICP board will not fit in slot 10 if the CPU board is using the standard CPU cooling fan. An ICP board will only fit in slot 10 if the CPU board has been modified by Protogate to use the slimmer CPU cooling fan.

[6] If a board is placed in PCIe slot 11, add 2 to bus numbers of slots 4 to 7.

[7] If a PCIe board in slots 8 to 11 is anything other than an ICP board (for example, an Ethernet board), all bus numbers may also be incremented by 1 in addition to being incremented by 2. Contact Protogate for more details.

```
#-------------------------------------------------------------#
# ICP3 Physical Parameters                                    #
#-------------------------------------------------------------#
#
device_name          =  icp3
device_type          =  icp2432
slave_address        =  0xf
bus_number           =  2
download_script      =  x25loadb
```

Note

The ICP device_name for ICP numbers 10 to 15 are represented as **icpa** to **icpf** (hexadecimal) in the bootcfg file.

6. Once you have edited the bootcfg file, save it back to the /tmp/boot directory on the Freeway. If you used FTP to edit the file on your PC, use FTP again to copy it back to the /tmp/boot directory on the Freeway. Make sure that your FTP program copies the file back as a UNIX ASCII file. For more details, refer to the *Text Files: Windows vs. UNIX* section in Chapter 6 of the *Freeway User Guide*.

7. Next save the bootcfg file to the non-volatile area on the Freeway disk drive. To save it to the non-volatile area, log into the Freeway menus and select 5-3-3 from the menu items as described in the *Menu Update Method (5-3-3)* section in Chapter 6 of the *Freeway User Guide.*

8. Reboot the Freeway by selecting menu items 1-2. After the Freeway system reboots, you may use the menu to display the Freeway log messages and confirm that the new ICP was successfully downloaded.

5.2 Installing an Additional Ethernet Board

To install an additional Ethernet board, use the following procedures:

5.2.1 Installing the Hardware

1. Shut down and power off the Freeway using the procedure described in Section 2.1 on page 28.
2. Unplug the power cord(s) from the back of the Freeway cabinet.
3. Slip the anti-static strap around your wrist and attach the alligator clip to any bare metal area of the Freeway cabinet.
4. Remove the top cover of the cabinet as described in Section 2.3 on page 32.
5. Remove the board support bar by removing the screw at each end of it that holds it to the cabinet and lifting the bar out of the way.
6. Remove the Ethernet board from its static protection packaging.
7. Slide the Ethernet board into the empty slot.

Caution

Be very careful when inserting a printed circuit board to prevent damage to the connectors and avoid causing incorrect power distribution due to a misaligned board.

8. Seat the board by applying pressure evenly to the top of the board.
9. Tighten the screw near the Ethernet board's face plate.
10. Replace the board support bar and tighten the screws that secure it in place.
11. Replace the top cover on the cabinet and tighten the screws that secure it in place.

12. Connect the Ethernet cable(s) to the rear of the Ethernet board.

13. Plug in the power cord(s) at the rear of the cabinet.

14. Power up the Freeway by opening the front door, then pressing the rocker switch on the front panel in the direction of the “1” symbol. Startup proceeds automatically as described in Section 2.1.4 on page 29.

5.2.2 Updating the bootcfg file

1. Locate the bootcfg file on the Freeway disk drive. The file is a text file in the /tmp/boot directory of the Freeway. You can edit the file right in this directory using the vi or ee editor. You can also use FTP to copy this file from the Freeway to your PC and edit the file there.

2. Determine the device name of the new Ethernet port(s) by displaying the Freeway log file.

3. Edit the bootcfg file to add the required information for the new Ethernet ports. Remove the pound signs (#) to uncomment the added_interface_type, added_interface_mask, and added_interface_addr lines as shown in the example below. These parameters are described in the *Freeway User Guide*.

```
#-------------------------------------------------------------#
# Added Ethernet Ports
#-------------------------------------------------------------#
#
added_interface_type =  em2
added_interface_mask =  ffffff00
added_interface_addr =  192.168.1.200
```

4. Once you have edited the bootcfg file, save it back to the /tmp/boot directory on the Freeway. If you used FTP to edit the file on your PC, use FTP again to copy

it back to the /tmp/boot directory on the Freeway. Make sure that your FTP program copies the file back as a UNIX ASCII file. For more details, refer to the *Text Files: Windows vs. UNIX* section in Chapter 6 of the *Freeway User Guide*.

5. Next save the bootcfg file to the non-volatile area on the Freeway disk drive. To save it to the non-volatile area, log into the Freeway menus and select 5-3-3 from the menu items as described in the *Menu Update Method (5-3-3)* section in Chapter 6 of the *Freeway User Guide.*

6. Reboot the Freeway by selecting menu items 1-2. After the Freeway system reboots, log into the Freeway and select menu items 1-6 to get to a shell prompt. Then type the command **ifconfig** at the shell prompt to confirm that the new Ethernet port was successfully added.

Appendix

A Hardware Specifications

General

Construction: Heavy duty steel chassis

Drive Bay: Shock-proof and front accessible 5.25” (x3) and 3.5” (x1) drivers

Cooling System: Dual easy-to-replace 84-114 CFM cooling fans with front-accessible air filters

Controls: Power switch (momentary on/off) and reset buttons behind lockable doors

Front Connectors: PS/2 keyboard and USB (normally disabled)

Rear Connectors: Dual 10/100/1000 Ethernet ports, 9-pin serial console cable

Physical Specifications

Height: 7 inches (177 mm)

Width: 19 inches (482 mm)

Length: 18.9 inches (479 mm)

Weight: 36 pounds (16.3 kg)

Mounting: Standard 19" rack mount

Environmental Specifications

Operating Temperature: 32° to 104° F (0° to 40° C)

Non-operating Temperature: -4° to 140° F (-20° to 60° C)

Humidity (non-condensing): 10%–85% at 104° F (40° C)

Vibration (operating): 5Hz–500hz, 0.5 G rams

Shock (operating):	10 G with one 11 ms duration, half sine wave
Altitude:	0 to 10,000 feet (0 to 3048m)

Passive Backplane

Single System Backplane model. Protogate P/N: 15-000-0864

AC Power Supply

Single 400W ATX P/N: 11-000-0118

Redundant 400W Power Supply 1 (ea) P/N: 11-000-0114

Power supply specifications shown in Table A–1:

Table A–1: Power Supply Specifications

Watts	Input	Output	Mini-load	Safety	MBTF
400W	100/240V 47-63Hz 8-4A	5V @ 35A 3.3V @ 25A 12V @ 28A -12V @ 1.2A -5V @ 0.5A	5V @ 2.5A 12V @ 0.5A 3.3V @ 0.2A	UL/cUL/TUV	100,000 hours at 75% load

Certifications

CE compliant, UL/cUL approved

Appendix

B Packing the Freeway for Shipment

Caution

Please keep the original box and packing material. To avoid damage during shipment, please use the original box and packing material when shipping your Freeway.

Packing Specifications

The packing material must meet the following specifications:

- The box must use double-wall construction and have dimensions of approximately 24" x 22" x 12 3/4".
- The original foam inserts can be replaced by 4" foam-in-place packaging.

Shipping and packing material can be purchased from your local FedEx/UPS store or from other shipping supply companies (such as ULINE, etc.).

Packing Instructions

1. Secure the bottom of the box with heavy duty staples and 3" reinforced, gummed tape.
2. Insert the original foam packing material in the bottom of the box. If you do not have the original packing material, use 4" foam-in-place packaging
3. Place the Freeway in the static proof wrapping.

4. Place the Freeway in the box, right side up, so that it fits firmly into the foam packing material you inserted in the box in Step 2.

5. Place the remaining foam packing material firmly around the top of the Freeway.

6. Close the top of the box, and seal it with 3" reinforced, gummed tape.

Note

Rack slides should be removed from the Freeway before returning. Also, do not return ICP cables unless instructed by Protogate.

Under exceptional circumstances, you may be asked by Protogate's Customer Service to return your Freeway to Protogate. Under these circumstances, you will be directed by Customer Service to obtain a Return Material Authorization number from Protogate at (858) 451-0865. Before calling Protogate, note your Freeway's serial number which is on the back of the unit above the power cord socket. For Freeways not covered by Protogate's standard warranty or service agreement, a purchase order to cover the cost of repairs must be sent with the returned product.

Ship prepaid, insurance optional, to:

Protogate, Inc.
12225 World Trade Drive, Suite R
San Diego, CA 92128
RMA #_____
Purchase Order #_____

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Customer Report Form

We are constantly improving our products. If you have suggestions or problems you would like to report regarding the hardware, software or documentation, please complete this form and mail it to Protogate at 12225 World Trade Drive, Suite R, San Diego, CA 92128, or email a PDF copy of the form to support@protogate.com.

If you are reporting errors in the documentation, please enter the section and page number.

Your Name: _____

Company: _____

Address: _____

_____

_____

Phone Number: _____

Product: _____

Problem or
Suggestion: _____

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San Diego, CA 92128