TOTAL CONTROL™

Total Control Chassis

HARDWARE INSTALL GUIDE

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About this Guide

This guide covers the installation and operation of the U.S. Robotics 35 and 45 Amp AC and DC Total Control Chassis and their corresponding Power Supply Units (PSUs) as well as the more recent 70 and 130 Amp AC and DC Total Control Chassis and their corresponding PSUs and Power Supply Interfaces (PSIs). These instructions apply to the 19-inch, 17-slot chassis. If you have purchased the smaller version of the chassis (Enterprise Network Hub/6), please refer to the small chassis install guide.

Although installation and operations guides for Network Application Cards (NACs) and Network Interface Cards (NICs) are supplied separately, general installation instructions for these cards are covered in this guide.

To meet diverse customer needs, some systems are shipped as components for on-site installation. Others are shipped fully assembled. If you don't need to assemble your system, use this guide for the operational information described below.

Operational Information

In addition to installation guidelines, this guide contains the following important information:

- Overview of components of a U.S. Robotics Total Control system
- Power failure troubleshooting and safety guidelines
- Technical Specifications

We Welcome Your Suggestions

Every effort has been made to provide useful, accurate information. If you have any comments or suggestions, please let us know.

Voicemail: (847) 933-5200

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Regulatory Certification

Radio Communications Interference

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the installation and operations guide, may cause interference to radio communications. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

In accordance with Part 15 of the FCC rules, any modification to or tampering with this device that causes harmful interference to others may be reason for prohibiting future operation.

FCC Registration

FCC68: CJEUSA-73130-FA-E
CJEUSA-75265-XD-N
CJEUSA-22213-MM-E

RINGER EQUIVALENCE: 0.4B

IC (Industry Canada)

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 Industry Canada (formerly the Canadian Department of Communications).

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la classe A prescrites dans le Reglement sur le brouillage radioelectrique edicte par l'Industrie Canada (anterieurement le ministre des Communications).

Canadian Installations

The Industry Canada (formerly the Canadian Department of Communications) label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The department does not guarantee the equipment will operate to the purchaser's satisfaction.

Before installing this equipment, make sure connection to the local telecommunications company is permissible. Install the equipment using an acceptable method. Be aware, however, that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

For protection, make sure that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Do not attempt to make such connections; contact the appropriate electrical inspection authority or electrician.

System Components

Overview

The Total Control chassis can be configured to operate with either analog or digital phone service, as well as two different styles of chassis management:

- *Total Control Manager/SNMP* is an SNMP-based, graphical Windows application that requires a Network Management Card (NMC). The NMC also occupies slot 17 next to the power supplies, and comes with a rear-mounted Ethernet or Token Ring NIC.
- *Total Control PC* software is a DOS-based, text interface program that requires a Hub Controller Unit. The HCU is a microcontroller that occupies slot 17 next to the power supplies, and comes with a rear-mounted Network Interface Card (HCU NIC).

Standard Components

70 and 130A AC and DC Chassis

Figure 1 illustrates the major components of the U.S. Robotics and 70 and 130A AC and DC Total Control system.

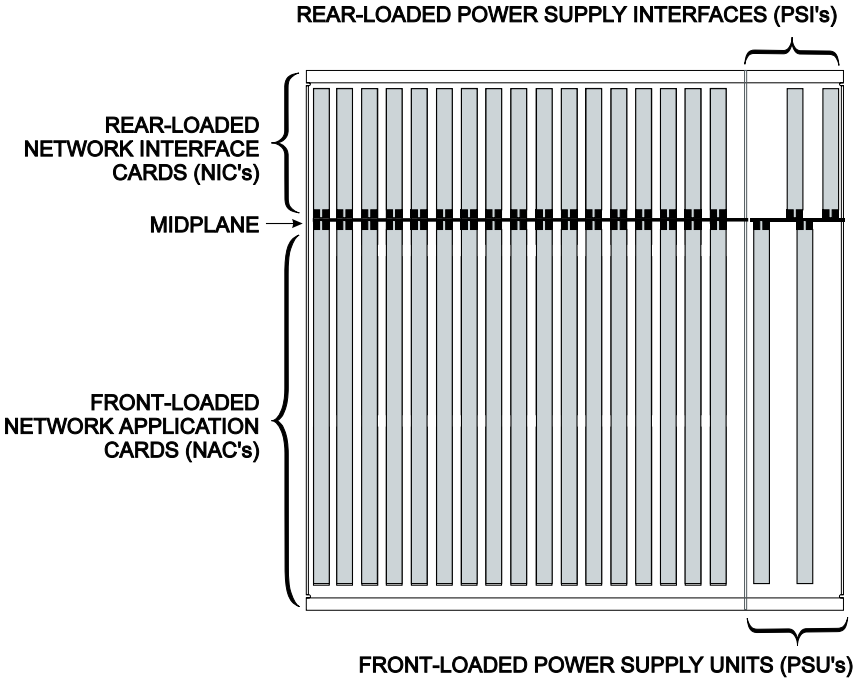

Figure 1. 70 and 130A
AC and DC Chassis (Top View)

Chassis

Also referred to as a card cage, the chassis contains the following parts:

- Slots for two front-loaded AC or DC Power Supply Units (PSUs) and their respective rear-loaded AC or DC Power Supply Interfaces (PSIs).
- Chassis midplane, with slots available for up to seventeen front-loaded network application cards (NACs) and their respective rear-loaded network interface cards (NICs).

> **NOTE:** The seventeenth slot on the midplane is always reserved for the management NAC (HCU or NMC). Do not install any other NAC in this slot.

  Although applications will vary, typical NACs include modems, T1 Cards, and Gateway Cards. NICs provide an application-specific interface.

- Integrated 15 fan fan tray assembly.
- Two power cord strain reliefs, one for each PSI position, mounted on rear of chassis.
- Three Electro Static Discharge (ESD) plugs on the chassis: one on each of the front mounting flanges, and one on the rear.

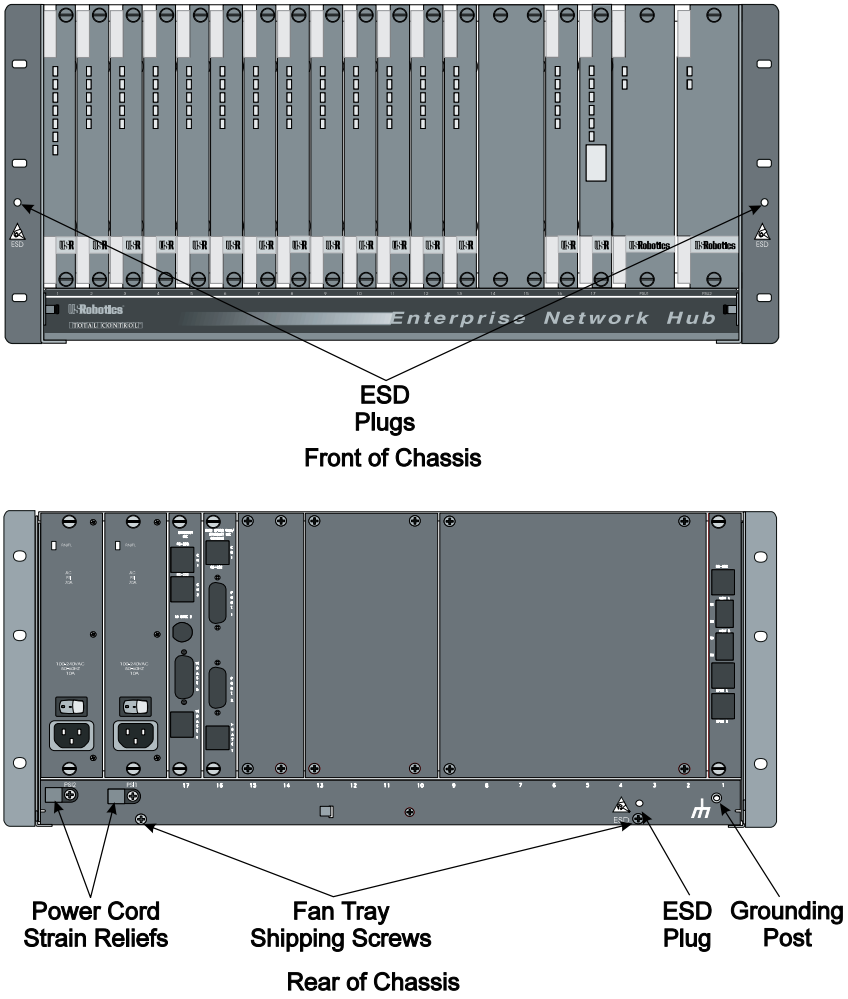

Figure 2. Front and Rear Views of 70 and 130 AC and DC Chassis

Power Supply

Operating voltages and currents are supplied to the chassis via a combination Power Supply Unit (PSU) and Power Supply Interface (PSI) system. The PSU is front loaded and its corresponding PSI is loaded in the rear of the chassis.

> **NOTE:** Only one PSU / PSI combination is required to power the chassis although a second PSU / PSI combination for full redundancy and load sharing is **strongly** recommended.

As you face the front of the chassis, the two slots on the far right side of the chassis are reserved for the PSUs. The slots just in back of these are reserved for the PSIs.

The AC input voltage version of the PSU / PSI has wide range input voltage capabilities and can accept any voltage between 100 and 240 VAC. The DC PSU / PSI combination requires a -48 VDC input.

35 and 45A AC and DC Chassis

Figure 3 illustrates the major components of the U.S. Robotics 35 and 45A AC and DC Total Control system.

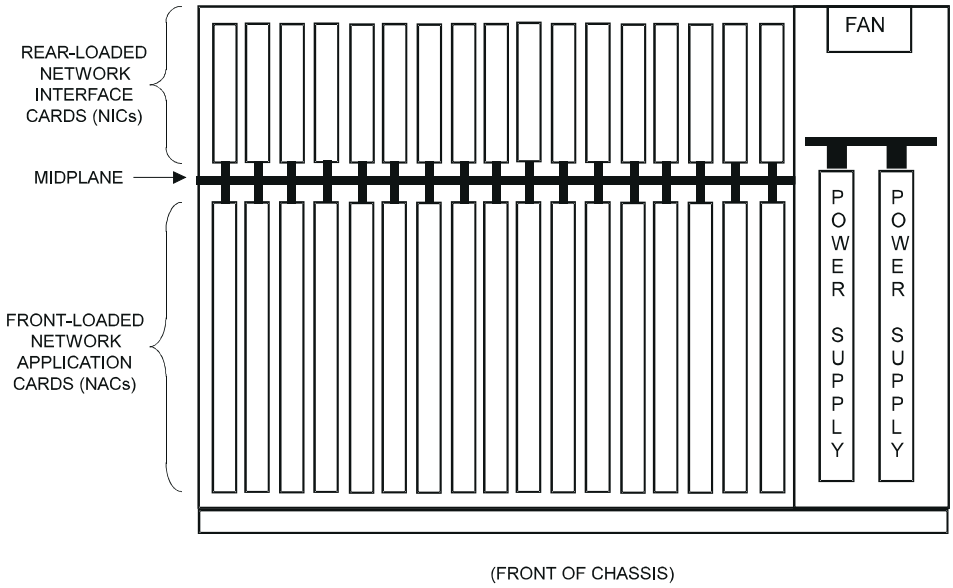

Figure 3. 35 and 45A AC and DC Chassis (Top View)

Chassis

Also referred to as a card cage, the chassis contains the following parts:

- Power supply backplane and slots for two front-loaded power supply units.
- Chassis midplane, with slots available for up to seventeen front-loaded application cards (NACs) and their respective rear-loaded interface cards (NICs).

> **NOTE:** The seventeenth slot on the midplane is always reserved for the management NAC (HCU or NMC). Do not install any of the other NACs in this slot.

Although applications will vary, typical NACs include modems, T1 Cards, and Gateway Cards. NICs provide an application-specific

interface. Figures 4 and 5 show typical configurations for analog and digital chassis.

Power Supply Units (PSUs)

The PSUs enable AC or DC power input and, via connectors in the midplane, supply DC power to the modems. A second PSU is optional, but strongly recommended for a fully-loaded chassis.

Modems

Network Application Cards (NACs)

The Total Control chassis can accommodate either analog or digital Modem NACs, available in Dual or Quad modem cards. The front-loaded Modem NACs and the midplane are equipped with DIN connectors. Through these connectors, the modems receive DC power from the PSU, as well as signals from the midplane and from the rear-mounted Modem NICs.

Network Interface Cards (NICs)

These cards, one per modem slot, are also equipped with DIN connectors. They plug into the midplane from the rear of the chassis and provide the physical EIA-232 (formerly known as RS-232) computer interface. NICs for analog modems also provide RJ45 jacks for the phone line signals.

Management Components

Digital/Analog Chassis

Network Management Card (NMC)

This component should be installed only in the seventeenth slot. Like the HCU, it is a microprocessor-based controller and communicates with all cards in the chassis via the management bus on the chassis midplane. The NMC can configure both digital and analog modems, the T1 Card, and Gateway Cards. The NMC acts as an SNMP proxy agent for the *Total Control Manager/SNMP* software.

NMC Network Interface Card (NMC NIC)

Serving as the physical link between the NMC and the PC running *Total Control Manager/SNMP*, this NIC is available in Ethernet and Token Ring versions, both of which supply a SLIP interface in addition to LAN ports.

Analog Chassis

Hub Controller Unit (HCU)

This component should be installed only in the seventeenth slot. It is a microprocessor-based controller that runs software to perform Total Control modem management functions. The HCU can only configure Dual Analog Modems. *Total Control PC* software is the PC-based operator interface.

Hub Controller Unit Interface Card (HCU NIC)

This component serves as the physical link between the HCU and the PC running *Total Control PC* software, auxiliary inputs and outputs, and an inter-rack bus.

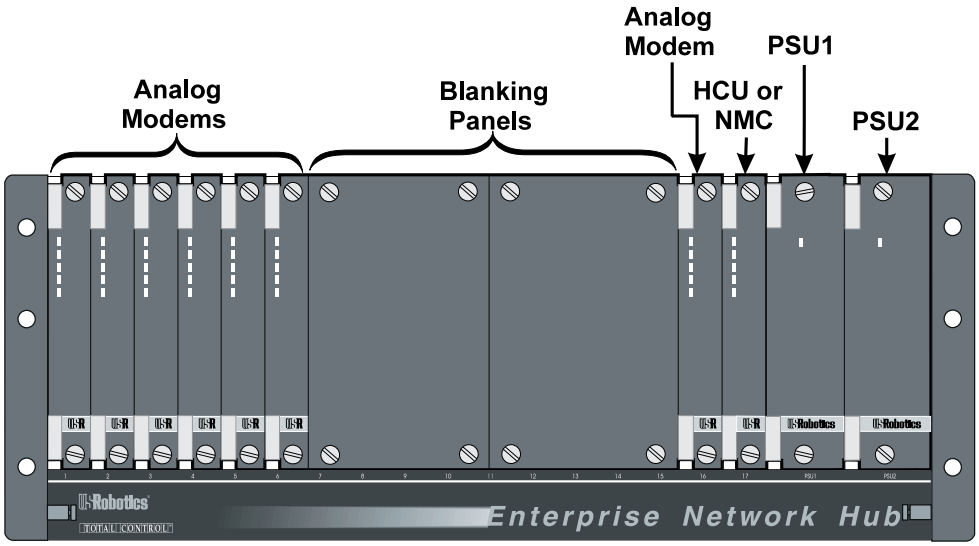

Figure 4. Typical Analog Chassis Configuration
(70 and 130A AC and DC Chassis Shown)

Digital Components

Dual T1 Network Application Card (NAC)

The T1 NAC is capable of handling two T1 lines. The card plugs into the midplane from the front of the chassis. This card performs the function of a DSU (Digital Service Unit, or channel bank). It demultiplexes the Digital Signals (DS0s) and distributes them to the Quad Modems via the TDM (Time Division Multiplexed) bus on the midplane.

Dual T1/PRI Network Application Card (NAC)

The Dual T1/PRI NAC can handle two T1 trunk lines. It also supports Integrated Services Digital Network Primary Rate Interface (ISDN PRI) call-routing protocols. Like all NACs, the Dual T1/PRI plugs into the midplane from the front of the chassis.

T1 Network Interface Card (NIC)

This card, also available in a dual version, provides the physical interface to T1 line(s) and the EIA-232 serial port, and plugs into the midplane from the rear of the chassis. The T1 NIC provides a Channel Service Unit (CSU) interface, which recovers clock and data from an incoming T1 signal, and also transmits data to the T1 span line(s). The card is used as the corresponding NIC for both the Dual T1 and the T1/PRI NACs.

Dual E1 PRI Network Application Card (NAC)

The Dual E1 PRI can handle two E1 trunk lines. It is the European equivalent of the Dual T1 PRI card. Like its counterpart, the Dual E1 PRI card supports ISDN PRI call-routing protocols. Like all NACs, it plugs into the midplane from the front of the chassis.

Dual E1 PRI Network Interface Card (NIC)

This card provides G.703/G.704 interfaces for the incoming E1 trunk lines and for an EIA-232 interface. It plugs into the midplane from the rear of the chassis. The G.703/G.704 interfaces recover clock and data signals from the E1 trunks. The Dual E1 PRI NIC plugs into the midplane from the rear of the chassis.

Gateway Application Cards (GWC)

There are currently three varieties of Gateway Cards:

- X.25 PAD—provides access to packet-switched networks. Interfaces with an EIA-232/V.35 NIC.
- NETServer Card—functions as a router and terminal server. Interfaces with both Token Ring and Ethernet NICs.
- API Card—allows customers to develop their own applications using the U.S. Robotics API software development kit. Interfaces with both Token Ring and Ethernet NICs.

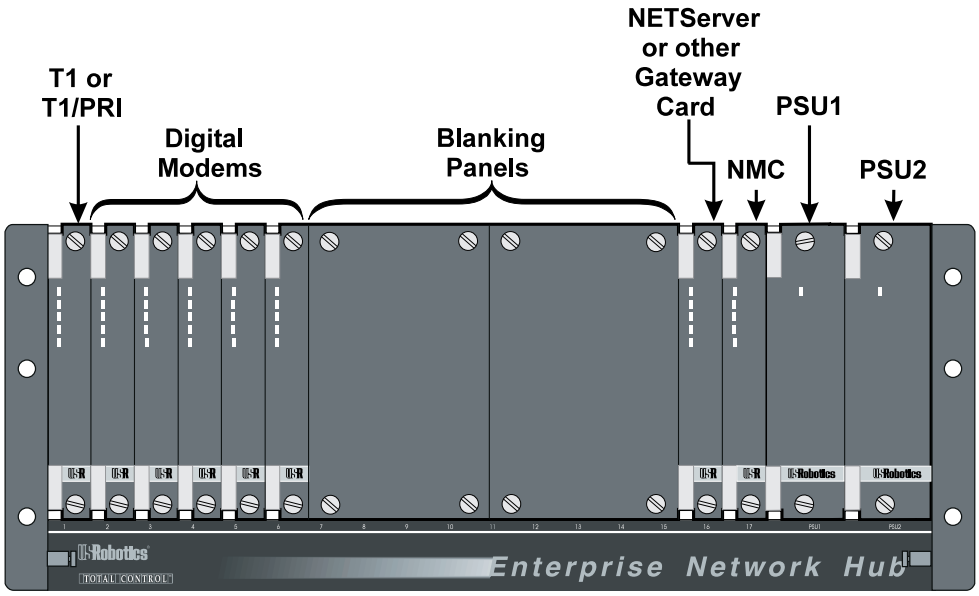

Figure 5. Typical Digital Configuration
(70 and 130A AC and DC Chassis Shown)

Chasssis Installation: 70 and 130A AC and DC

Follow the instructions in this guide, and have U.S. Robotics screwdriver, which was provided, handy. It should take you less than half an hour to assemble a complete chassis.

We recommend that you follow this sequence for installation:

1. Chassis
2. Power Supply Units (PSUs) and Power Supply Interfaces (PSIs)
3. Network Interface Cards
4. Network Application Cards

This section also covers removing and reinstalling the integrated fan tray, should it ever be needed.

> **NOTE:** When the Total Control system is shipped unassembled, protective safety panels cover all of the chassis slots. Leave the blanking panels in place on any unoccupied slots.

Installing the Chassis

Equipment Rack Installation

The optimal rack installation is as follows:

- Managed temperature control, 25° C
- 6 chassis installed per rack
- Each AC chassis should be provided with its own 15A branch of electrical service for use at a nominal 120 VAC and 7.5A service at a nominal 220 VAC input
- Each chassis installed approximately a “1U” gap (approximately 1.71 inches) from the next chassis to allow adequate ventilation

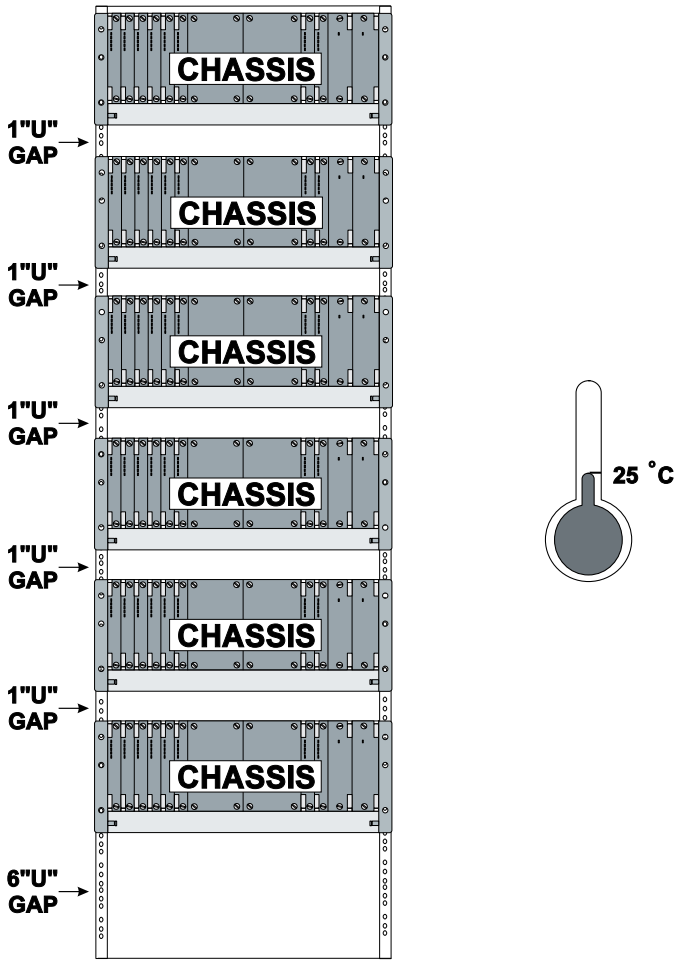

Figure 6. Optimal Rack Installation

19-inch Equipment Rack Installation

To mount the chassis in a standard 19-inch equipment rack, use the screws that came with the equipment rack to mount the chassis. You will need three screws for each of the mounting rails.

1 Slide the chassis into the rack. See Figure 7.

2 Beginning with the two **bottom** screws, secure all 6 of the chassis mounting flange slots to the front vertical rails of the rack.

3 Remove integrated fan tray shipping screws. See Figure 2 for the location of these screws.

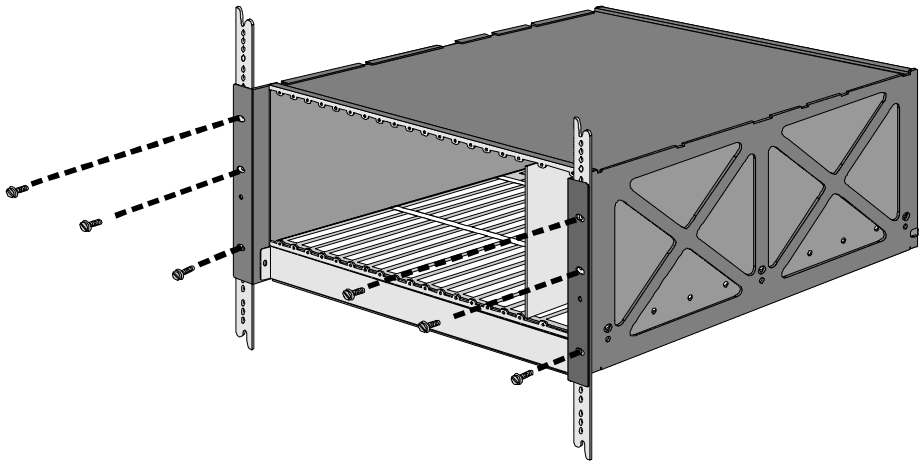

Figure 7. Typical 19-inch Equipment Rack Installation

23-inch Equipment Rack Installation

The chassis can be mounted in 23-inch racks using brackets as width extenders. These brackets can be acquired through U.S. Robotics.

- In a standard 23-inch equipment rack, use the extender brackets to bolt the chassis mounting flange to the equipment rack, such that the front of the chassis is flush with the front of the rack.

To mount the chassis in this type of rack:

1. Using the bolts that came with the brackets, fasten them to the chassis mounting flanges. See Figure 8.
2. Using the screws that came with the equipment rack, fasten the brackets and chassis to the mounting rails of the rack. Begin with the **bottom** two screws.
3. Remove integrated fan tray shipping screws. See Figure 2 for the location of these screws.

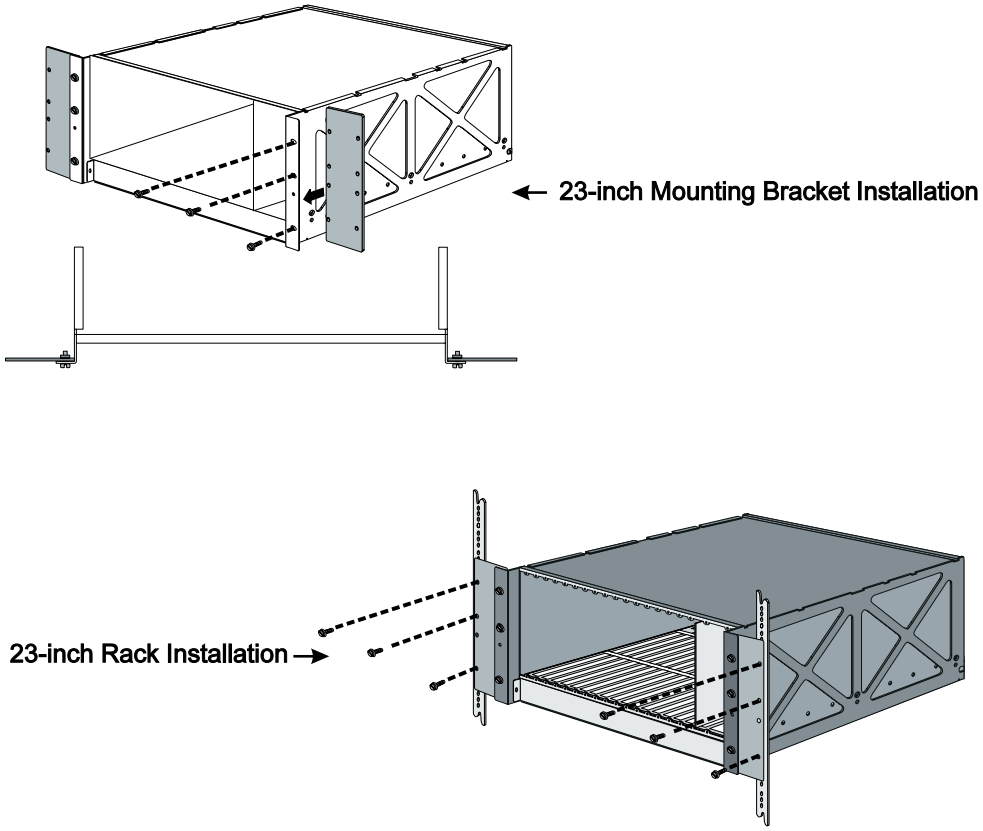

Figure 8. Typical 23-inch Equipment Rack Installation

19 and 23-inch Rack Rear-Mount Installation

Rear-mounting brackets are available, and recommended for racks with rear mounts. The difference between the 19 and 23-inch rear-mounting brackets is that the rear mounting flange on the 23-inch brackets is longer than on the 19-inch. Depending on your mounting requirements, make sure you have the correct type of bracket.

To mount the chassis using the rear mount brackets:

1 Remove the sides of your equipment rack if you have not already done so.

2 Follow the steps for mounting the chassis as noted in the *19-inch Equipment Rack Installation* and *23-inch Equipment Rack Installation* sections of this manual.

3 Choose a convenient side to start and slide the rear-mounting bracket into the back of the rack. Line the bracket mounting holes up with the threaded mounting holes on the side of the chassis, ensuring that the

rear mounting flange on the bracket meets the rear mounting rail on the rack. See Figure 9.

4 Once you have lined up the mounting holes on the bracket with the mounting holes on the chassis, secure the bracket to the chassis using the screws that came with the bracket.

5 Repeat steps 3 and 4 for the other side of the chassis.

6 Mount the rear-mounting flanges of the bracket to the rear mounting rails of the rack using the bolts that came with the rack.

7 Reinstall the sides of your equipment rack.

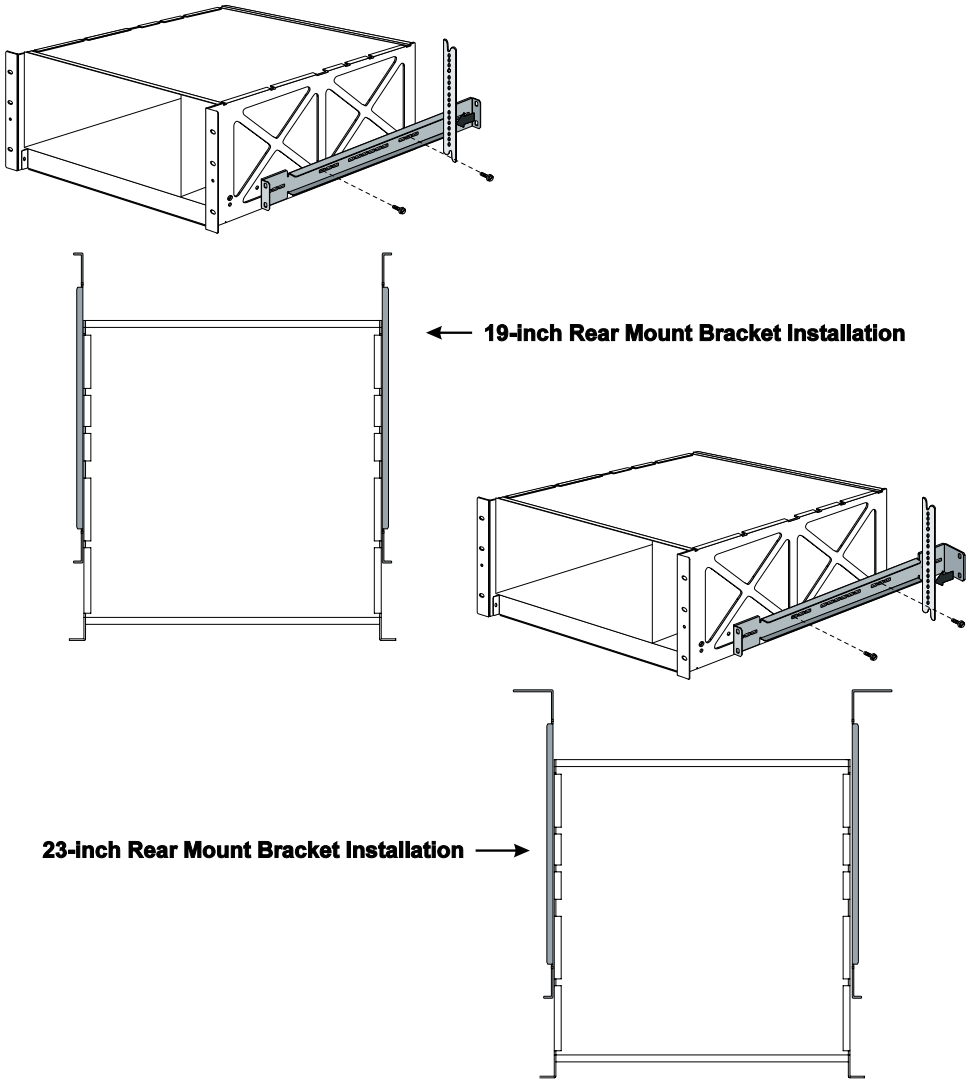

Figure 9. 19 and 23-inch Rear-Mount Installation

19 and 23-inch Rack Mid-Mount Installation

Brackets are available for mid-mounting the chassis into 19 or 23-inch equipment racks.

- To mid-mount in a 19 or 23-inch equipment rack, or a frame-type rack, use the mid-mount brackets to bolt the front of the chassis extending out in front of the rack.

NOTE: Mid-mount brackets must be used if you wish to adhere to the Bellcore Standard on Earthquakes NEBS TR-NWT-000063, Sections 5.5.7 and 5.5.9, Issue 5.

For mid-mount chassis installation:

1. Using the bolts that came with the brackets, fasten them to the chassis mounting flanges. See Figure 10.
2. Using the screws that came with the equipment rack, fasten the brackets and chassis to the mounting rails of the rack. Begin with the **bottom** two screws.

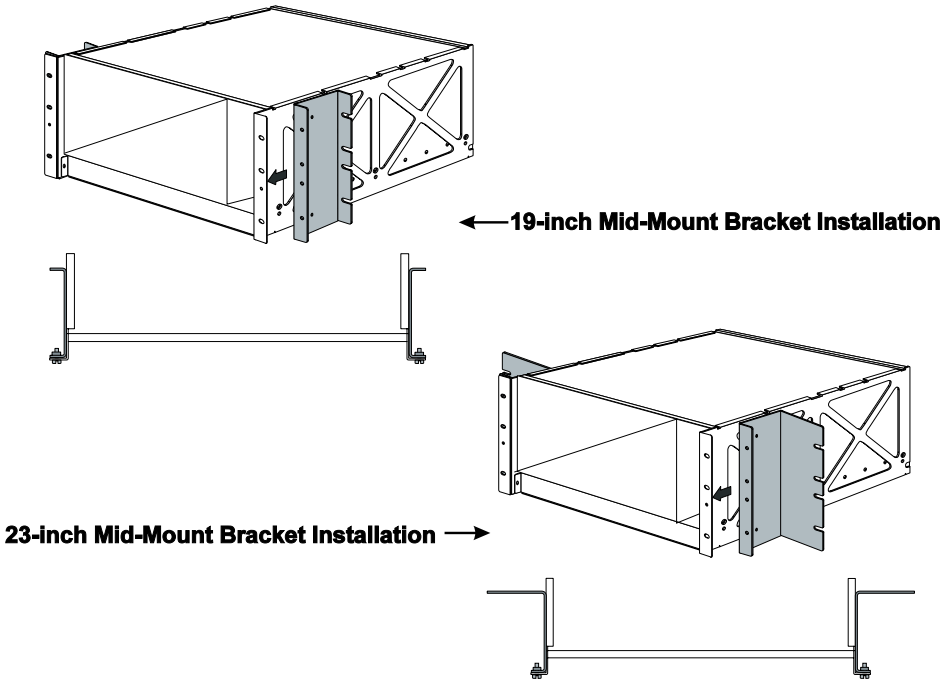

Figure 10. 19 and 23-inch Mid-Mount Installation

Installing the Power Supply

As stated previously, the chassis power supply is available in AC or DC versions. Each version consists of two parts: a Power Supply Unit (PSU) and a Power Supply Interface (PSI). The AC PSU / PSI combination accepts an AC power input to the chassis and provides DC power to the slots. The DC PSU / PSI combination accepts a DC power input to the chassis and provides DC power to the slots. The AC or DC combinations can be recognized by the silk screen labels on their face plates. See Figures 11 and 12.

IMPORTANT: It is strongly recommended that two PSU / PSI combinations be installed in the chassis for full redundancy.

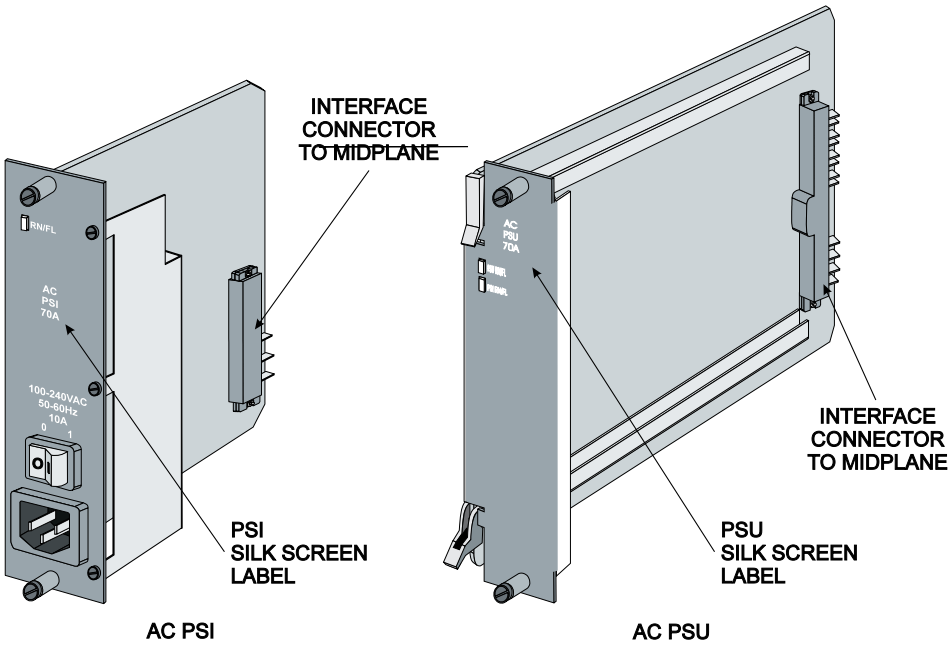

Figure 11. AC PSU and PSI

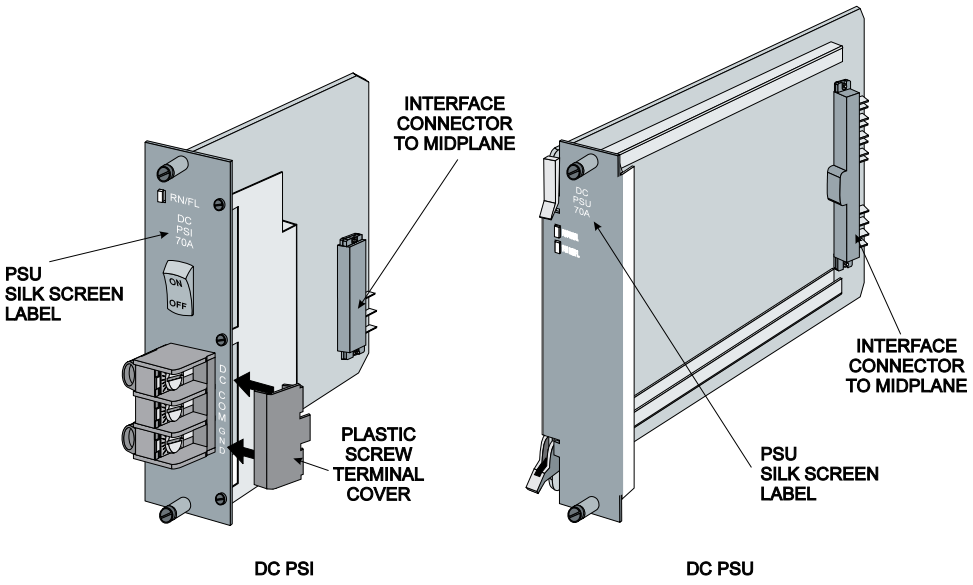

Figure 12. DC PSU and PSI

WARNING: There may be induced voltage between the fully installed chassis and the equipment at the other end of the EIA-232 interface. To avoid any potential shock hazard, do not touch both pieces of equipment at the same time.

Installation Procedure

NOTE: If you are installing only one PSU, you should install it in the farthest slot on the right side as you face the front of the chassis. This is the PSU2 slot. The corresponding PSI will be installed in the PSI2 slot, which is directly in back of the PSU2 position.

If you will be using two PSUs, you will be using both the PSU2 and the PSU1 slots as well as the PSI2 and PSI1 slots for the corresponding PSIs. The PSU1 slot is located to the left of the PSU2 position and the PSI1 slot is located to the right of the PSI2 position.

WARNING: To avoid the risk of electric shock when using only one PSU / PSI combination, install safety panels (blanks) over the PSU1 and the PSI1 slots.

1 Insert the PSU into the appropriate slot in the front of the chassis by guiding it into the upper and lower card guides. See Figure 13.

As you slide the PSU in, use your thumbs to lift the top ejector tab and lower the bottom ejector tab away from each other. The ejector tabs are located on the left side of the PSU front panel.

When the PSU will not slide in any further, close the ejector tabs by pressing them towards each other. If the card is inserted properly, it will slide in easily joining the connector at the rear of the PSU to the connector on the midplane. If it does not, remove then reinsert the PSU.

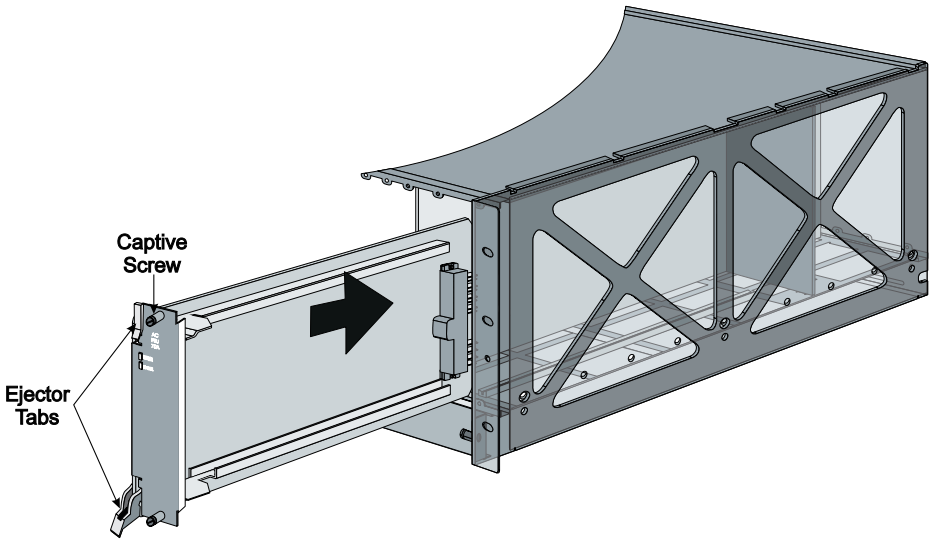

Figure 13. PSU Installation

2 Tighten the PSU's captive screws on the front panel to secure the unit(s). Safety agencies require that the power supplies be screwed in place.

3 Insert the PSI into the slot in the rear of the chassis corresponding to the slot in which you installed the PSU. See Figure 14.

> **NOTE:** If you have installed a DC PSU in your chassis, we recommend that you first connect the DC power cables to the corresponding PSI before fully installing it. Follow the instructions in the next section, *Powering on the System: DC Models* for cabling details.

Slide the PSI in smoothly and ensure that its connector is firmly seated in the connector in the midplane.

4 Tighten the PSI's captive screws on the front panel to secure the unit(s). Safety agencies require that the power supplies be screwed in place.

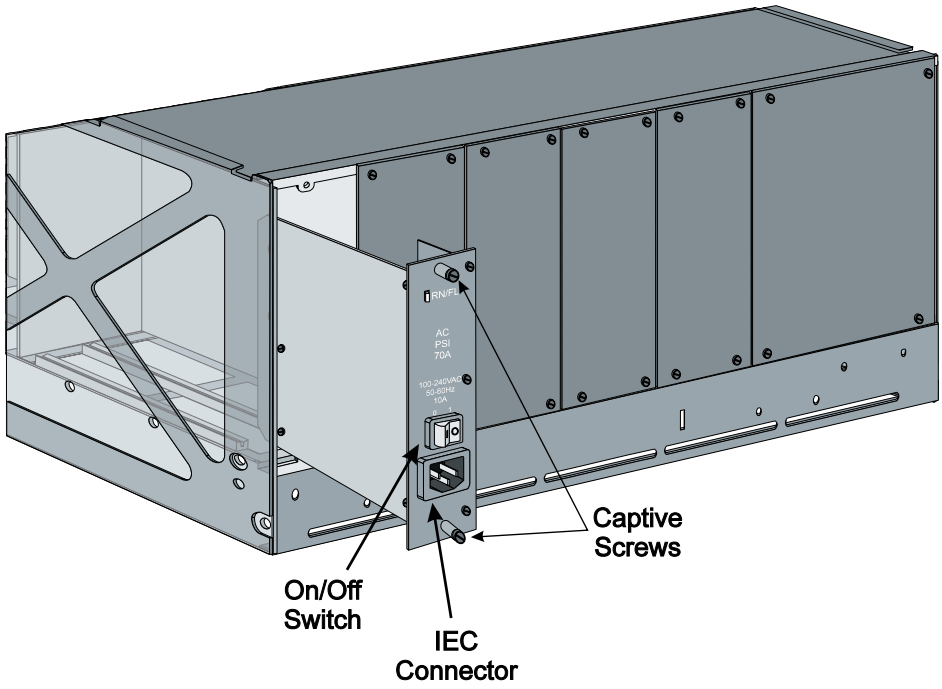

Figure 14. PSI Installation

Powering on the System

Note that each PSU / PSI combination is shipped with its own power cord. If you are using two combinations in your chassis, two power cords are required.

AC Models

CAUTION: Each AC chassis should be provided with its own 15A branch of electrical service at nominal 120 VAC input and 7.5A service at nominal 220 VAC input.

1 Make sure the power switch is in the off (0) position.

2 Plug the AC power cord into the IEC connector on the Power Supply Interface (PSI), and then into the AC power supply source. The connector and power switch are on the PSI, at the rear of the chassis.

NOTE: To prevent the accidental removal of the power cord from the chassis, use the strain reliefs located at the rear of the chassis to secure the cord. See Figure 15.

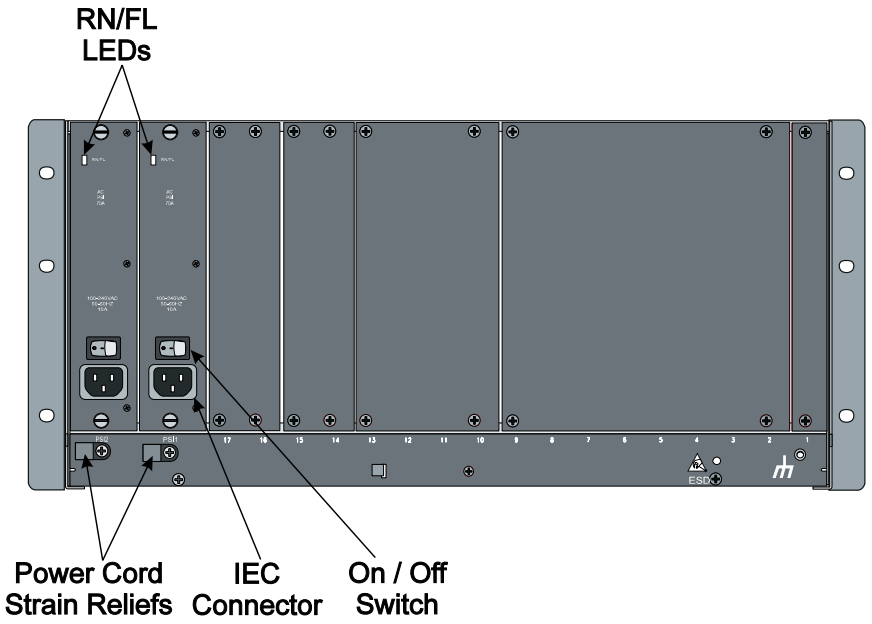

Figure 15. AC Chassis Rear Panel

NOTE: The AC input voltage version of the PSU / PSI combination has wide range input voltage capabilities and can accept any voltage between 100 and 240 VAC. Each PSU and PSI has LEDs that indicate if power is on.

3 Turn on the power switch, from zero (0) to one (1).

4 Check the RN / FL (RUN / FAIL) indicator light on the PSU front panel and on the PSI rear panel. A green light for each installed PSU / PSI indicates proper operation. If the indicator is red or is not on at all, there has been a failure

CAUTION: If you suspect there is a power-supply problem, particularly if the system is running and calls are in progress, be sure to follow the instructions under *Power Failure Diagnostics* in the section on *Troubleshooting*.

DC Models

1. **To avoid the risk of shock hazard, make sure the power switches on the DC PSI and on the user supplied DC voltage source are in the off (0) position.**

2. If it is already fastened in place, partially remove the PSI from the chassis following the procedure in the following section, *Removing the Power Supply*. The card should be pulled out far enough to provide you with adequate room to comfortably torque the screws on the terminal.

3. Remove the plastic cover to expose the terminals. There are three terminals: one DC (-48VDC input), one COM (COMMON or signal ground), and one GND (CHASSIS or earth ground). Each terminal will accept spade or ring lugs, or direct connection with 12 to 16 gage wire. See Figure 16.

4. Make the appropriate wiring connections to the terminal beginning with the source signal ground. This is connected to the COM terminal. Next, connect the -48VDC source signal to the DC terminal. Finally, connect the GND to earth ground.

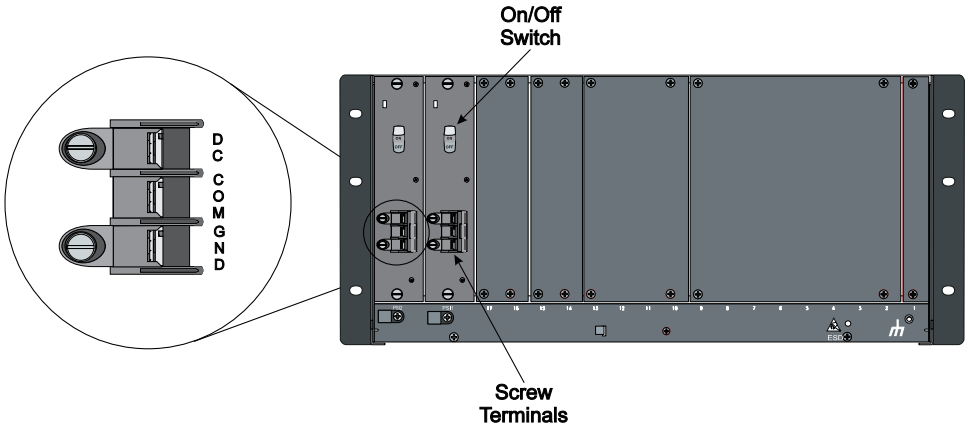

Figure 16. DC Chassis Cabling

5. Once all terminal wiring is complete, reattach the plastic terminal cover.

6. Follow steps 3 and 4 in the previous section, *Installation Procedure*, to install the PSI in the chassis.

7. Turn on the power switch, from zero (0) to one (1).

8. Check the RN / FL (RUN / FAIL) indicator lights on the PSU front panel and on the PSI rear panel. A green light for each installed PSU / PSI

indicates proper operation. If the indicator is red or is not on at all, there has been a failure.

> **CAUTION:** If you suspect there is a power-supply problem, particularly if the system is running and calls are in progress, be sure to follow the instructions under *Power Failure Diagnostics* in the section on *Troubleshooting*.

If after the powering the chassis you notice that the fan tray is not fully functional, remove power from the chassis. Remove and then reinstall the chassis fan tray following the procedures outlined in the following section. If the fan tray is still not responding properly, contact the U.S. Robotics Technical Support Department at (800) 231-8770.

Removing the Power Supply

If you need to remove the chassis power supply (PSU and PSI) for any reason, follow the instructions below:

1. Ensure that the power switch on the PSI is in the "0" (off) position. **If the Power supply that you are removing is AC then remove the power cord from the AC power supply source and from the PSI to reduce the risk of shock hazard; if it is DC, then power down the user supplied DC voltage source.**

> **WARNING: Wait 10 seconds to allow all capacitors on the PSI and PSU to discharge before handling either of the cards.**
>
> When you turn off the power supply using the On / Off power switch on the PSI, you must wait 10 seconds before you can safely remove the PSU and PSI.
>
> Also, you will notice that during this time, the Run / Fail LEDs on the PSU and PSI will briefly maintain its color and then slowly go dark. This is because the capacitors on the PSU / PSI require 10 seconds to discharge.
>
> **Do not touch the PSU/PSI during this period.** After 10 seconds, the PSU or PSI can safely be removed. **Be careful, however, in handling them: some components, in particular the heat sinks, may be very hot.**

2. Once all the RN / FL (RUN / FAIL) LEDs are off on the PSU and PSI, loosen the captive screws on the PSI. Grasp the screw posts and pull the card towards you.

3 Loosen the captive screws on the PSU and then push the ejector tabs away from each other. The PSU will pop out slightly. Use the tabs or grasp the front panel to remove the unit.

Removing/Installing the Fan Tray

The chassis integrated fan tray is installed at the factory. You should not need to install the fan tray, unless you replace it at some later time.

There are two shipping screws located on the rear of the chassis. Figure 2 shows the placement of the two screws. These were installed to help secure the fan tray in the chassis during shipping and installation. **We recommend that you remove the shipping screws once you have installed the chassis.** The two screws on the front of the fan tray should be fastened while the unit is in operation.

The fan tray is located at the bottom of the chassis. Each chassis comes with a fan tray, and each fan tray has 15 individual fans. Figure 17 shows a top view of the fan tray.

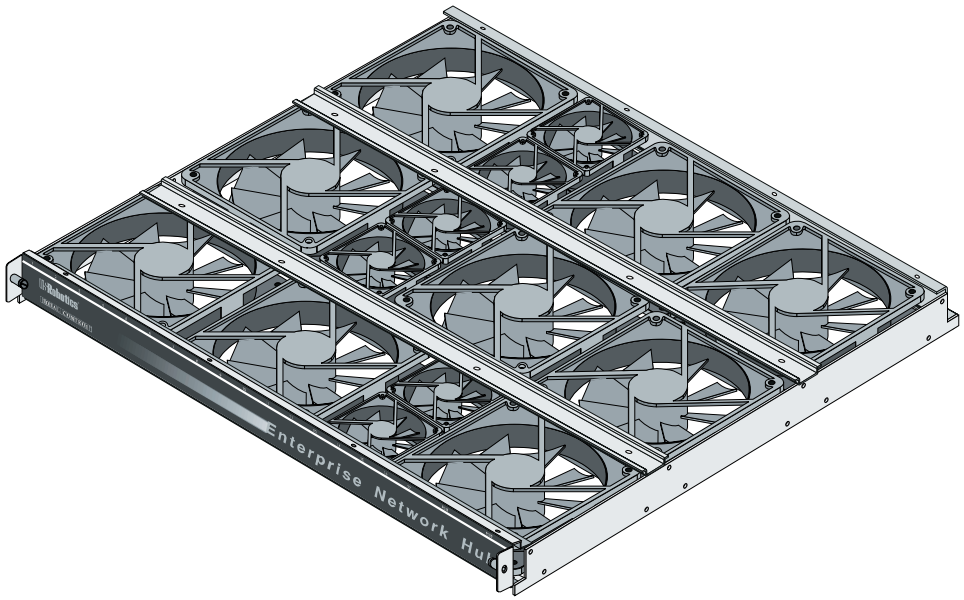

Figure 17. Fan Tray

WARNING: Do not operate a loaded chassis without the fan tray. Doing so even for short periods of time can potentially cause thermal shutdown. You may configure the NMC and *TCM* software to detect fan tray failures. In the event of a failure, call U.S. Robotics Technical Support Department at (800) 231-8770.

Removing the Fan Tray

You do not need to disconnect power or power down the chassis to remove the fan tray. It is fully hot-swappable.

> **CAUTION:** When you remove the fan tray, the individual fans may continue to spin for a few seconds. Make sure that you grip the sides of the fan tray, and do not touch the individual fans until they have stopped spinning.

1. Loosen the two fan tray screws at the front of the chassis.
2. From the front of the chassis, remove the fan tray carefully by sliding it toward you. When you remove the fan tray, make sure that you keep it flat as you are pulling it out—do not tilt the fan tray. See Figure 18.

Installing the Fan Tray

1. To install the fan tray, insert it into the front of the chassis making sure the sides of the tray fit smoothly into the guide rails. For best results, keep the fan tray level with the guides. See Figure 18.
2. Carefully slide the fan tray along the guide rails until it is snug against the rear of the chassis.
3. Tighten the two screws located at the front of the chassis.

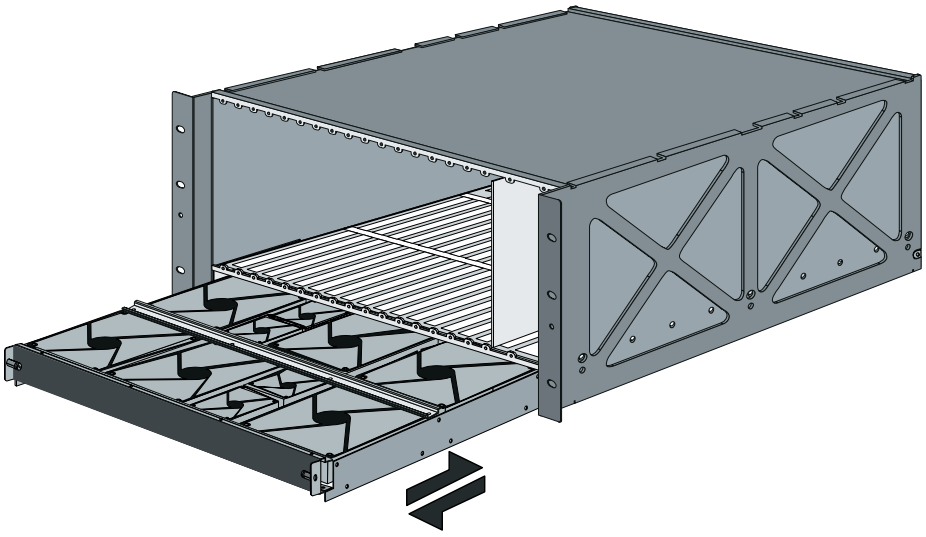

Figure 18. Removing/Installing the Fan Tray

Chassis Installation: 35 and 45A AC and DC

Follow the instructions in this guide, and be prepared to use the U.S. Robotics screwdriver that came with the hardware.

We recommend that you follow this sequence for installation:

1. Chassis
2. Fan Tray(s)
3. Power Supply Unit(s)
4. Network Interface Cards
5. Network Application Cards

NOTE: When the Total Control system is shipped unassembled, protective safety panels cover all of the chassis slots. Leave the blanking panels in place on any unoccupied slots.

Installing the Chassis

CAUTION:

- Do not block the rear fan, behind the power supply units.
- Do not block the openings on the top and bottom of the chassis. If operated as a stand-alone unit, the chassis may be set on a flat surface, but the bottom vents should not be blocked. Similarly, the top should be clear of anything that blocks ventilation to the inside of the chassis.
- When installing more than one chassis in an equipment rack, leave room above and below them for adequate ventilation. Installing fan trays in the rack along with the chassis can help regulate the temperature. See *Fan Tray Installation* later in this section.

Equipment Rack Installation

The optimal rack installation without fan trays is as follows:

- Managed temperature control, 25° C
- Seven chassis installed per rack
- Each chassis installed approximately 3 inches from the next chassis to allow adequate ventilation

> **NOTE:** We recommend forced air cooling of 1000 cfm per chassis if it is operated in a 40° C environment. If the controlled temperature of the environment in which the chassis is installed is 25° C, the airflow can be de-rated.
>
> It is also recommended that forced air be distributed. One way you can achieve this is by installing fan trays.

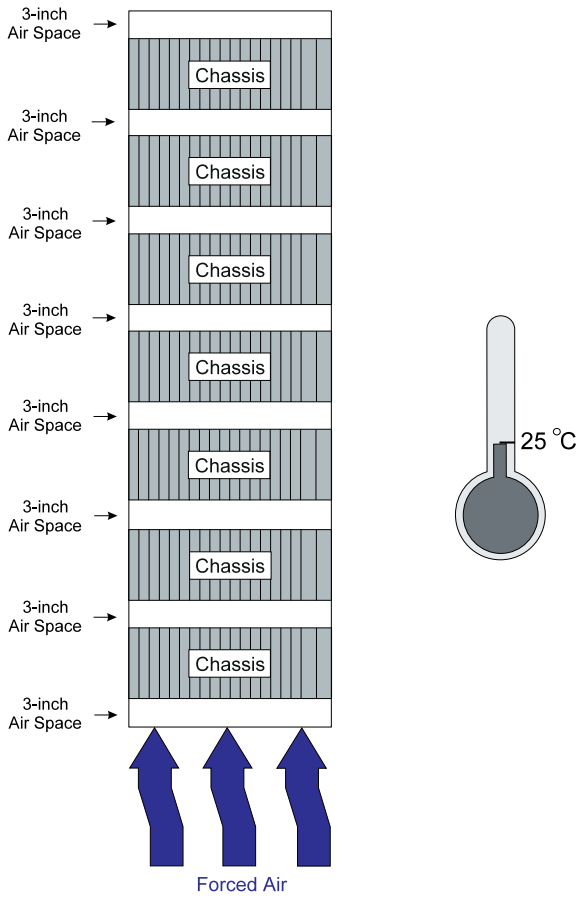

Figure 19. Optimal Rack Installation Without Fan Trays

19-inch Equipment Rack Installation

To mount the chassis in a standard 19-inch equipment rack, use screws that came with the equipment rack to mount the chassis. You will need two screws for each of the mounting rails.

1. Slide the chassis into the rack. See Figure 20.
2. Beginning with the two **bottom** screws, secure all four of the chassis mounting flange slots to the front vertical rails of the rack.

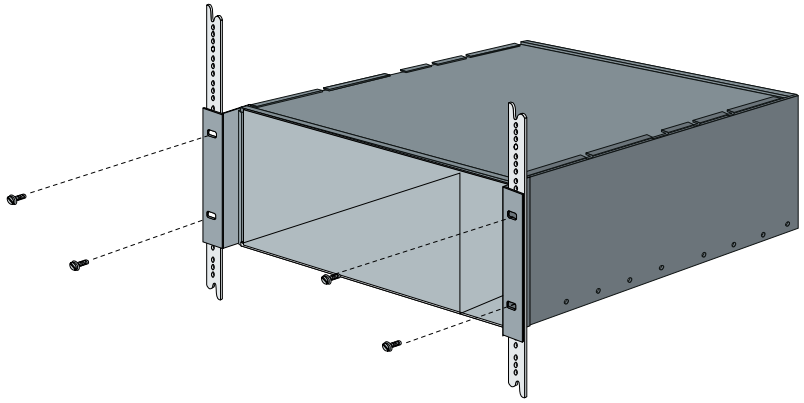

Figure 20. Typical 35 and 45A 19-inch Equipment Rack Installation

23-inch Equipment Rack Installation

The chassis can be mounted in 23-inch racks using brackets as width extenders. These brackets can be acquired through U.S. Robotics.

- In a standard 23-inch equipment rack, use the extender brackets to bolt the chassis mounting flange slots to the equipment rack, with the front of the chassis flush with the front of the rack.

To mount the chassis in this type of rack:

1. Using the bolts that came with the brackets, fasten them to the chassis mounting flanges. See Figure 21.
2. Using the screws that came with the equipment rack, fasten the brackets and the chassis to the mounting rails of the rack. Begin with the **bottom** two screws.

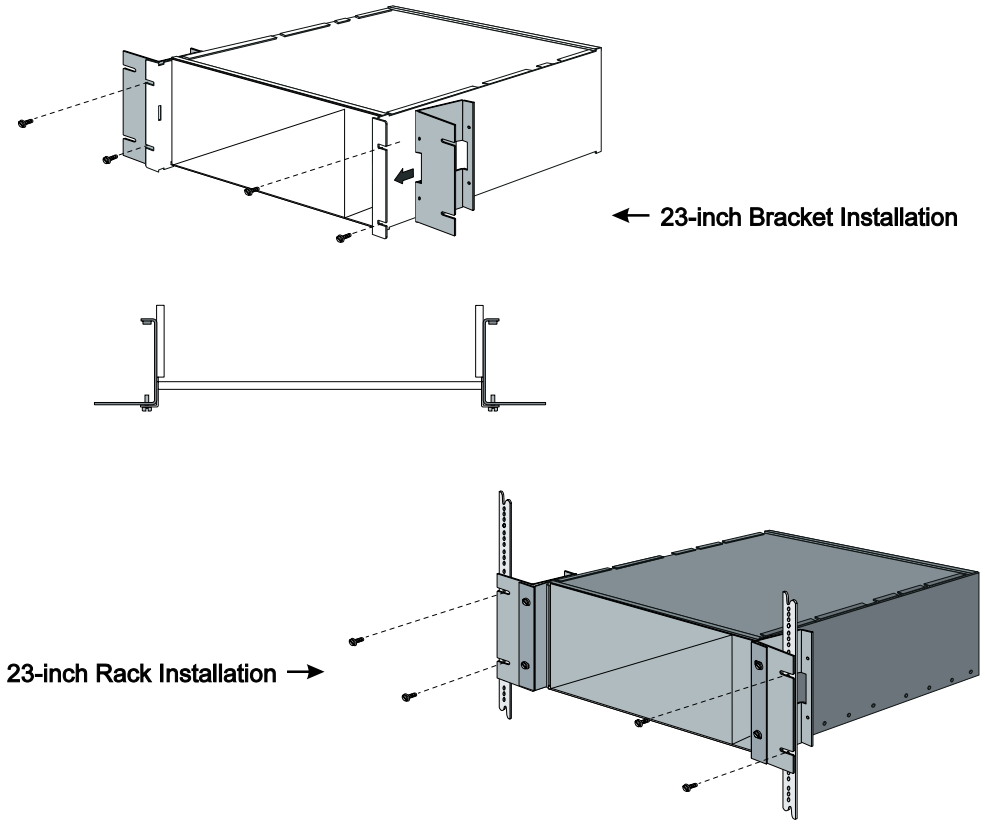

Figure 21. 23-inch Equipment Rack Installation (Top View)

19 and 23-inch Rack Mid-Mount Installation

Brackets are available for mounting the chassis in 19 and 23-inch equipment racks. The brackets for 19-inch rack mid-mounting also allow for the mid-mounting of a fan tray.

- To mid-mount in a 19 or 23-inch equipment rack, or a frame-type rack, use the extender brackets to bolt the front of the chassis extending out 5 inches in front of the rack.

NOTE: Mid-mount brackets must be used if you wish to adhere to the Bellcore Standard on Earthquakes NEBS TR-NWT-000063, Sections 5.5.7 and 5.5.9, Issue 5.

For mid-mount chassis installation:

1 Using the bolts that came with the brackets, fasten them to the chassis mounting flanges. If you are mid-mounting the chassis and a fan tray

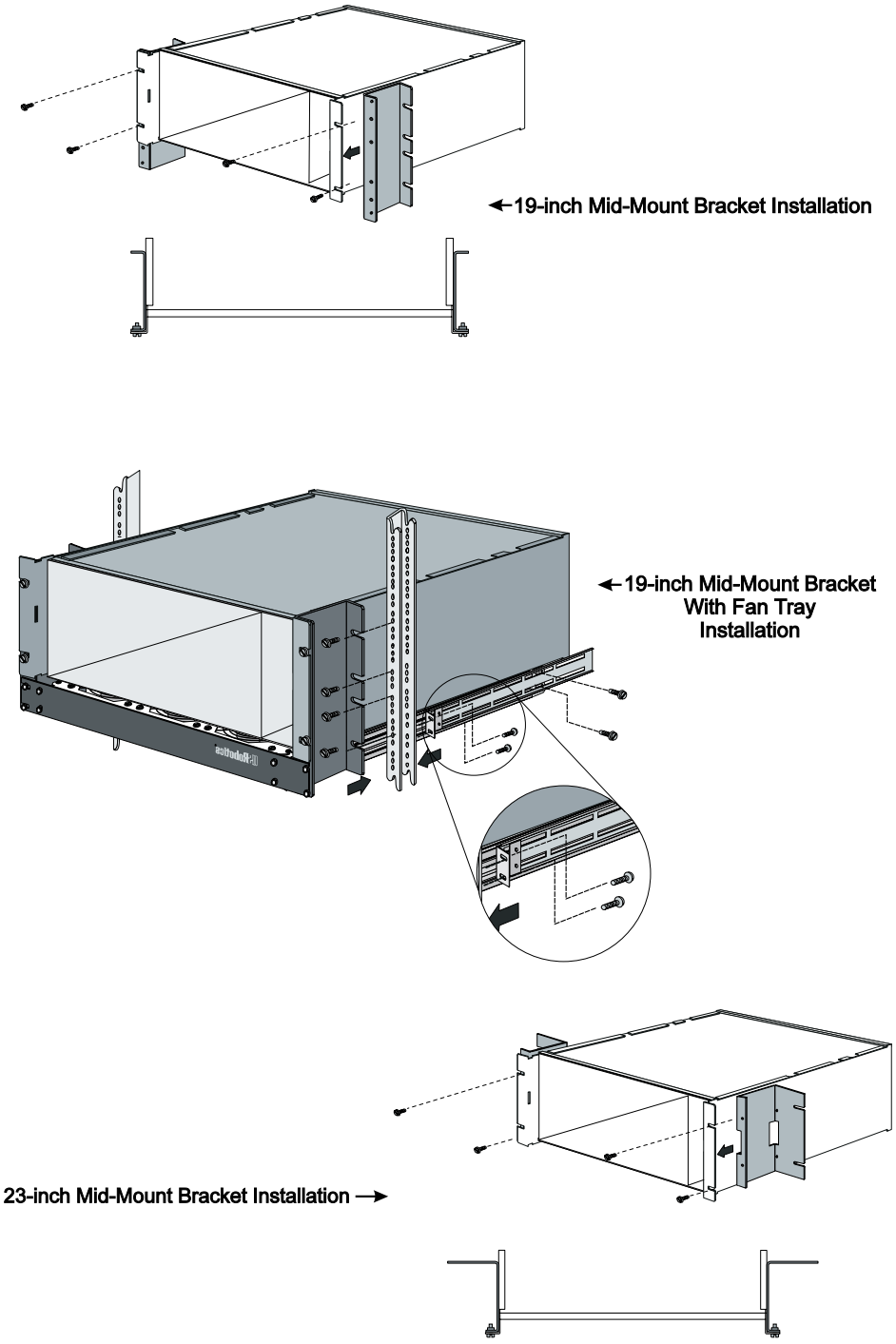

Figure 22. 35 and 45A 19 and 23-inch Equipment Rack Installation

into a 19-inch rack, fasten the bracket to the fan tray as well. See Figure 22.

2. Using the screws that came with the equipment rack, fasten the brackets and the chassis to the mounting rails of the rack. Begin with the **bottom** two screws.

3. If you are mid-mounting the chassis and a fan tray into a 19-inch rack, reverse the rear support bracket (see Figure 22) such that the mounting flange is facing the vertical mounting rail.

4. Mount the rear support bracket to the fan tray with the mounting flange flush against the vertical mounting rail.

5. Screw the fan tray rear support bracket mounting flange to the vertical mounting rail. See Figure 22.

Installing the Fan Tray

If the rack does not have forced air or built-in cooling to help maintain temperature at 25° C, fan trays must be installed in the rack to provide ventilation and control the temperature.

Fan trays can be obtained from various sources. U.S. Robotics markets a fan tray that contains nine 4 1/2-inch axial fans. Each fan provides approximately 112 cfm ventilation, and is protected with finger guards on the top and bottom. The tray comes completely assembled, and is designed with adjustable rear support brackets for easy installation on mounting rails in standard EIA racks. See Figure 23 below.

Figure 23. U.S. Robotics Fan Tray

Fan trays should be installed in a rack according to the following minimum configuration: one fan tray beneath every chassis, and one fan tray at the top. At least one inch of air space must be left below each fan tray to ensure adequate air circulation and cooling. An example of this configuration is shown in Figure 24:

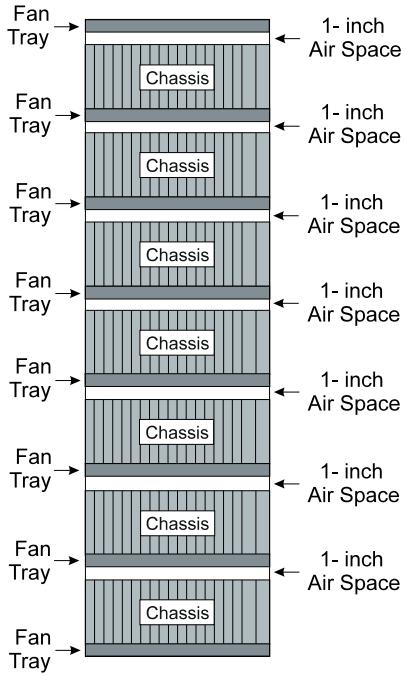

Figure 24. Equipment Rack with Fan Trays

It is possible to install the fan tray from either the front or rear of the rack. This procedure describes the front-loading method:

1. At the front of the rack, where you intend to install the tray, remove the large screws that came with the rack from the vertical mounting rails. There should be two screws in each of the mounting rails.
2. Unscrew and remove the fan tray rear support brackets. See Figure 25 for the location of these brackets.
3. Fit the side rails of the tray to the sides of the cabinet and slide the fan tray into the rack.
4. Use the hardware that came with the rack to attach the fan tray at the front of the rack. Beginning with the two **bottom** screws, secure all four of the fan tray front panel mounting flange slots to the front vertical rails of the rack.

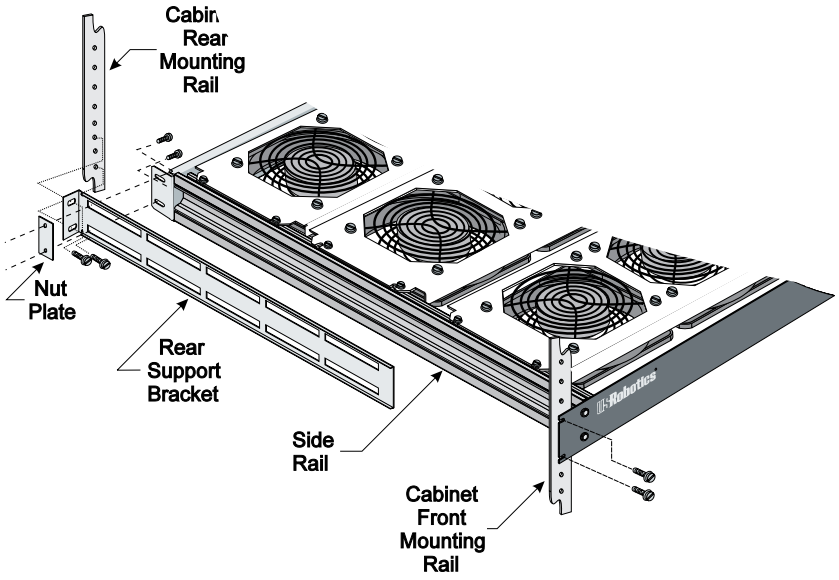

Figure 25. Installation at Back of Rack

5 At the back of the rack, screw the adjustable rear support brackets to the rear vertical rails of the rack, as shown in Figure 25.

6 Plug the fan in to start operation.

Installing the Power Supply Unit

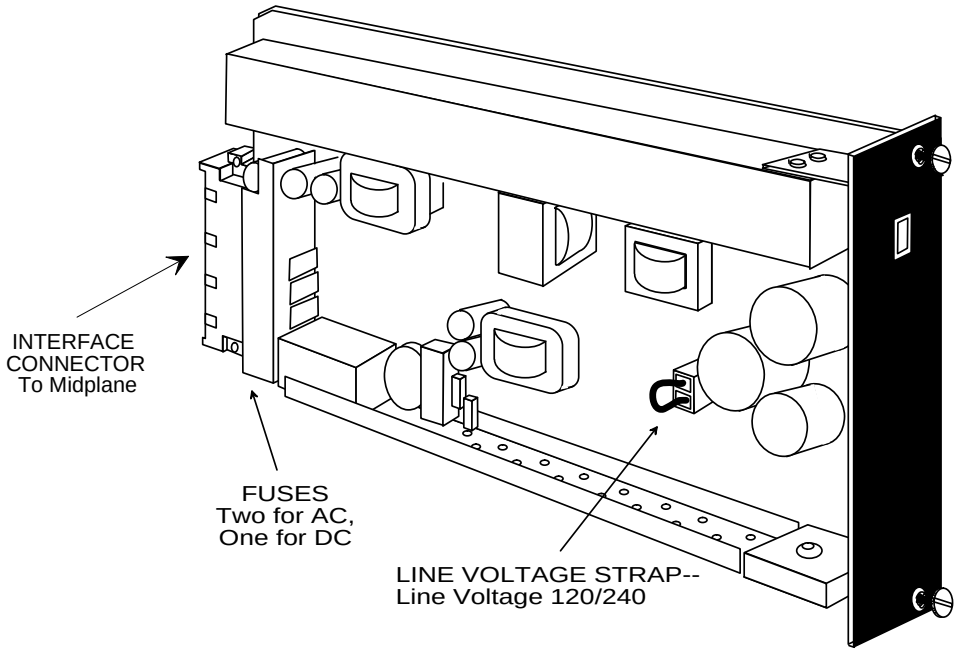

Figure 26. Line Voltage Strap and Fuse Locations

WARNING: There may be induced voltage between the fully installed chassis and the equipment at the other end of the EIA-232 interface. To avoid any potential shock hazard, **do not touch both pieces of equipment at the same time.**

Power Supply Units (PSUs) are available in both AC and DC versions. Verify that you have received the correct version by checking the silk-screen label on the front panel of the PSU. Also, notice that the DC PSU does not have a line voltage strap (see Figure 26).

AC PSU

The AC PSU enables AC power to the system and provides DC power to the card slots of the chassis (Modem NACs, NICs, HCU, etc.).

Signal and Chassis Grounds

The AC PSU is shipped with signal and chassis grounds separated. The DC PSU also separates the -48VDC input power common. If your installation requires that you connect these grounds so that they are

shorted together, contact the U.S. Robotics Technical Support Department at (800) 231-8770.

120 VAC/240 VAC Options (AC Version Only)

AC power input may be from either of the following sources:

- Nominal 120 VAC, 90–132 VAC at 47–63 Hz
- Nominal 240 VAC, 180–264 VAC at 47–63 Hz

The power supply is shipped with AC line voltage set for 120 VAC. To set the supply to use 240 VAC, follow these steps:

1. Locate the Line Voltage Strap shown in Figure 9 and the 120/240 label that is printed on the PSU board. The strap's continued plastic casing holds a heavy-duty wire shunt that connects the lower two of the strap's three contacts in the 120 VAC position (see Figure 27).
2. Lift up the shunt casing. If necessary, use the U.S. Robotics screwdriver for leverage.
3. Replace the shunt so that it connects the top two contacts. This is the 240 VAC position.

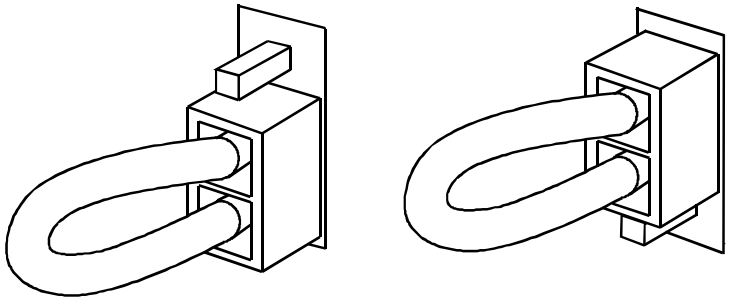

Figure 27. Line Voltage Strap Positions

DC PSU

The DC version enables the chassis to accept a -48 VDC power input to the system, and converts DC voltages to power the card slots. The DC PSU also separates the -48 VDC input power common. See cabling instructions for the DC chassis following the *Installation Procedure*.

Installation Procedure

1. Verify that you are installing the correct type of PSU: that is, a DC PSU for a DC chassis or an AC PSU for an AC chassis. The AC chassis can be easily identified by the power rating information screened on the Power Rear Panel.

2. For AC PSUs, reset the Line Voltage Strap if necessary, as described in the previous section.

3. The power supply slots are the two slots farthest on the right edge of the chassis. If you are installing only one power supply, remove the safety panel over the right-most slot of the chassis. This is slot PSU2. The single PSU will be installed in this slot. If you are installing two power supplies, then remove both safety panels. Set the panel(s) and screws aside.

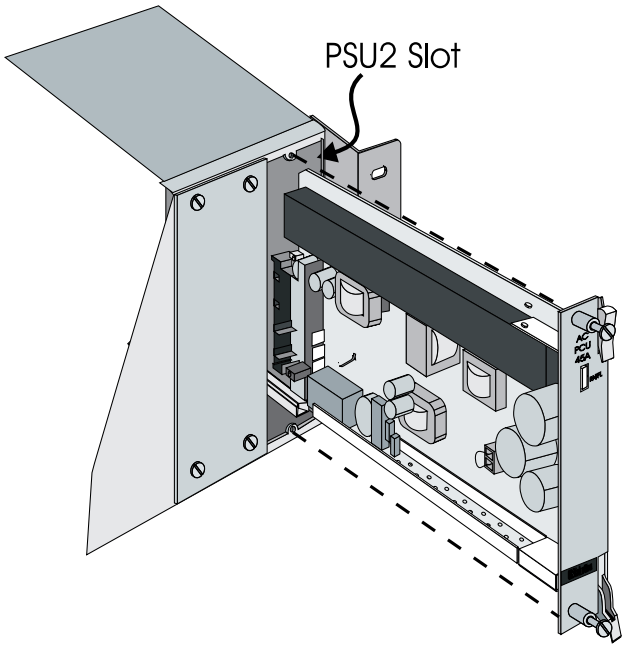

Figure 28. Installation of PSU

4. With the DIN connector toward the bottom of the Power Supply Unit and the PSU components to your left, insert the PSU into the upper and lower card guides of the slot (see Figure 28). As you slide the unit in, use your thumbs to lift the ejector tab at the top right of the PSU front panel to allow the unit to enter. Slide the unit in smoothly and ensure that its DIN connector is firmly seated in the connector in the power supply backplane.

5 Tighten the captive screws on the front panel to secure the unit(s). Safety agencies require that the power supplies be screwed in place.

Removing the Power Supply

If you need to remove the chassis power supply (PSU) for any reason, follow the instructions below:

1 Ensure that the power switch is in the "0" (off) position and remove the power cord if it is attached.

WARNING: Wait 10 seconds to allow all capacitors on the PSI and PSU to discharge before handling either of the cards.

When you turn off the power supply using the On/Off power switch on the PSI, you must wait 10 seconds before you can safely remove the PSU.

Also, you will notice that during this time, the Run/Fail LED will briefly maintain its color and then slowly go dark. This is because the capacitors on the PSU require 10 seconds to discharge.

Do not touch the PSU during this period. After 10 seconds, the PSU can safely be removed. **Be careful, however, in handling them: some components, in particular the heat sinks, may be very hot.**

2 Once the RN/FL (RUN/FAIL) LED is off on the PSU, loosen the captive screws on the PSU and then push the ejector tabs away from each other. The PSU will pop out slightly. Use the tabs or grasp the front panel to remove the unit.

Cabling the DC Chassis

To provide power to the DC chassis, you must connect your DC power source to the terminals at the rear of the chassis. As shown in Figure 29, the five terminal lugs are shielded with a plastic cover, held in place by two screws.

CAUTION: Safety requirements stipulate that the plastic cover be replaced over the terminals and screwed down after any connections are made.

1 Check to be sure that you have a DC chassis, with the terminal block shown in Figure 29. Placing a DC PSU into an AC chassis may blow a fuse and will not provide power to the system.

2 Check that the power switch is in the OFF position (the switch is toggled toward the “0”).

3 Remove the plastic cover to expose the terminals. There is one CHASSIS GND (ground), two COMMON ground, and two -48 VDC terminals (VDC 1, and VDC 2). Each terminal will accept spade or ring lugs, or direct connection with 12 to 16 gage wire. To make a connection, loosen the terminal screw, insert an exposed wire or terminal lug, and tighten the screw.

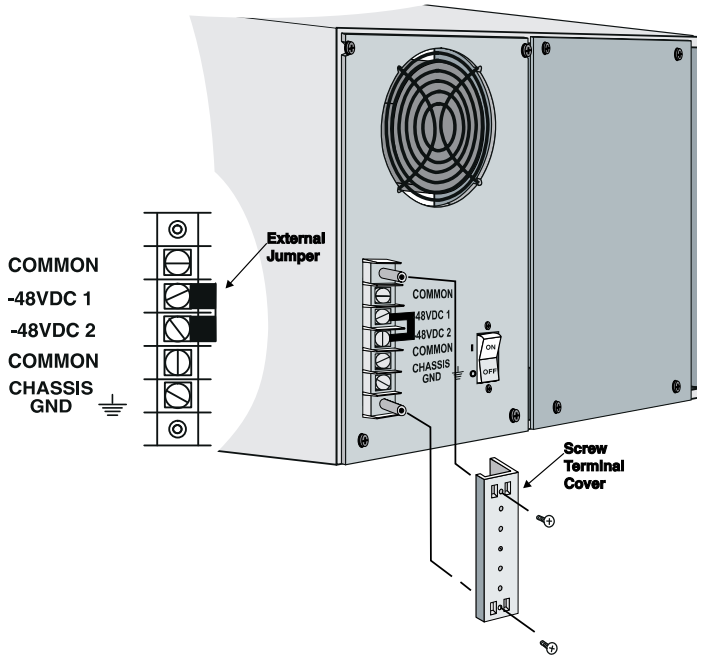

Figure 29. Rear of DC Chassis

4 You may optionally wire the CHASSIS GND terminal to an earth source.

5 The two COMMON terminals are internally tied within the chassis. Connect the ground (common) wire from your -48 VDC source to either of the two COMMON terminals.

6 A shorting bar connects the two -48 VDC terminals (-48 VDC 1 and -48 VDC 2). If you are using a single input power source (i.e., 2 wires), leave the shorting bar in place. This assures that power will be

supplied to both PSU slots (PSU1 and PSU2). Connect the -48 VDC source wire to either of the -48 VDC terminals.

If your source has independent (fully redundant) -48 VDC input feeders, and you have two PSUs, you can power each unit with a separate -48 VDC input. Loosen the screws and lift off the shorting bar. The -48 VDC 1 terminal powers the PSU1 slot, and the -48 VDC 2 terminal powers the PSU2 slot.

Connect one of the -48 VDC source wires to the -48 VDC 2 terminal (if the rack is shipped with only one supply, it will be in the PSU2 slot). Connect the other -48 VDC source wire to the -48 VDC 1 terminal.

NOTE: Even if two PSUs are installed in a chassis, only one PSU will be active if you remove the shorting bar and connect only one -48 VDC input.

- If the second source is not attached, the corresponding PSU will have a solid red indicator on the PSU front panel to show it is inactive.

For example, if the shorting bar is removed and the -48 VDC 1 terminal is not connected, and if PSU1 is installed, there will be a solid red indicator for PSU1.

7 Be sure that all terminal screws are tightened; then replace the plastic cover over the terminal block and screw it down.

Powering on the System

1 For the AC chassis, plug the AC cord into the IEC connector on the chassis, and then into the AC power supply source. The connector and power switch are at the rear of the chassis, behind the power supplies. See Figure 30. For the DC chassis, make sure it has been wired properly as noted in the previous section.

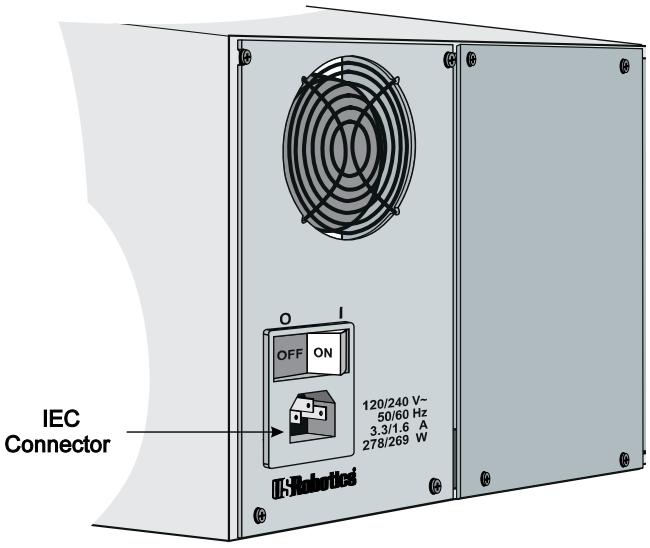

Figure 30. AC Chassis Rear Panel

CAUTION: The AC PSUs are not auto-sensing. Be sure the 120/240V strap on each PSU is set correctly before powering on the chassis.

2 Turn on the power switch, from zero (0) to one (1).

3 Check the indicator light on the PSU front panel. A green light for each installed PSU indicates proper operation. If the indicator is flashing red, there has been a failure.

In the rare instance that a PSU indicator light does not go on or turns red, reinstall the Power Supply Unit. Unscrew the front panel of the unit in question, unplug the unit, and slide it in smoothly to reseat it in the DIN connector on the power supply backplane.

Check the front panel LED to see that the unit is installed correctly. If the LED doesn't light, the PSU has failed, and you'll have to contact U.S. Robotics technical Support Department at (800)-231-8770.

NOTE: If you suspect there is a power-supply problem, particularly if the system is running and calls are in progress, be sure to follow the under *Power Failure Diagnostics* in the *Troubleshooting* section.

Installing Network Interface and Application Cards

We recommend that you first install all of the rear-loaded Network Interface Cards (NICs) and then the Network Application Cards (NACs). If at any time you wish to remove a NIC or NAC, remove the NIC first and then the NAC. For most NICs and NACs, it does not matter whether the Total Control chassis is powered on or off during installation or removal. Most NICs and NACs are hot-swappable. Consult the documentation pertaining to the specific product for information in this area.

WARNING: To reduce the risk of shock hazard, always disconnect any cables from it before removing any NIC.

Depending on the configuration of the system, safety panels may cover one or several slots on the front and rear of the chassis. We recommend that you leave the safety panels in place for any unused slots. Store any safety panels and screws that you remove for future use.

CAUTION: To prevent static and electric shock damage, we recommend that you wear a *grounded anti-static strap* when handling any of the cards. For your convenience, ESD plugs are located on both the front and rear of the chassis. See Figure 2.

Network Interface Card Installation

1. Verify that you have made any needed configuration changes before you install the NIC.

   NOTE: Individual NIC configurations can be found in the install guide pertaining to that product.

2. Insert the NIC in the upper and lower plastic card guides of the chosen slot, connector first. Slide the board inward until its connector is firmly plugged into the midplane and its rear panel is flush with the rack. See Figure 31.

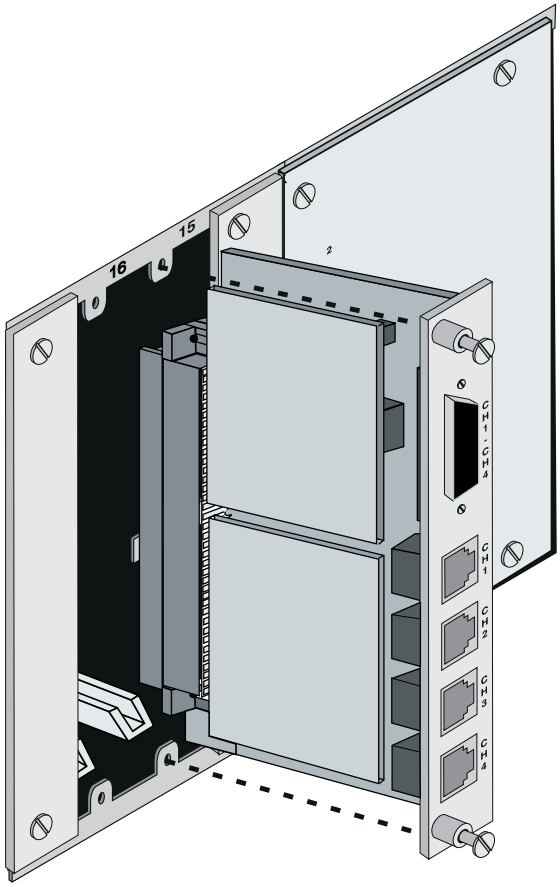

Figure 31. Inserting a Network Interface Card

3 Tighten the captive screws that are attached to the card's rear panel until the NIC is secure.

4 Power on the rack if it isn't already on.

Network Application Card Installation

1 Make sure all DIP switches on the NAC are set to your specifications.

> **NOTE:** Individual NAC configurations can be found in the install guide pertaining to that product.

2 Insert the NAC in the upper and lower plastic card guides of the chosen slot, connector first, and LEDs facing the front. Slide the board inward until its connector is firmly plugged into the midplane. The front panel should be flush with the front face of the chassis. See Figure 32.

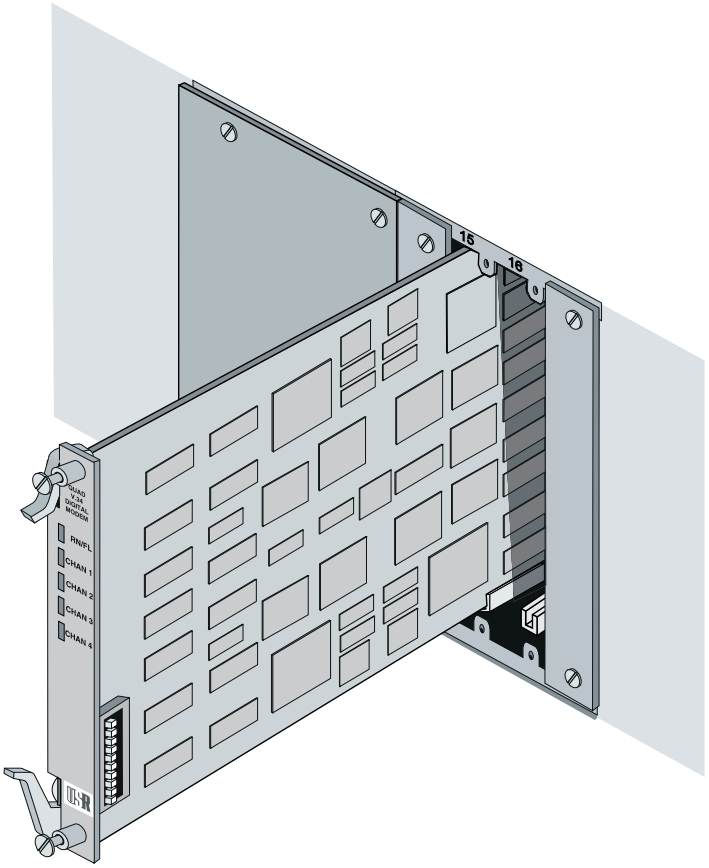

Figure 32. Inserting a Network Application Card

Once the connector is plugged in and the NAC has power, it begins running some self-diagnostic tests. See the appropriate install guide for more information.

3 Use the captive screws on the NAC's front panel to screw the board in place. Pay careful attention to the alignment of the screws before tightening them. Problems could arise if the screws are not threaded properly.

Cabling

Each Total Control installation will vary to some extent. We have made an effort to supply certain cables required for connecting components of the chassis. We expect that network managers will fill the additional cabling needs of their installations.

NOTE: You must supply your own interface adapter if your hardware uses anything other than a DB-25 connector.

- *HCU-configured chassis*—The HCU NIC is supplied with one 4-foot RS-422 Inter-Rack Bus (IRB) cable, one 12-foot EIA-232 cable (DB-9 to 8-position modular), and one DB-9 to DB-25 adapter to connect the HCU NIC and the *Total Control PC* computer.
- *NMC-configured chassis*—The NMC NIC is supplied with one 12-foot EIA-232 cable (DB-9 to 8-position modular) and one female-to-female null modem adapter to connect the NMC NIC and the PC running *Total Control Manager/SNMP*.
- *Dual-Modem Cards*—The Dual Analog NIC requires EIA-232 DB-25 male cables and either RJ45 or RJ11C phone connector cables. Two cables of each type, EIA-232 and phone, are required.
- *Quad Modem Cards*—The Quad EIA-232 NIC is supplied with a fan-out cable (HD 50 to four DB-25 connectors).
- *T1* Cards—The T1 NIC is supplied with an EIA-232 cable (DB-9 to 8-position modular) and one female-to-female null modem adapter.
- *Gateway Cards*—The X.25 PAD and the EIA-232/V.35 NIC are supplied with two EIA-232/V.35 to DB-25 adapters, one null modem adapter, and one 12-foot RJ45 to DB-25 EIA-232 adapter cable.

  Both the NETServer Card NIC and the API Card NIC are supplied with one 12-foot EIA-232 cable (DB-9 to 8-position modular) and one female-to-female null modem adapter. Additional LAN-specific cables are the responsibility of network managers.

Power Failure Diagnostics

Power supply unit failure may be caused by any of the following conditions.

- Input voltage failure
- Internal power supply fuse failure
- Internal power supply failure
- Input voltage out of spec (for example, too low)

U.S. Robotics power supply units are fully short-circuit protected. If there is a current overload sensed at the power supply output terminals, the power supply automatically shuts down until the fault is corrected. Once it is corrected, the power supply automatically comes back on.

If a PSU / PSI RN / FL (RUN / FAIL) LED is red, try the following brief sequence of tests. See Figures 10 and 11 for the location of these LEDs. Depending on the situation, these procedures should enable you to diagnose the cause of the problem.

Power Supply Overvoltage

If overvoltage is sensed at the output terminals, the power supply immediately shuts down

1. Remove the PSU and PSI whose LED is flashing by following the procedures in the *Removing the Power Supply* section of this manual and plug it in again to recycle the power.

   CAUTION: Be careful to observe the warnings in that section about shock hazards and touching hot components.

2. Reinsert the unit and check the Run / Fail indicator on the PSU front panel and / or PSI rear panel.

The problem may have been minor, and the unit may reset. If not, completely remove the faulty PSU / PSI and contact the U.S. Robotics Technical Support Department at (800) 231-8770.

Overload Conditions

Check for a modem or interface unit failure that may be causing an overload condition. Remove each modem and NIC one at a time, until the power supply indicator lights. The last modem or interface unit removed is probably the cause of the overload condition.

Technical Specifications

For specifications on NICs and NACs, see the respective hardware install guide.

70 and 130A AC and DC Chassis

Chassis Capacity

- Houses up to 17 front-loaded application cards (NACs), and their respective rear-loaded interface cards (NICs)
- Two Power Supply Unit / Power Supply Interface combinations (PSU / PSIs); the second optional for full redundancy
- One fan tray assembly

Certification

- Complies with FCC Part 15 Class A EMI / RFI requirements; complies with FCC Part 68; UL-listed; CSA-approved; IC-certified
- This product complies with the European EMC directive and holds the "CE" mark.

Power Supply

- Fuse protection
- Auto shutoff for overvoltage and short-circuit protection
- Automatic redundant switchover with two units installed

Power Requirements

AC PSU/PSI

Specified range: 100V - 240VAC @ 50-60Hz

DC PSU/PSI

Specified range: -42 to -56VDC

Power Supply Output

- One power supply carries a fully loaded chassis
- Two power supplies are strongly recommended for backup redundancy

Maximum Output Power

280 watts

VDCout	70A PSU AC & DC	130A PSU AC & DC
+5.2V	70A	130A
-5V	2A	2A
+12.2V	5.5A	5.5A
-12.2V	5.5A	5.5A

Power Supply Input

Typical Input Power

DC to DC		AC to DC	
70A PSU	130A PSU	70A PSU	130A PSU
680 watts	1095 watts	670 watts	1080 watts

Maximum Input Current

DC to DC		AC to DC	
70A PSU	130A PSU	70A PSU	130A PSU
20A	30A	10A	15A

Mechanical

Mean Time Between Failure

50,000 hours @ 40° C

Weight of Fully Loaded Chassis

29.1 kg, or 65.0 lbs.

Chassis/Cabinet Dimensions

	L"	W"	H"
Chassis	18.590	19.000	8.719

	L cm	W cm	H cm
Chassis	47.219	48.260	22.15

Operating Environment

Temperature: 0–40° C, 32°–104° F

Relative Humidity: 40–60% non-condensing

35 and 45A AC and DC Chassis

Chassis Capacity

- Houses up to 17 front-loaded application cards (NACs), and their respective rear-loaded interface cards (NICs)
- Two Power Supply Units (PSUs), second optional for full redundancy

Certification

- Complies with FCC Part 15 Class A EMI / RFI requirements; complies with FCC Part 68 for nationwide telephone systems; UL-listed; CSA-approved; IC-certified

Power Supply

- AC and DC fuse protection; input line fuse protection with all DC PSUs
- Auto shutoff under overvoltage and short-circuit conditions
- Automatic redundant switchover with two units installed

Power Requirements

AC PSU

Nominal 120V (90–132 VAC) @ 47–63 Hz,
or strap-selectable nominal 240V (180–264 VAC) @ 47–63 Hz

DC PSU

Nominal -48 VDC (-42 VDC to -60 VDC) with respect to common

Power Supply Output

One power supply carries a fully loaded chassis

Maximum Output Power

280 watts

	35A PSU	45A PSU
+5.2V	35A	45A
-5V	2A	2A
+12.2V	3.5A	3.5A
-12.2V	3.5A	3.5A

Power Supply Input

Maximum Input Power

35A PSU	45A PSU
400 watts	470 watts
1365 BTUs	1604 BTUs
3.3A (AC)	4A (AC)
8.3A (DC)	10A (DC)

Typical

35A PSU	45A PSU
210 watts	250 watts
716 BTUs	860 BTUs
1.75A (AC)	2.1A (AC)
5A (DC)	5.2A (DC)

Mechanical

Mean Time Between Failure

50,000 hours @ 40° C

Weight of Fully Loaded Chassis

24.4 kg, or 54.5 lbs.

Chassis/Cabinet Dimensions

Component	L"	W"	H"
Chassis	18.590	19.000	7.000
Cabinet	19.680	19.528	8.822

	L cm	W cm	H cm
Chassis	47.219	48.260	17.780
Cabinet	49.987	49.601	22.408

Operating Environment

Temperature:	0–40° C, 32°–104° F
Relative Humidity:	40–60% non-condensing