

# 10

## Power Systems

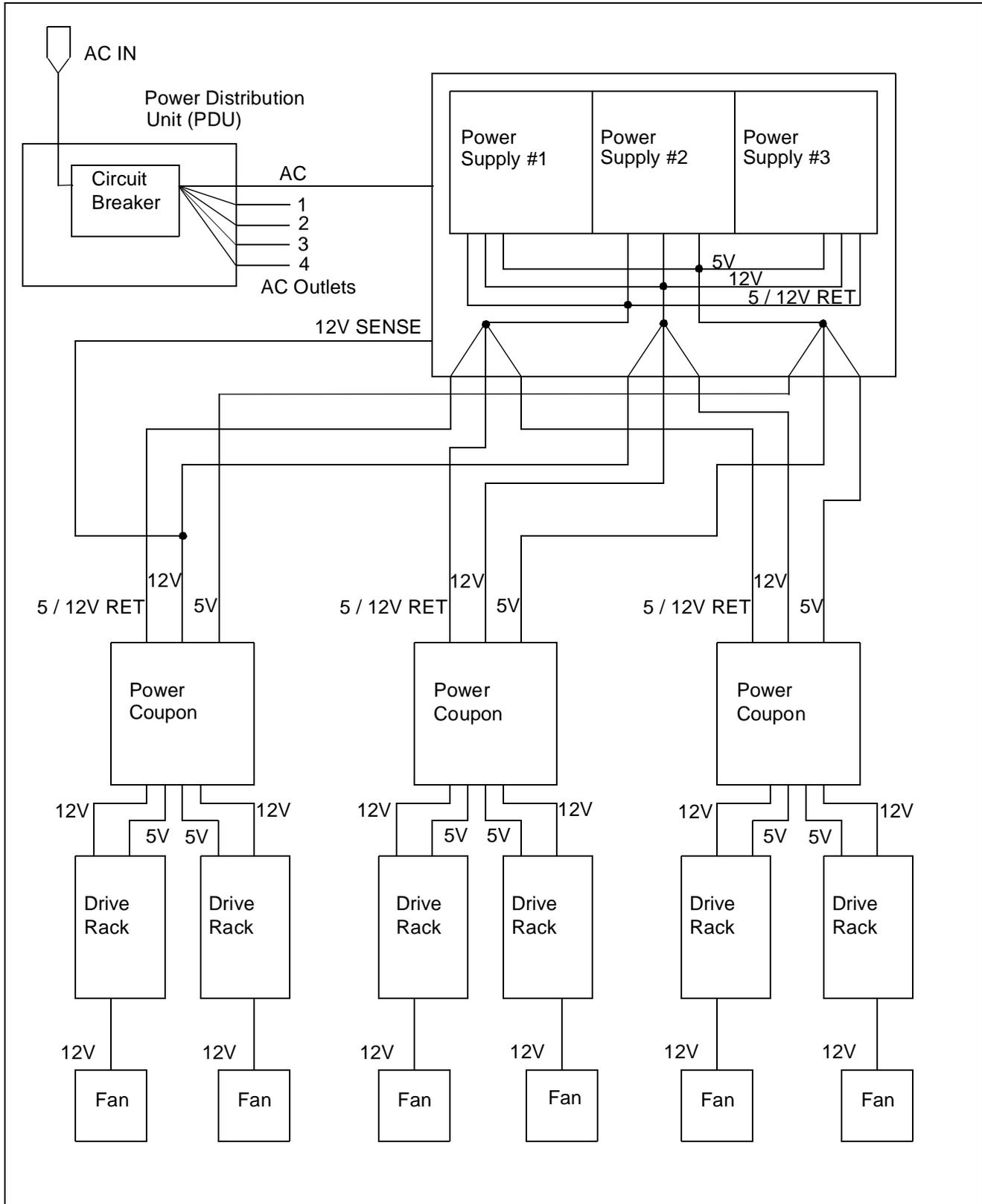
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### Introduction

Power systems are common and fundamental to all Auspex NetServers. Although power systems seldom fail, degraded performance can lead to problems in all other subsystems.

### Objectives

- ▲ Identify the NetServer power supplies and describe how to determine their operating status
- ▲ Identify the NetServer power distribution units and explain their function in the power system
- ▲ Explain how power supply redundancy is achieved in the various NetServer models



**Mack Truck II/III drive rack power distribution (base cabinet)**

## Overview

Auspex NetServer power systems have three major components:

- ▲ Power distribution units (PDUs)
- ▲ Power harnesses
- ▲ Power supplies

AC power is routed through the PDU to the power supplies and from the supplies to the other NetServer subsystems. In the Mack Truck I, the supplies are functionalized: one provides power to the drive racks and the other provides power to the card cage. The Roadrunner/Dino servers use a single power supply while the Mack Truck II/III cabinets use one to three identical supplies, depending on system needs. For details on Mack Truck II/III power distribution, refer to the figures entitled *Mack Truck II/III drive rack power distribution* and *Mack Truck II/III card cage power distribution*.

Auspex NetServers are available with redundant or non-redundant power systems. The sections that follow describe power supply redundancy and how it is achieved for the various NetServer products.

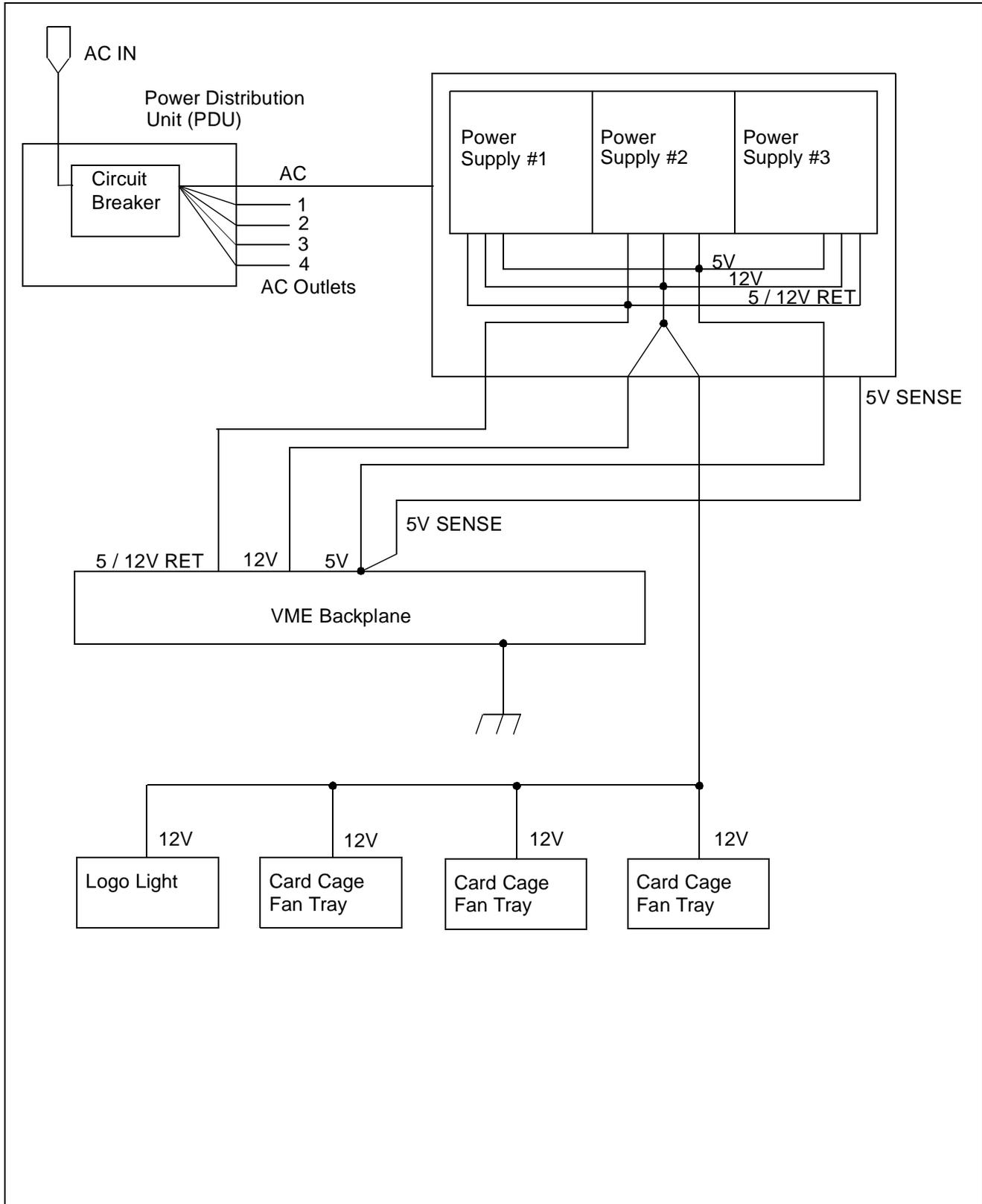
## Power Distribution Units

Power enters the NetServer through the Power Distribution Unit (PDU) which regulates the AC input power to the power supplies. The PDU is physically located in the back of each base and expansion cabinet at the bottom of the cabinet. On the Roadrunner/Dino cabinets, the PDU is incorporated within the power supply and is therefore not field-replaceable as a separate unit.

## Power Harnesses

The Mack Truck I power harness is field-replaceable and consists of two parts:

- ▲ The wire group providing power to the drive racks



**Mack Truck II/III card cage power distribution (base cabinet)**

▲ The wire group providing power to the VME card cage

The Mack Truck II/III power harness also consists of the same two parts but is not field-replaceable. The Roadrunner/Dino power harness is a single unit and is not field-replaceable.

## Power Supplies

Power supplies are discussed and illustrated in detail in the following sections.

### Mack Truck II/III Power System

The Mack Truck II/III cabinets support up to three identical power supplies, part number 650011 or 650014.<sup>1</sup> These supplies can be hot-plugged if installed in sufficient quantity to ensure redundancy. N+1 redundancy requirements vary based on system configuration.

### Determining Operating Status

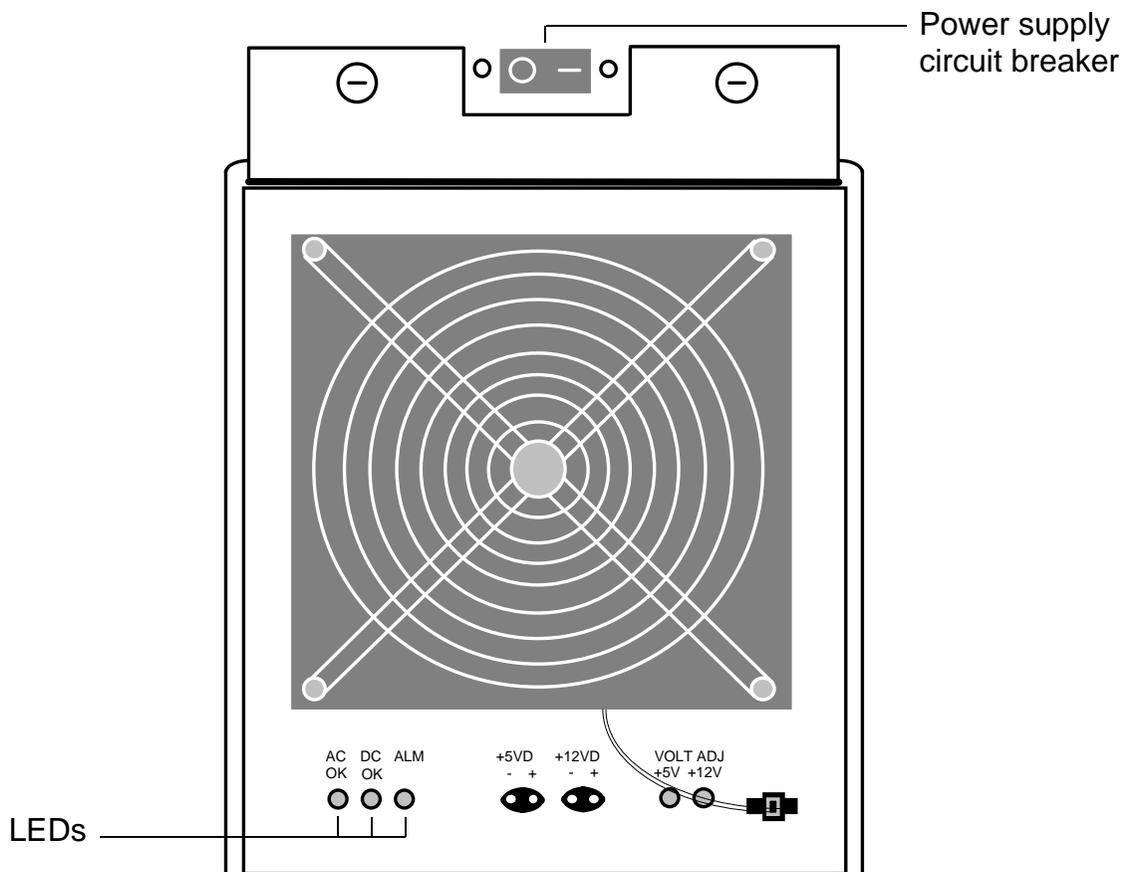
The operating status of the 650011 or 650014 power supplies can be determined by examining the LED indicators on the front of the supplies. The figure in this chapter entitled *Mack Truck II/III power supply* shows how the LED indicator display is interpreted.

### Replacing a Mack Truck II/III Power Supply

Your *Field Service Guide* provides complete instructions for power supply replacement, but observe the following two cautions.

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1. Part number 650011 was the original Mack Truck II power supply. It is being replaced by part number 650014 via Field Change Order (FCO) 101.



### LED power supply status indicators for Mack Truck II/III

Lit LEDs	Power supply status	Required action
Green LEDs only	Fully operational	None
Yellow ALM LED	Supply failure	Replace failed supply
Yellow DC LED	Insufficient power	Add a supply or determine the cause of the overload
Yellow AC LED	AC voltage is out of range	Check the power cord, power service, and AC voltage
None	Not receiving AC power, or catastrophic failure	Check system power switch, ensure supply is plugged into PDU, or replace supply

### Mack Truck II/III power supply

 **Caution:** Refer to the *Field Service Guide* to determine the power supply requirements for a specific system configuration. As a rule, when dealing with three-power supply systems, do not turn off more than one supply while the system is running.

 **Caution:** Do not carry a power supply by the handle (yoke); it is not strong enough to support the weight of the supply.

## Mack Truck II/III Power Distribution Unit

The Mack Truck II/III Power Distribution Unit (PDU) is either part number 510047, or part number 510056. Part number 510056 replaced 510047, and is currently shipped with Mack Truck III systems, but field systems were not retrofitted with the new part. You will therefore find both PDUs in the field.

The PDU is a simple device and seldom fails. Consult your *Field Service Guide* for the replacement procedure.

## Mack Truck II/III Power Supply Redundancy

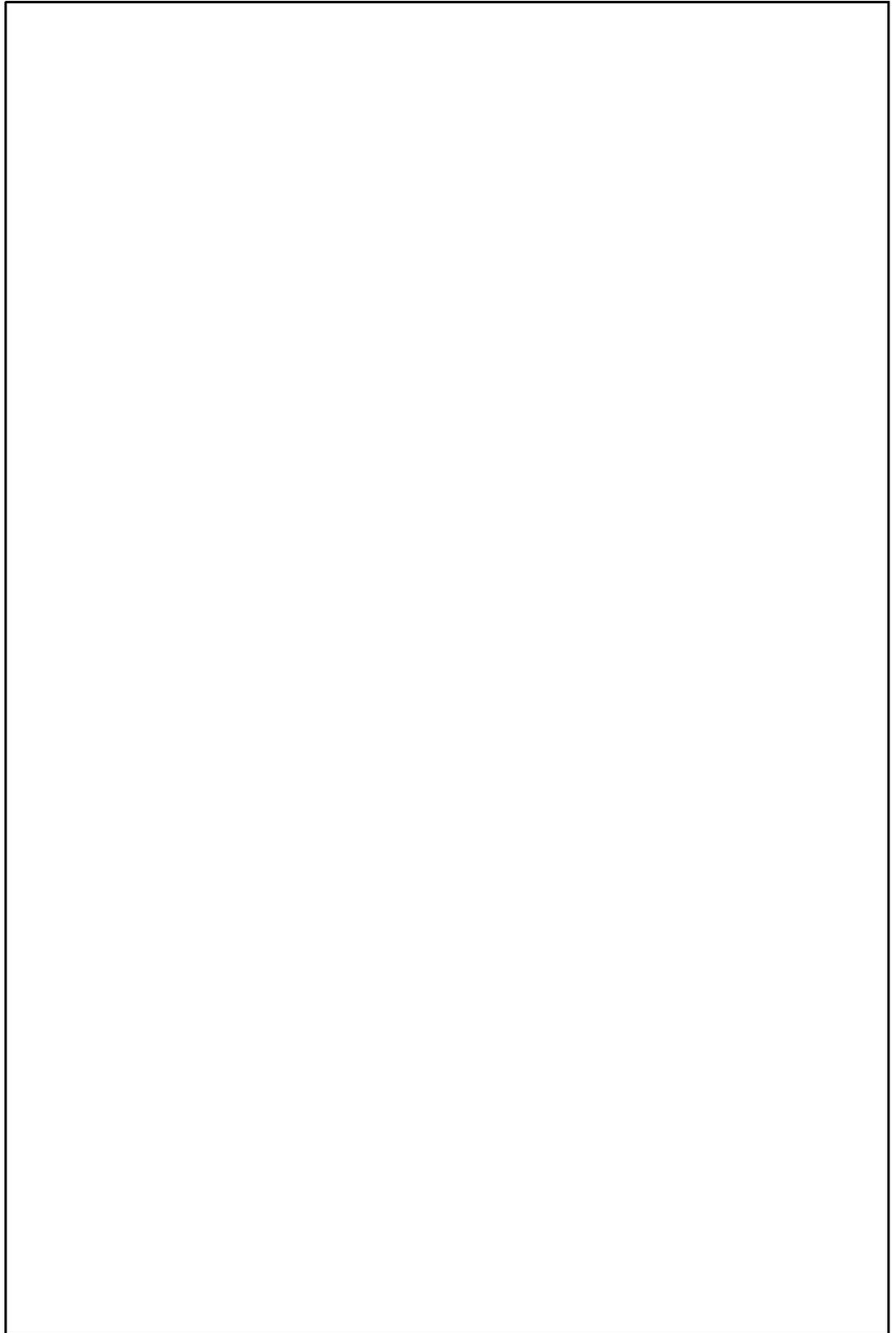
Mack Truck II and III power supply redundancy is established by first determining the minimum number of supplies required for a specific configuration, then adding one power supply. Once established, this “n+1 redundancy” allows the load to be shared equally among the installed supplies. If one supply fails, the remaining supply (or supplies) will provide the required system power until the failed supply is replaced.

The tables entitled *Mack Truck II/III base cabinet power supply requirements* and *Mack Truck II/III expansion cabinet power supply requirements* provide guidelines for recognizing and establishing power supply redundancy. Note that these tables are guidelines only; in marginal situations, power measurement or power analysis may be necessary to determine redundancy requirements.

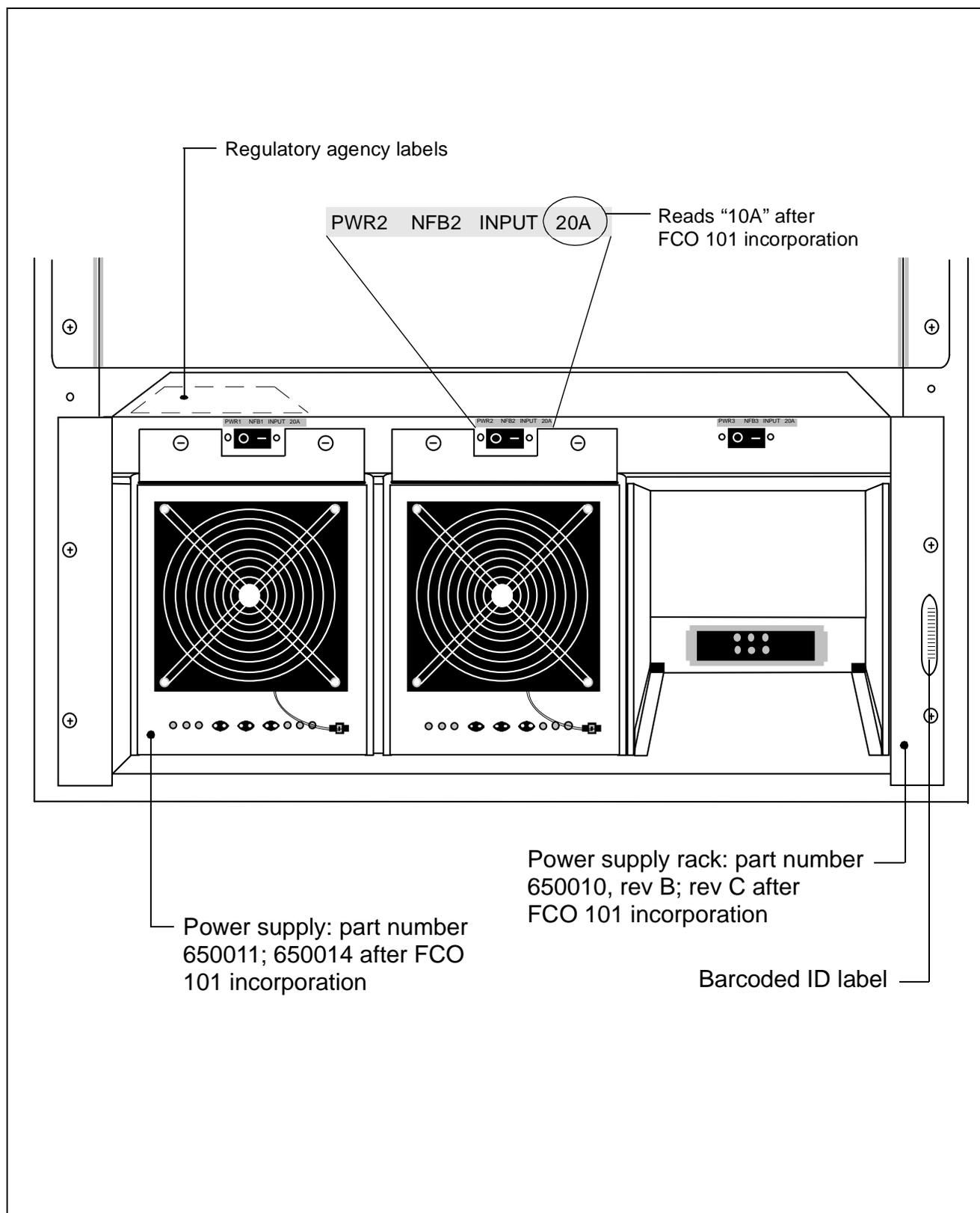
<b>Mack Truck II/III base cabinet power supply requirements</b>									
<b>Number of drives installed</b>	<b>Number of processor boards installed</b>								
	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
1-7	1	1	1	1	2	2	2	2	2
8-14	1	1	1	2	2	2	2	2	2
15-21	1	1	2	2	2	2	2	2	2
22-28	1	2	2	2	2	2	2	2	2
29-35	2	2	2	2	2	2	2	2	2
36-42	2	2	2	2	2	2	2	2	2

<b>Mack Truck II/III expansion cabinet power supply requirements</b>		
<b>Number of drive racks installed</b>	<b>Number of power supplies needed</b>	
	<b>Non-redundant operation</b>	<b>Redundant operation</b>
1-6	1	2
7-12	2	3



**Student Notes**



**Items affected by FCO 101**

## Field Change Order (FCO) 101

FCO 101 affects Mack Truck II power supplies, power supply circuit breakers, power supply racks (ID label only), and regulatory agency labels. The details of FCO 101 are contained within the FCO 101 field bulletin in Appendix B. The figure entitled *Items affected by FCO 101* gives the student an overview of the differences in the power subsystem before and after FCO 101 incorporation.

## Mack Truck I Power System

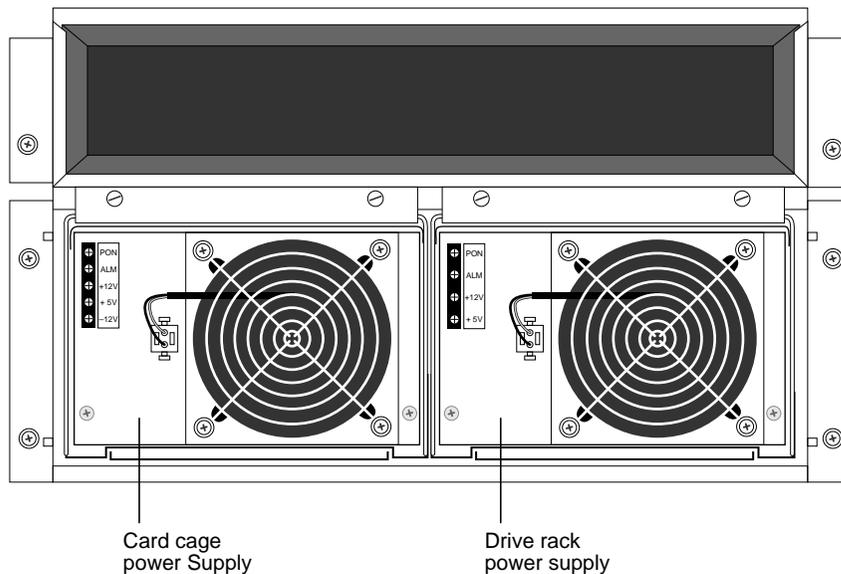
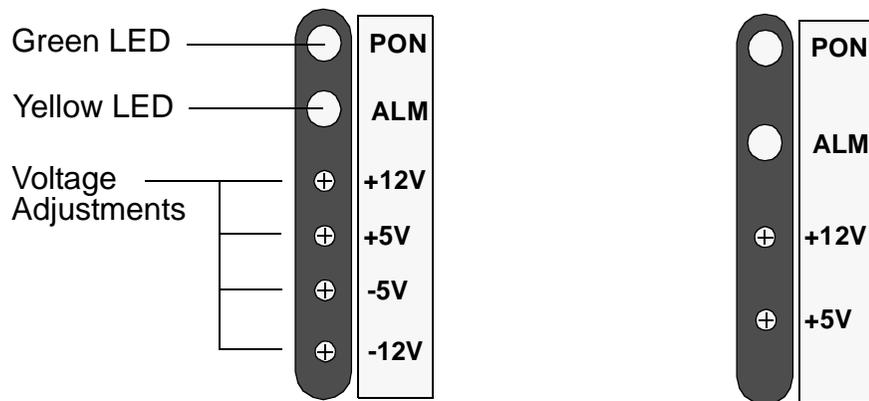
The Mack Truck NetServers support redundant and non-redundant power systems.

In the base cabinet of non-redundant servers, one supply (part number 500012) provides power to the card cage, and the other (part number 500011) provides power to drive racks 1–4. In the expansion cabinet, one supply provides power to drive racks 5–8, and the other provides power to racks 9–12.

For redundant systems (models NS 7000/502, NS 6002, and NS 5502), four power supplies are used to support redundant operation. In the base cabinet, two card cage supplies (part number 650007) are located below the card cage; they share the power demands of the board set and backplane. Two drive rack power supplies (part number 650006) are located between the card cage and the first drive rack; they share the power demands of the drives in racks 1–4. In the expansion cabinet, two supplies are located below drive rack 5 to provide power to racks 5–8. If racks 9–12 are installed, an additional pair of supplies are located below rack 9 to provide power for those racks.

## Determining Operating Status

The operating status of the Mack Truck I power supplies can be determined by examining the LED indicators on the front of the supplies. The figure in this chapter entitled *Mack Truck I power supplies* shows



**LED power supply status indicators for Mack Truck I**

Lit LEDs	Power supply status	Required action
Green LED only	Fully operational	None
Yellow LED only	Failed supply	Replace supply
None	Not receiving AC power, or catastrophic failure	Check system power switch, ensure supply is plugged into PDU, or replace supply

**Mack Truck I power supplies**

how the LED indicator display is interpreted. The LED location is the same for redundant and non-redundant systems.



**Note:** Older Mack Truck I power supplies with integral fan assemblies do not have LEDs.

## Replacing a Mack Truck I Power Supply

The *Field Service Guide* provides complete instructions for power supply replacement, but observe the following note and caution.



**Note:** If the NetServer has a redundant power supply configuration, it will operate normally if one power supply fails. However, it should be replaced immediately in order to return the server to a redundant power status.



**Caution:** Do not attempt to hot-plug a power supply in a Mack Truck I or Roadrunner/Dino cabinet. Only the power supplies in Mack Truck II/III cabinets are hot-pluggable.

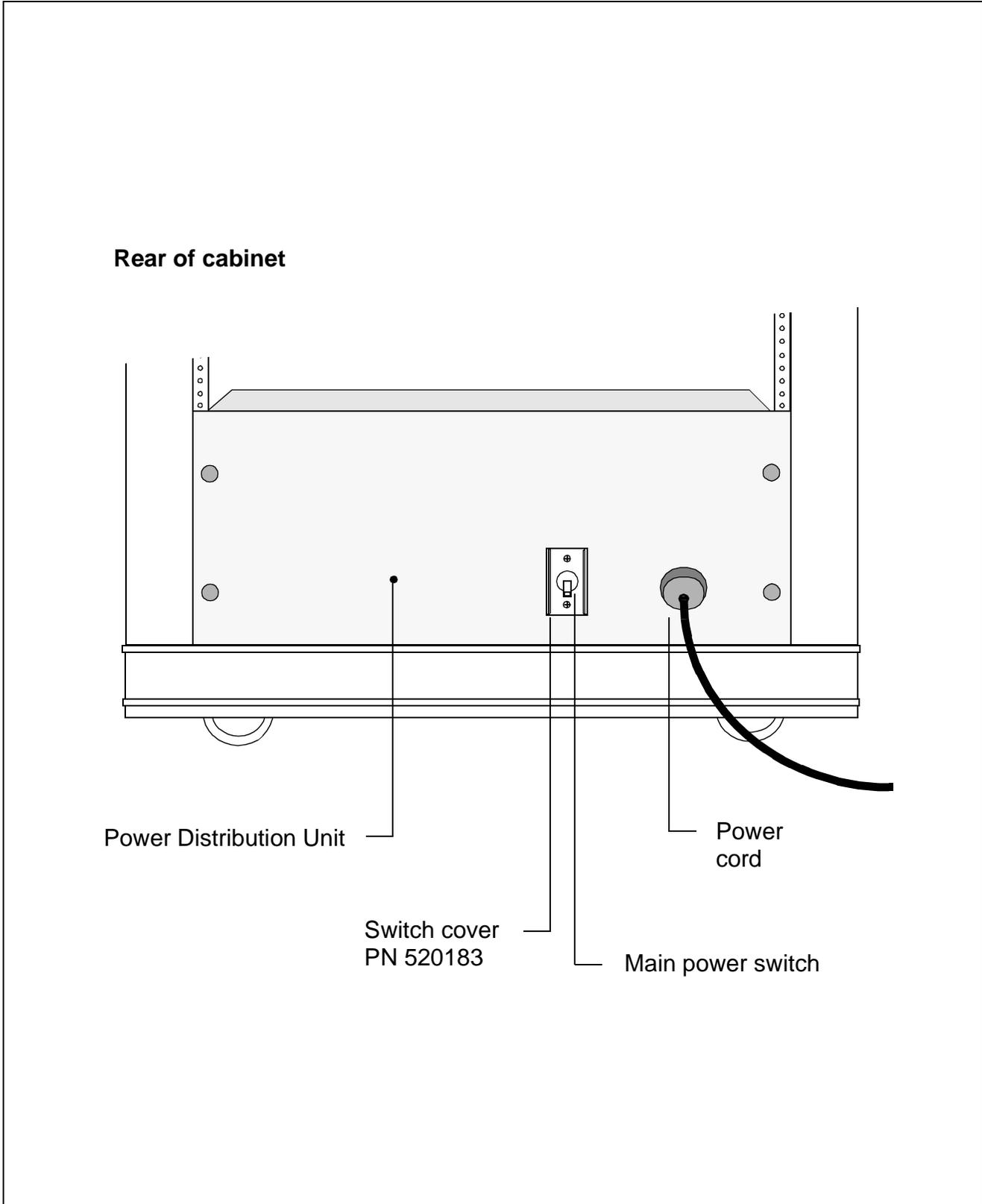
## Mack Truck I Power Distribution Unit

The PDU for the Mack Truck I cabinets will bear part number 500026 or part number 500054. The 500026 was the original PDU shipped with the NS 5000 and 5500. The 500054 is the functional replacement with a few enhancements.

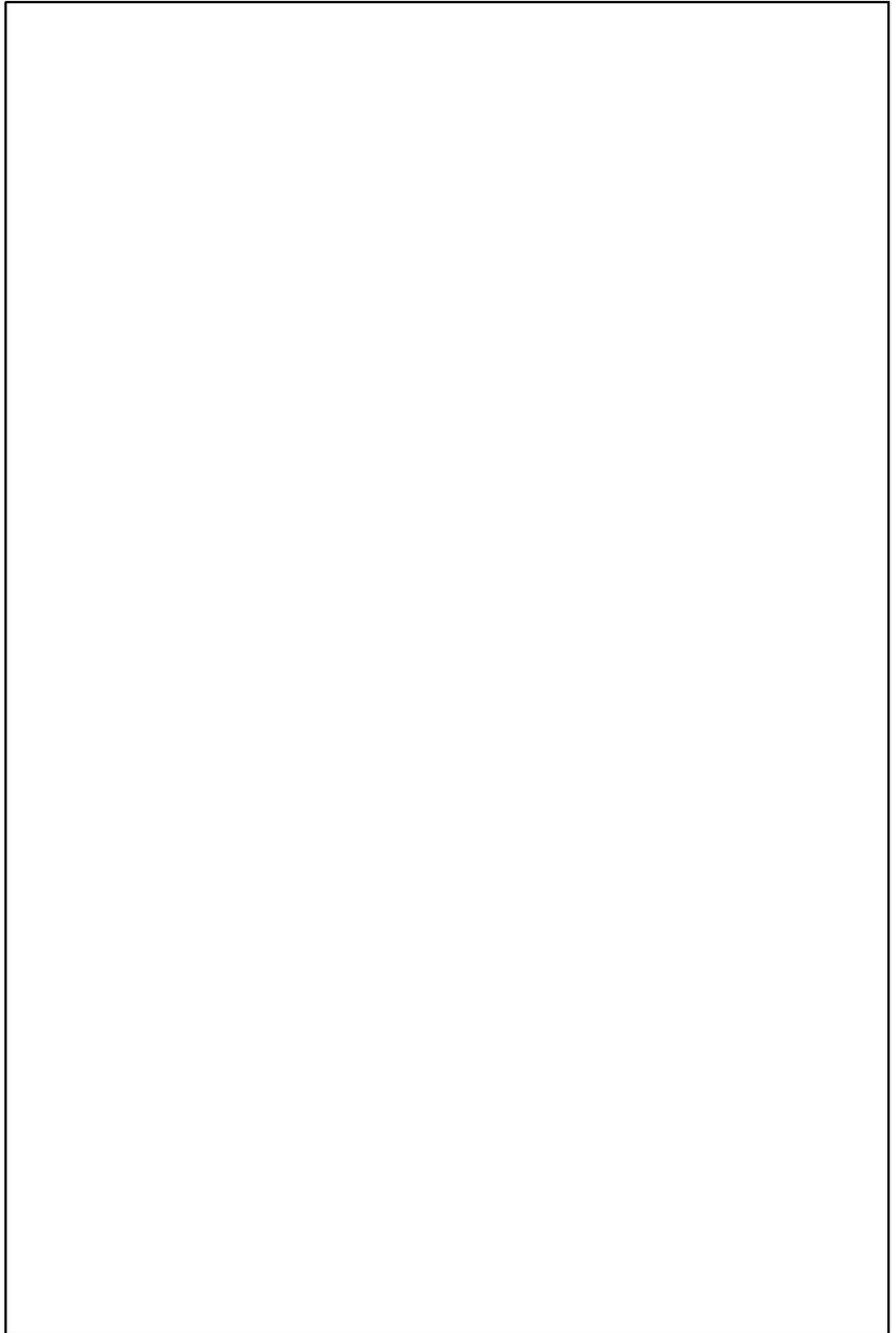
Observe the following note when dealing with 500026 PDUs in the field.



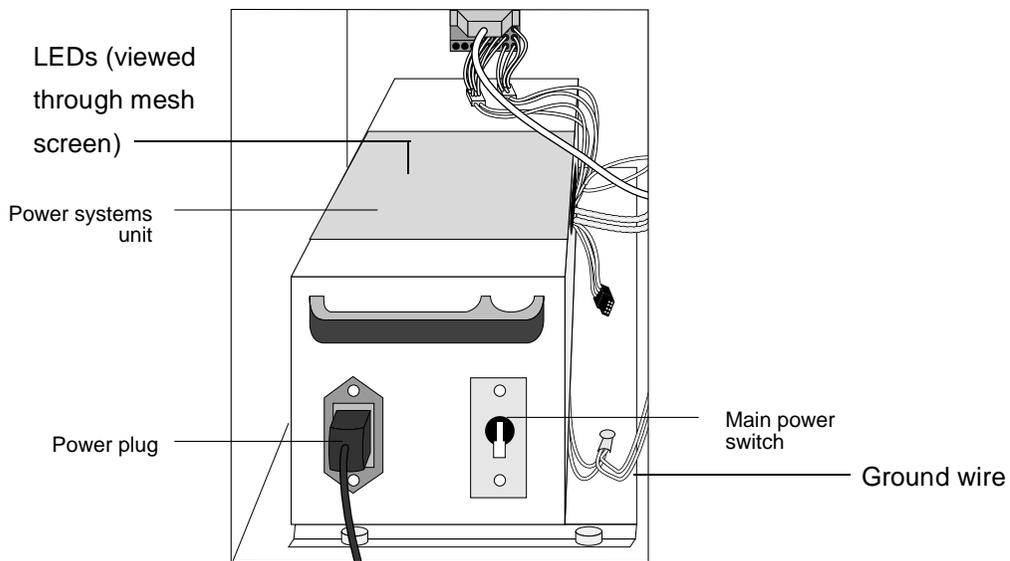
**Caution:** To prevent accidental power shut-down, the 500026 PDU should have the switch cover shown in the figure entitled *Mack Truck I power distribution unit* (later in this chapter). If you observe a 500026 PDU without the switch cover, contact Auspex technical support immediately. The switch cover on the 500054 PDU is standard equipment; it was added to the 500026 as a result of FCO 71.



**Mack Truck I power distribution unit**



**Student notes**



**LED power supply status indicators for Roadrunner/Dino**

Lit LEDs	Power supply status	Required action
Green LED only	Fully operational	No action required.
Left LED is red	Power problem or supply failure	Check the AC power or replace the failed power supply.
Middle LED is red	Power problem or supply failure	Verify DC power connector wires are properly connected or replace the failed power supply.
Right LED is red	Power problem or supply failure	Visually inspect the backplane bus bar to ensure proper wire and bus contacts or replace the failed supply.
None	The supply is not receiving AC power, or it has a catastrophic failure.	Check the system power switch, ensure the supply's power plug is firmly plugged into the PDU, or replace the supply.

**Roadrunner/Dino power supply**

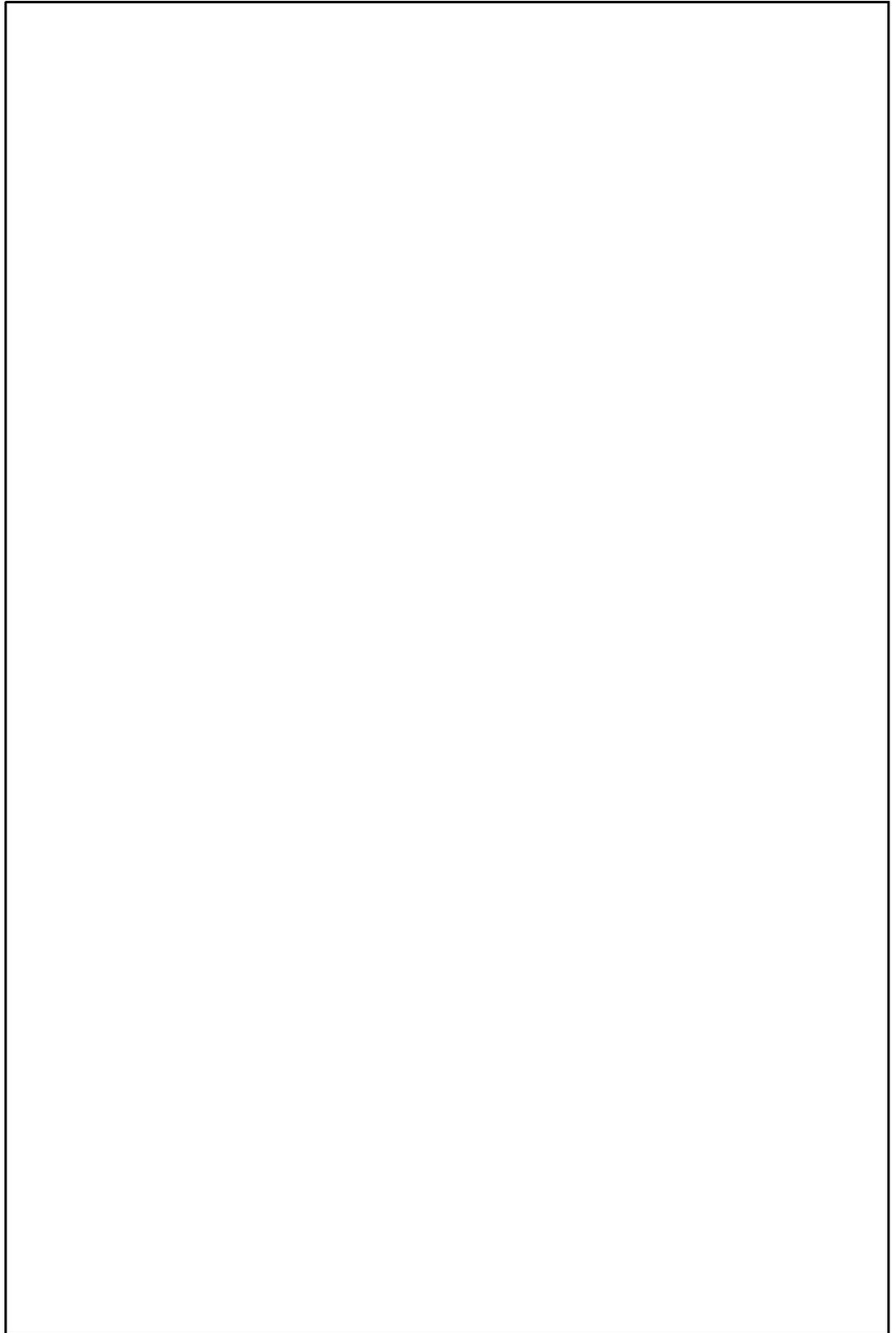
## Roadrunner/Dino Power System

The Roadrunner/Dino power supply (part number 500130 for the base cabinet and part number 500147 for the expansion cabinet) is a single unit that provides power for all NetServer subsystems. An important distinction is that the Roadrunner/Dino power supplies are not field-adjustable.

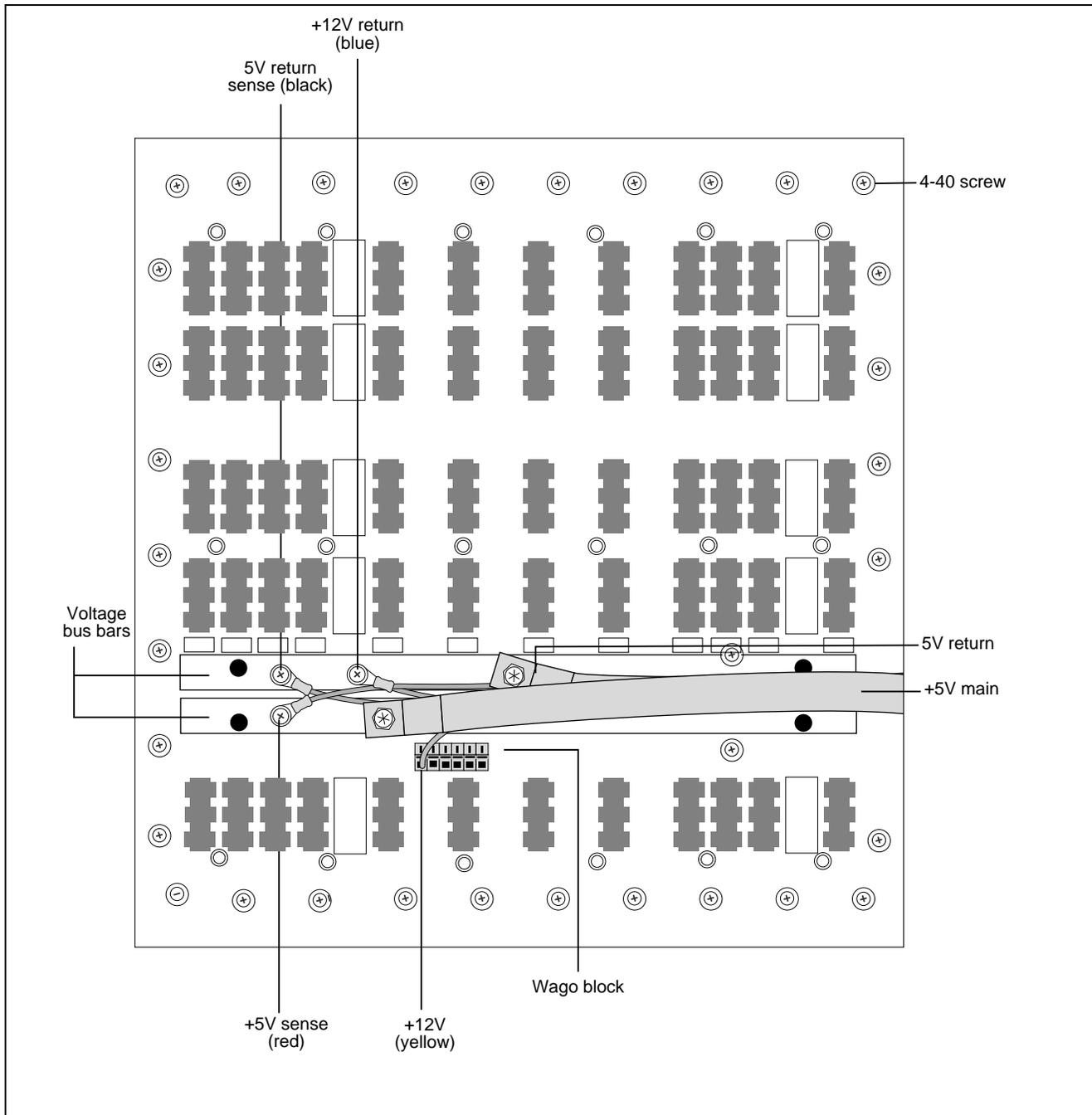
The figure on the facing page shows how to interpret the status indicators (which must be viewed through the mesh screen on the top of the supply).

There is no separate power distribution unit for the Roadrunner/Dino power system; it is integrated into the power supply.

<b>Power System Components Summary</b>	
<b>Component</b>	<b>Part Number</b>
<b>Mack Truck I</b>	
Non-redundant power supply	
Card cage	500012
Drive rack	500011
Redundant power supply	
Card cage	650007
Drive rack	650006
Power Distribution Unit (PDU)	500026
	500054
<b>Mack Truck II</b>	
Power supply	650011
	650014
Power Distribution Unit	510047
	510056
<b>Mack Truck III</b>	
Power supply	650014
Power Distribution Unit	510056
<b>Roadrunner/Dino</b>	
Power supply, base cabinet	500130
Power supply, expansion cabinet	500147



**Student Notes**



**Mack Truck II/III system voltages**

Voltage	Tolerance	Measurement location	Return location
+5 VDC	+5.08 ± 0.15 Volts	+5V (red)	5V return (black)
+12 VDC	+12.10 ± 0.3 Volts	+12V (yellow)	12V return (blue)

**Mack Truck III VME backplane (“extended” backplane)**

## Mack Truck II/III System Voltages

The table entitled *Mack Truck II/III system voltages* lists the voltage levels, voltage tolerances, and measurement locations for Mack Truck II and III system voltages.

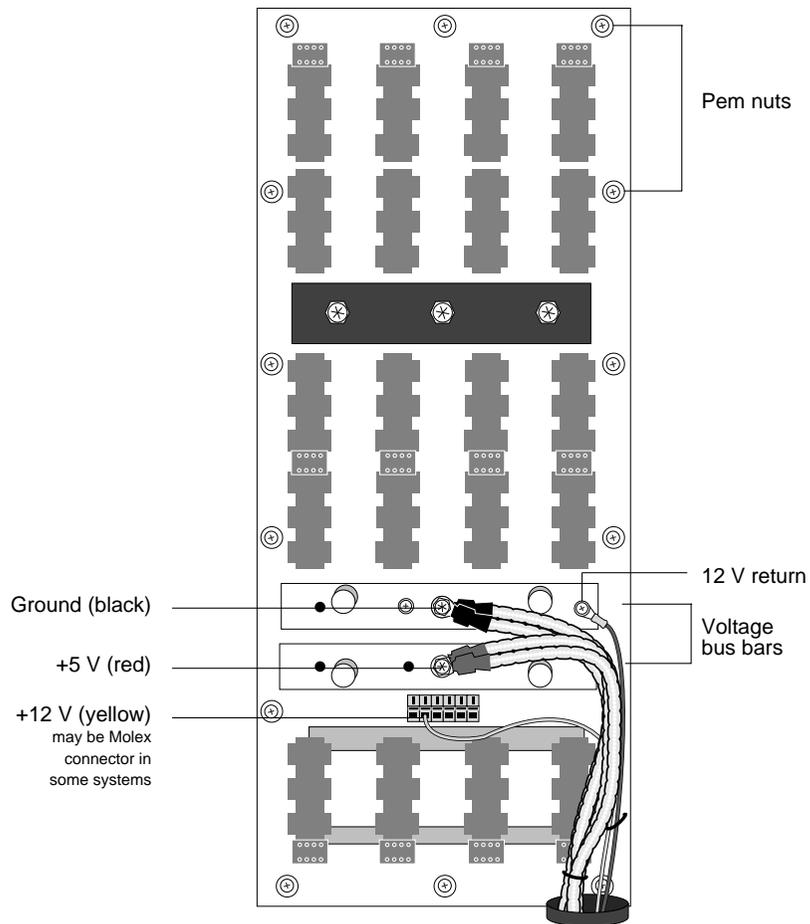


**Note:** The voltages shown in the table entitled *Mack Truck II/III system voltages* are measured between the measurement location and the return location.



**Note:** The Mack Truck II and III systems use the same power subsystem but have different VME backplanes. The Mack Truck III uses the backplane shown in the figure entitled Mack Truck III VME backplane. The Mack Truck II uses the same backplane as the Mack Truck I.

See the *Field Service Guide* and the *System Maintenance* chapter in this manual for more information on voltage testing.



**Roadrunner/Dino system voltages**

Voltage	Tolerance	Measurement location	Return location
+5 VDC	+5.08 ± 0.15 Volts	+5V (red)	5V return (black)
+12 VDC	+12.10 ± 0.3 Volts	+12V (yellow)	12V return (blue with yellow stripe)

**Roadrunner/Dino VME backplane**

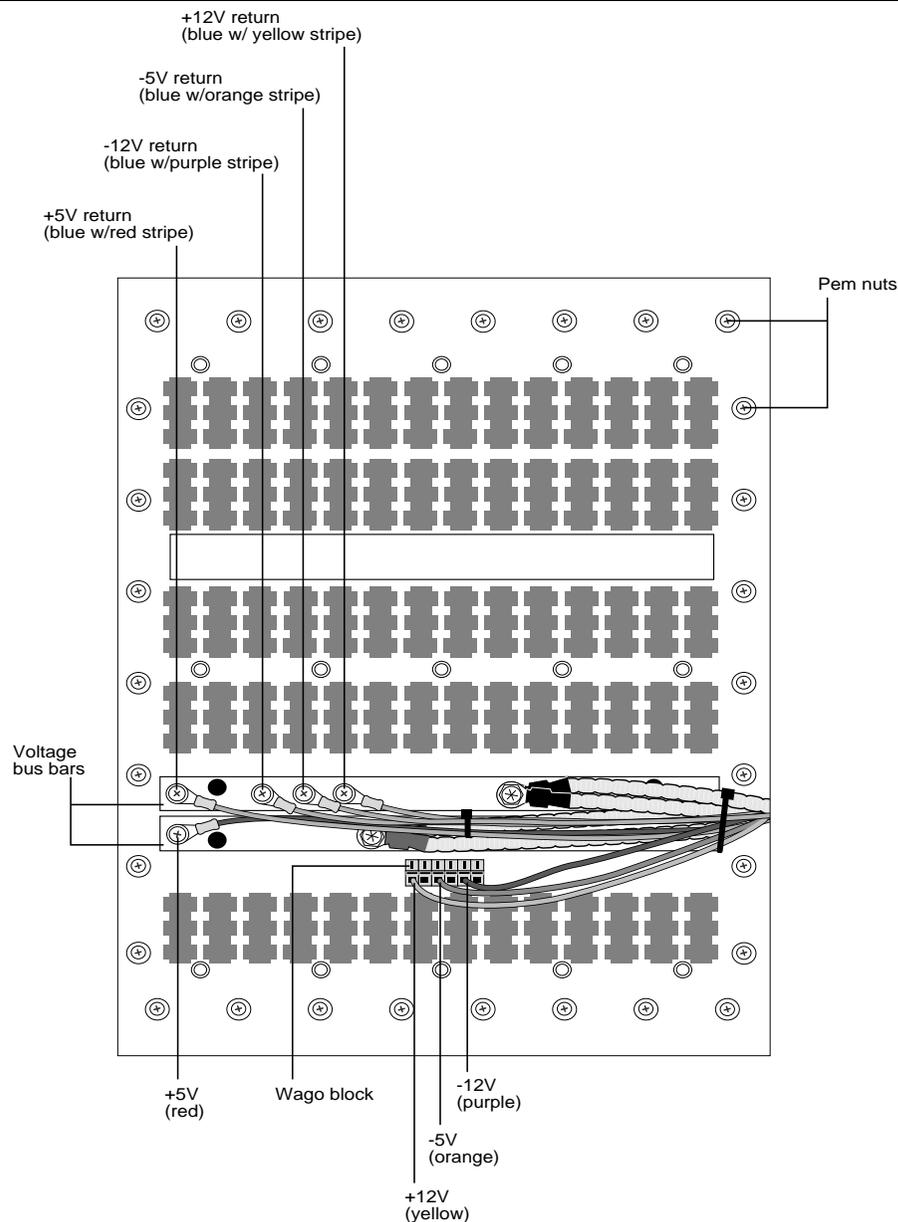
## Roadrunner System Voltages

The table entitled *Roadrunner/Dino system voltages* lists the voltage levels, voltage tolerances, and measurement locations for Roadrunner and Dino system voltages.



**Note:** The voltages shown in the table entitled *Roadrunner/Dino system voltages* are measured between the measurement location and the return location.

See the *Field Service Guide* and the *System Maintenance* chapter in this manual for more information on voltage testing.



**Mack Truck I card cage voltages**

Voltage	Tolerance	Measurement location	Return location
+5 VDC	+5.1 ± 0.15 Volts	+5V (bus bar)	5V return (bus bar)
+12 VDC	+12.0 ± 0.3 Volts	+12V (yellow)	12V return (blue with yellow stripe)
-12V	-12.0 ± 0.3 Volts	-12V (purple)	-12V return (blue with purple stripe)

**Mack Truck I VME backplane**

## Mack Truck I System Voltages

### Mack Truck I Card Cage Voltages

The table entitled *Mack Truck I card cage voltages* lists the voltage levels, voltage tolerances, and measurement locations for the Mack Truck I card cage.



**Note:** The voltages shown in the table entitled *Mack Truck I card cage voltages* are measured between the measurement location and the return location. If any of the voltages measured are out of tolerance, refer to the *Field Service Guide* and follow the adjustment procedure.

See the *Field Service Guide* and the *System Maintenance* chapter in this manual for more information on voltage testing.

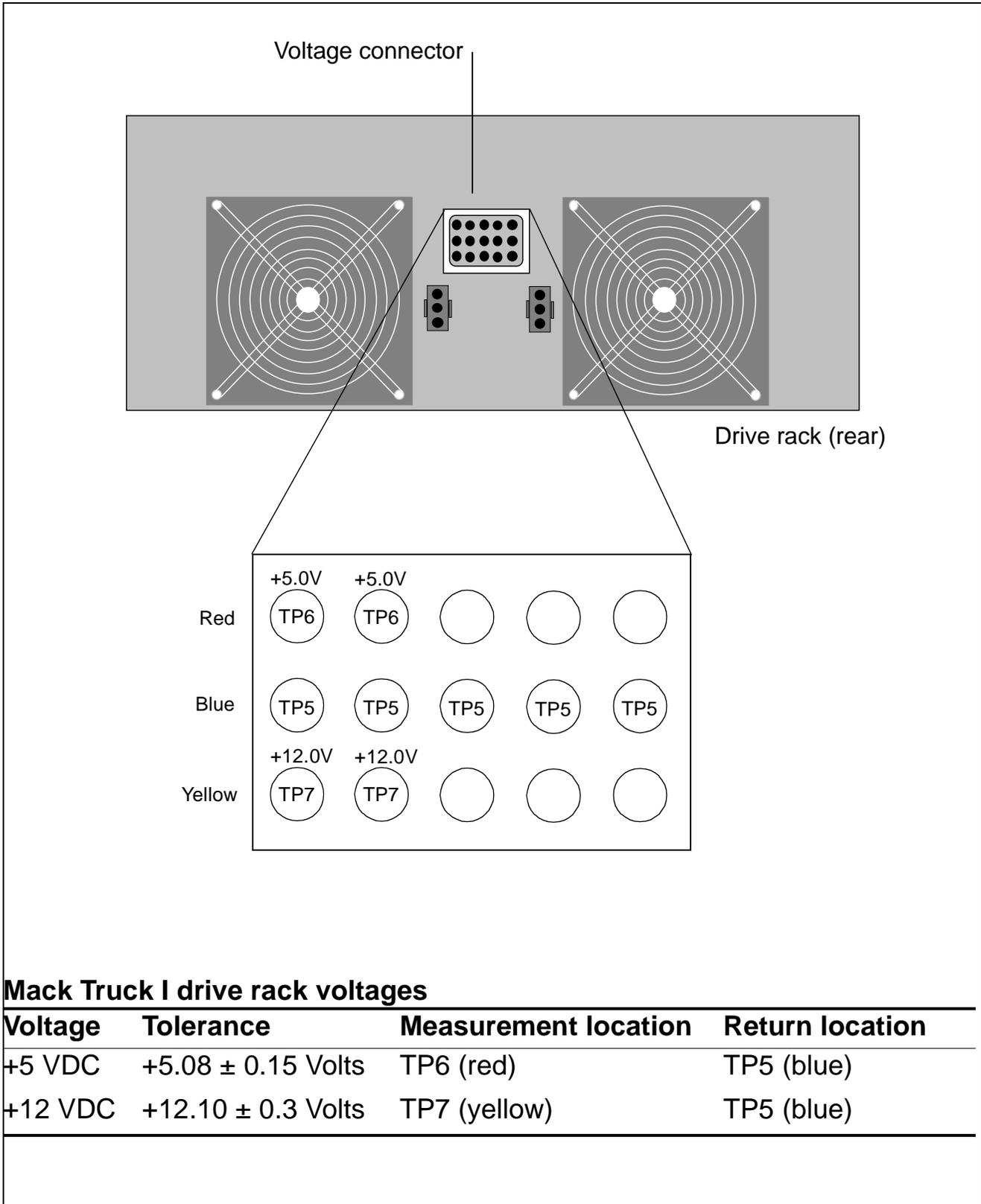
### Mack Truck I Drive Rack Voltages

The table entitled *Mack Truck I drive rack voltages* lists the voltage levels, voltage tolerances, and measurement locations for Mack Truck I drive racks.



**Note:** The voltages shown in the table entitled *Mack Truck I drive rack voltages* are measured between the measurement location and the return location. If any of the voltages measured are out of tolerance, refer to the *Field Service Guide* and follow the adjustment procedure.

See the *Field Service Guide* and the *System Maintenance* chapter in this manual for more information on voltage testing.



**Mack Truck I drive rack voltage test points**