



PSU9700-AC
PSU9700-DC
RMU9700-16
August 2000

Access Rack and Power Supply User Manual

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Radio and TV Interference

The Access Rack power supplies generate and use radio frequency energy, and if not installed and used properly—that is, in strict accordance with the manufacturer's instructions—may cause interference to radio and television reception. They have been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If these products do cause interference to radio or television reception, which can be determined by turning off the unit, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

CE Notice

The CE symbol on your Black Box equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the European Union. A Certificate of Compliance is available by contacting Technical Support.

General Information

Thank you for your purchase of these Black Box products. They have been thoroughly inspected and tested and are warranted for One Year parts and labor.

Features

- Low-Profile mid-plane architecture design
- Provides redundant DC power for Patton rack cards
- Plugs into Black Box Access Rack Chassis (RMU9700-16)
- Redundant supply serves up to 14 function cards
- *Single supply* serves up to 16 function cards
- Easily replaceable front and rear modules
- LED Indicators: 12V, Fail, and Temperature

Description


There are two Access Rack power supplies: (1) PSU9700-DC and (2) PSU9700-AC. Using two Access Rack power supply modules, system operations will not crunch to a standstill if one supply fails. The second supply simply takes over! CSU/DSUs, Baseband modems, and G.703 modems plugged into an Access Rack power supply continue to operate as normal.

Full redundancy is provided using two front power supply modules and two rear power entry modules. That's only two slots in a Black box Access Rack chassis (RMU9700-16). The remaining 14 slots can provide high speed G.703 access, router links or short haul modem hook-ups. When redundancy is not required, a single power supply may be used to power a full rack of 16 function cards.

Scope

This service manual covers the installation, servicing and operating instructions for the Black Box units PSU9700-AC and PSU9700-DC redundant, rack-mount power supply modules. The modules are part of the Access rack system.

WARNING! - High Voltage Service Access Area

The power entry cavities and power supply cards are part of a Service Access Area. This is designated by the electric shock symbol  located on the front and rear panels. Only qualified service personnel should be permitted to access, install, remove, service or configure power supply modules.

Definition of Service Personnel

Qualified service personnel are defined as persons who have the appropriate technical training and experience necessary to (A) perform tasks in the SERVICE ACCESS AREA of the equipment, and (B) be aware of the hazards to which they are exposed in performing a task, and of measures to minimize the danger to themselves or other persons.

Safety Precautions and Operating Instructions

To comply with the published safety standards, the following must be observed when using or installing the power supply modules.

- A. Hazardous voltages exist in the primary circuits of AC-input power supplies. Beware of internal lethal voltages due to charged capacitors even after the AC input is disconnected. A minimum of 3 minutes should be allowed after input power is disconnected before servicing the AC power supply modules.
- B. Normal operating temperature range is 0°C to + 50°C at full rated output power. Derate linearly to 50% of full load from 50°C to 70°C.
- C. All chassis ventilation holes and fan intake openings must remain open and unobstructed.
- D. The power supply modules are components of the Access rack system. When installing the modules and making input connections, the relevant safety standards e.g. IEC950/VDE 0805, UL 1950 and EN 60950 must be complied with.
- E. For continued safe operation, the power supplies must be operated with the appropriate fuses installed. For the AC supply, the fuse should only be replaced by a 3.0A, 250V, time delayed, Bussmann type GMD-3A or Wickmann type 198-1300-0-00.
For the DC supply, the fuse should only be replaced by a 5.0A, 250V, time delayed, Littelfuse type 215 005 or Wickmann type 19181-063-FS.
- F. The disconnection of the input line voltage is made by pulling the mains plug (AC supply) or the disconnection of the DC source at the rear power entry card (DC supply).
- G. The earth wire must be connected only to the chassis earthing points marked with the earth ground symbol.
- H. In case of failure or malfunction, the power supplies must be returned to Black Box for servicing to ensure continued compliance with all safety requirements

Installation

The following sections describe in detail how to properly install the power supply modules, configure the rear power entry card alarm operation, and describe the initial installation of the front power supply cards. Also included in the following sections are descriptions on making the alarm relay connections, connecting a rear entry card to the AC voltage source (90-264 VAC, 50-60 Hz), and connecting a rear entry card to the 48 VDC source (42-60 VDC). This section also contains information on replacing a PSU9700-AC and a PSU9700-DC front card.

The Rack Chassis

The RMU9700-16 chassis is compact in size. It occupies only 2U (3.5") of vertical height in a 19" rack. Two sturdy front handles allow the unit to be installed, extracted or transported easily. Two configurations of the Access Rack are available:

1. Redundant power supply system:
Two power supplies and up to fourteen (14) function cards.
2. Standard power supply system:
One power supply and up to sixteen (16) function cards.

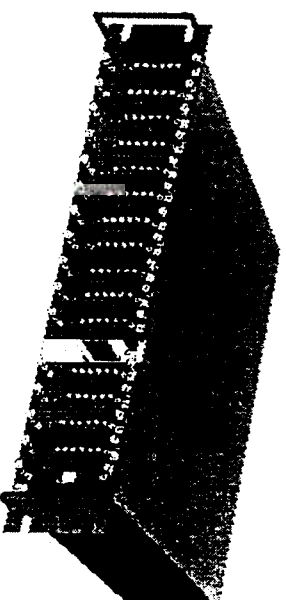


Figure 1: Access Rack Chassis

There are two power supply options:

1. **PSU9700-AC**
Universal AC input (90-264 volts, 50-60 Hz) power supply: The complete supply consists of a front power supply card and a rear power entry card. These two cards together comprise a universal AC input supply module, henceforth referred to as "the AC power supply".

Access Rack Power Supplies

PSU9700-DC

- 48 volt DC input (42-60 volts) power supply: The complete supply consists of a front power supply card and a rear power entry card. These two cards together comprise a 48 VDC input supply module, henceforth referred to as "the DC power supply".

A single 1001R16P rack system may be fitted with any combination of the above-listed power supplies. For redundant applications, two supplies are required.

Installing the Power Supply Modules

This section describes how to install rear and front power supply cards into the chassis and how to make the necessary rear card connections.

All rack-mount power supplies consist of two cards: the rear power entry card and the front power supply module card. The cards meet inside the rack chassis and plug into each other using multi-pin connectors. Refer to the following sections to correctly install the power supply cards into the Access Rack chassis.

CAUTION! The power supply cards contain static-sensitive circuitry. Failure to use proper ESD precautions during installation or removal may result in damage to the power supply circuits.

Configuring the Rear Power Entry Card Alarm Operation

The PSU9700-AC and PSU9700-DC rear entry cards contain a PC board mounted jumper to allow the customization of the alarm operation. The jumper is located adjacent to the blue 8-pin power connector. With the jumper installed onto the two posts (default position), the relay contacts will NOT indicate an alarm condition when a front card is physically removed from the rack chassis. With the jumper installed onto only ONE post (or removed), the relay contacts will indicate an alarm condition if a front power supply card is removed from the chassis (or is not properly seated). Before installing the rear entry card, configure the jumper as required by the application.

Access Rack Power Supplies

Installing the Rear Power Entry Cards

The power supply modules occupy the right-most slots on the rack system (as viewed from the front). Refer to Figure 2 and follow the instructions below to properly install the rear power entry cards into the rack chassis. The rear entry cards must be in place and securely fastened before the front cards can be installed.

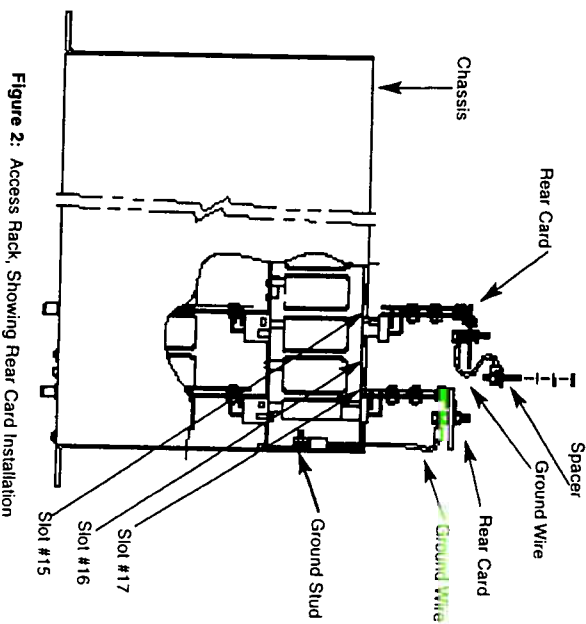


Figure 2: Access Rack, Showing Rear Card Installation

Warning! To avoid electric shock, never install or service any rear power entry card while the input voltage source is connected.

To install a rear power entry card follow the steps below:

- Attach the earth ground wire (green with yellow tracer) of the first power entry card (slot #17) to the stud along the inside wall of the chassis, as shown. The star washer should be between the chassis and the ground lug. Securely tighten the retaining nut. Failure to connect the earth ground wire may result in a hazardous condition.
- Install the first power entry card into slot #17 in the rear of the chassis. Secure the card using the two screws provided.

Steps 3-5 are for redundant applications only:

3. Attach the ground wire of the second power entry card to the bare metal side of the rear spacer. The spacer has two ground studs and is powder-coat finished on only one side. The star washer should be installed between the spacer and the ground lug. Securely tighten the retaining nut.
4. Secure the rear spacer to slot #16 using the two screws provided.
5. Install the second power entry card into slot #15. Secure the card using the two screws provided.

Installing the Front Power Supply Cards (Initial Installation)

To install a new front power supply card into the chassis, follow the instructions below:

1. Make sure that the associated rear power entry card is securely installed into the rack chassis.
2. Install a new power supply front card by carefully aligning the card with the chassis guides. Gently slide the card, along the metal rails provided, into the front of the chassis. The card connectors will meet the mid-plane bus when the card is almost all the way into the chassis.
3. After the connectors meet, gently apply even pressure to the top and bottom of the panel to seat the card. Do not force the card into the chassis. This may damage the connector pins.
4. Use a flat blade screwdriver to tighten the captive screws.
5. Repeat steps 1-4 for the second power supply card (redundant applications only).
6. Secure the front spacer to slot #16 using the two screws provided (redundant applications only).

Making the Alarm Relay Connections

The PSU9700-AC and PSU9700-DC rear power entry cards (figure 3, below) feature a 3-position, screw-type terminal plug for the alarm connections. Both normally-open (NO) and normally-closed (NC) relay contacts are provided. Choose the appropriate set of contacts for the intended application. The NO contacts are open for normal operating conditions and close when a fault condition occurs (loss of module input power, overheating or module failure). The NC contacts are closed under normal operating conditions.

"NO" Contacts: The "NO" (normally-open) contacts are open for normal operating conditions and close when a fault condition occurs (loss of input power, overheating or module failure).

"NC" Contacts: The "NC" (normally-closed) contacts are closed for normal operating conditions.

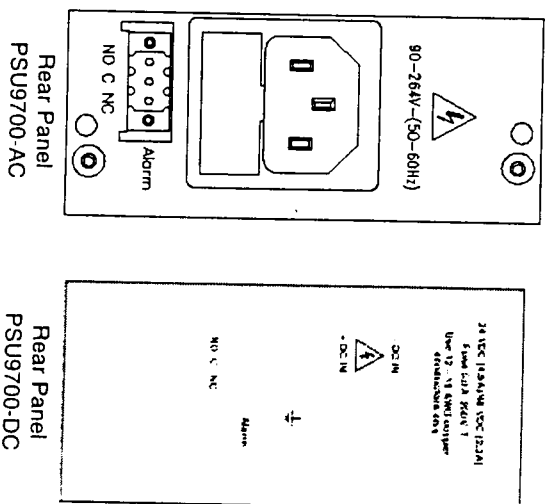


Figure 3. Rear panel

The alarm terminal plug accepts 12-26 AWG size wire, solid or stranded. For ease of hookup, the terminal plug can be removed from the rear panel alarm port by loosening the two securing screws. After connections to the plug have been made, insert the plug back into the alarm port on the rear panel and tighten the securing screws.

Access Rack Power Supplies

Spare terminal plugs may be obtained directly from Black Box. See **Appendix** for part numbers, contact ratings and general alarm port specifications.

Connecting a Rear Entry Card to the AC Voltage Source (90-264 VAC, 50-60 Hz)

WARNING! Rear power entry cards are to be used **ONLY** with three wire grounded outlets.

For the AC main connection, the rear power entry card is equipped with a shrouded male IEC-320 compatible power entry connector. This connector contains an integral fuse and accepts a domestic US power cord or any of several international AC power cords. Only three-wire power cords containing an earth ground lead may be used. After the power cord is properly connected and power is applied, the green "12V" LED on the front power entry card's front panel will be illuminated and the fan will operate. Voltage selection is automatic. There is no on/off switch.

Connecting a Rear Entry Card to the 48 VDC Source (42-60 VDC)

For the 48 VDC connection, the rear power entry card is equipped with a three-position, clamp-style terminal block. Only the two outer-most terminals are used. In addition to the terminal block, an external lug is provided for the connection of earth ground. Follow the steps below to make the DC power connections:

CAUTION: Use copper conductors between 12 - 18 AWG only

1. Connect the earth ground of the DC source to the exterior lug on the entry card using the hardware provided. The earthing conductor must be equivalent to or larger than the conductors used for the input supply connections.
2. Strip back the insulation on each of the wires approximately $\frac{1}{4}$ inch.
3. Use a small flat-blade screwdriver to open the cage clamp of the terminal block. Insert the stripped end of the positive lead into the "+DC input" of the terminal block and remove the screwdriver. Repeat the procedure for the negative lead, using the "-DC input" of the terminal block. Make sure that all strands of wire are captured and that there is no exposed wire.

Access Rack Power Supplies

After the DC power supply leads are properly connected and power is applied, the green "12V" LED on the front power entry card's front panel will be illuminated and the fan will operate. There is no on/off switch.

Service Procedure - Replacing a PSU9700-DC Front Card

This section describes the procedure for replacing an already-installed PSU9700-AC power supply front card. A flat blade screwdriver is required to remove and install the card.

To replace an already-installed PSU9700-AC power supply front card, follow the detailed instructions below:

WARNING! Hazardous voltages present. To avoid electric shock or personal injury, adhere to the module replacement instructions exactly as stated.

1. Loosen the two front-panel captive securing screws. Do not remove the screws from the card.
2. Using two hands, grasp the captive screws and slowly separate the card from the rack until the front panel is approximately ONE INCH from the edge of the rack chassis. This disconnects the front card from the AC voltage source. **DO NOT COMPLETELY REMOVE THE CARD FROM THE RACK CHASSIS!**

WARNING! Hazardous voltages exist in the primary circuits. Beware of internal lethal voltages due to charged capacitors even after the AC input is disconnected. A minimum of 3 minutes should be allowed after AC input power is disconnected before removing or handling the front power supply module.

3. After a minimum of three minutes have elapsed after disconnecting the AC voltage source, the front card may be safely removed from the rack chassis.
4. Install a new PSU9700-AC front module by carefully aligning it with the chassis guides. Gently slide the card into the chassis along the metal rails provided. The card connectors will meet the mid-plane bus when the card is almost all the way into the chassis.

5. After the connectors meet, gently apply even pressure to the top and bottom of the panel to seat the card. Do not force the card into the chassis. This may damage the connector pins.
6. Tighten the captive screws. The green "12V" LED should be illuminated and the fan should operate.

Service Procedure - Replacing a PSU9700-DC Front Card

Follow the same procedure as outlined in the section "REPLACING A PSU9700-AC FRONT CARD". Since the PSU9700-DC uses only non-hazardous, low DC voltage, it may be safely removed from the rack chassis immediately after loosening the captive screws.

Operation

Once the Access Rack power supply power supply module is properly installed, you are ready to operate the unit. Figure 4 (below) shows the location of LED indicators.

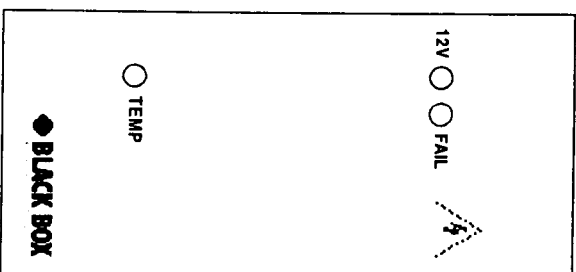


Figure 4: PSU9700-DC & PSU9700-AC Front Panel, Showing LEDs

LED Status Monitors

The power supply modules features three LEDs on the front panel that indicate the status of the unit. The following describes the LED status monitors.

- 12V** Green LED lights when the module is operating normally and is supplying 12 VDC to the rack mid-plane.
- FAIL** Red LED lights when the module fails, overheats or input power is lost.
- TEMP** Red LED lights when maximum module operating temperature has been exceeded, due to fan failure, overload or extremely high ambient temperature. During an over temperature condition, module output power is drastically reduced. After the module has sufficiently cooled, normal operation is restored.

Appendix A

Black Box PSU9700-DC
48VDC Specifications

Input Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage - DC	Reverse polarity protected.	42	48	60	VDC
Brown out Protection	Lowest DC input voltage that regulation is maintained with full rated load.	36			VDC
Input Current	42 VDC, 72W load		2.2		A
Input Protection	User-replaceable, internally located DC input time fuse				
Input Surge Suppression	TVS		75		VDC

Output Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Output Voltage	Output voltage to midplane bus. (75% load).	12.3	12.4	12.5	VDC
Output Power	Continuous output power.			72	Watts
Turn-on Delay	Time required for initial output stabilization.			3	Sec
Turn-on Rise Time	Time required for output voltage to rise from 10% to 90%.			1	Sec
Transient Response	Recovery time to within 1% of initial set point due to a 30-100% load change.			250	us
Load Sharing Accuracy	Two Supplies, 72W load.			1	5 %
Efficiency	Full load, 48VDC in.		78		88 %

Appendix A

(continued)

Black Box PSU9700-DC
48VDC Specifications

Interface Signals and Internal Protection

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Indicators	GREEN indicator for normal operating mode. RED indicators for power fail and excessive internal temperatures.				
Power Fail Warning (TTL compatible)	Logic LOW to Cascade Module control card (denotes power fail detected).			0.7	VDC
	Logic HIGH with internal pull-up to output.		10		k ohm
	Output low voltage trip point.	11.6	11.8	12.0	VDC
	Power fail trip point, maximum load, decreasing input.	30	36	38	VDC
	Time before regulation dropout, full load, due to loss of input power.			200	us
Alarm Contacts	Normally-open and normally closed contacts via 3-position terminal block (1A@30V). Contacts operate upon power failure detection.				
Overtemperature Indication	RED indicator. Shifts power fail signal to a logic LOW state. Output voltage during overtemperature condition	4	4.5	5	VDC
User Controls	Single jumper to select "maintenance mode" (No alarm if PS is removed).				

Safety, Regulatory and EMI Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Agency Approvals	CE Mark FCC Part 15, Class A				
Dielectric Withstand Voltage	Input to output, 1 second Input to chassis, 1 second		3000		V/RMS
			1500		V/RMS

Appendix A
(continued)

Black Box PSU9700-DC
48VDC Specifications

Safety, Regulatory and EMI Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Operating Temperature	Derate linearly above 50°C by 2.5% per °C.		At 100% load, 0 At 50% load, 70	50 70	°C
Storage Temperature		-40		85	°C
Relative Humidity	Non-condensing			90	%RH
Weight			0.7		lbs.

Appendix A
(continued)

Black Box PSU9700-DC
48VDC Specifications

Input Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Input Voltage - AC	Universal input, Auto ranging.	90	115/230	264	VAC
Input Frequency	AC Input.	47		63	Hz
Brown Out Protection	Lowest AC input voltage that regulation is maintained with full rated load.	90			VAC
Hold-up Time	Nominal AC input voltage.	72W load, 15ms 36W load, 30ms			ms
Input Current	90 VAC, 72W load		1.8		ARMS
Input Protection	User-replaceable, externally located AC input line fuse.				
Inrush Surge Current	Internally limited by thermistor. Vin = 264 VAC (one cycle) 25°C.			38	APK
Input Surge Suppression	Line-to-line via MOV		300		VAC

Output Specifications

PARAMETER	CONDITIONS/DESCRIPTION	MIN	NOM	MAX	UNITS
Output Voltage	Output voltage to midplane bus. (75% load).	12.3	12.4	12.5	VDC
Output Power	Continuous output power.			72	Watts
Turn-on Delay	Time required for initial output stabilization.			3	Sec
Turn-on Rise Time	Time required for output voltage to rise from 10% to 90%.			1	Sec
Transient Response	Recovery time to within 1% of initial set point due to a 30-100% load change.			250	us
Load Sharing Accuracy	Two Supplies, 72W load.		1	5	%
Efficiency	Full load, 115VAC in.		78		88 %

Appendix C

**Black Box Factory Replacement
Parts and Accessories**

<u>Black Box Model #</u>	<u>Description</u>
PSU9700-DC.....	Redundant 48-VDC Front and Rear Power Supply Module
PSU9700-AC.....	Redundant Universal AC Input Front and Rear Power Supply Module
RMU9700-16.....	2U 14 Slot Redundant Access Rack Chassis

Appendix D

**Safety Agency Recognition
Plenum Installation**

Compliance with NRTL/UL 1950/EN60950

Safety agency regulations require the use of an approved plenum with each Access Rack installation. A rack chassis fitted with the plenum constitutes an agency recognized fire enclosure. All Access Rack installations require at least one plenum to be fitted underneath the bottom-most chassis in the system for continued compliance with agency regulations.

Thermal Management

Due to the small size and high performance of the Access Rack system, a fully-loaded rack chassis may generate a considerable amount of heat. To ensure long equipment life, it is important the thermal management guidelines are adhered to in all Access Rack installations. In high density, stacked configurations, additional plenums may be required between each chassis to improve system thermal performance. Ambient air temperature, total rack power dissipation and the number of stacked units must all be considered when determining cooling requirements. For further information, see the application note "Thermal Management Guidelines for the Access Rack System", available by calling Black Box Technical Support.