297-2291-156

DMS-100 Family

TOPS MPX

Power Distribution and Grounding Guide

LET0013 Standard 03.01 February 2000

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DMS-100 Family

TOPS MPX

Power Distribution and Grounding Guide

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Publication history

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Standard 03.01 was issued to add information on power and grounding requirements for the TOPS-IWS ethernet equipment system (NTNX51DA).

May 1995

Standard 02.02 was issued to add information on bonding conductors used for customer-provided furniture and privacy panels, on monitor bezels or anti-glare screens, and on the relativity humidity range for rooms containing TOPS MPX workstations.

June 1994

Standard 02.01 was issued to include information on TOPS MPX-IWS type workstations.

December 1992

Standard 01.02 was issued for the following reasons:

- to comply with the generic design intent, terminology, and definitions of applicable Northern Telecom Corporate Standards
- to improve the composition, arrangement, and structure of the subject content
- to limit the technical content specifically to the TOPS MPX system
- to simplify and improve the text, figures, and tables

March 1990

Standard 01.01 was the first release of NTP 297-2291-156.

Contents

About this document

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *Product Documentation Directory,* 297-8991-001.

This document is written for all DMS-100 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in *Product Documentation Directory,* 297-8991-001.

References in this document

The following documents are referred to in this document:

- *Product Documentation Directory,* 297-8991-001.
- *Generic Requirements for Telephone Headsets Used at Bell Operating Company (BOC) Operator Consoles,* Issue1, TR-NPL-000314
- *DMS-100 Family Power Distribution and Grounding Systems User Guide,* 297-1001-156

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER Possibility of personal injury

DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING Possibility of equipment damage

WARNING

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION Possibility of service interruption or degradation

CAUTION
Possible loss of service
Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

>BSY

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

>BSY CTRL

Variables

Variables are shown in lowercase letters:

>BSY CTRL ctrl_no

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

1 Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no
and pressing the Enter key.

where

ctrl_no is the number of the CTRL (0 or 1)

Example of a MAP response:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

1. Introduction

1.1. Definitions

The following definitions conform as closely as possible to those of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

ac equipment grounding (ACEG) conductor (green wire)

A conductor used to protect personnel from injury. The ACEG conductor does not normally carry current. It is permanently bonded to the serving panel ground and to metal parts of electrical equipment that do not normally carry current. The ACEG conductor is an insulated conductor for the applications covered by this document.

ac service entrance ground

The ground reference point for all ac-powered equipment. It must also be connected to the building principal ground.

bonding

The permanent joining of non-current carrying metallic parts to form an electrically conductive path, which ensures electrical continuity and the capacity to safely conduct any current likely to be imposed upon the path.

bonding network (BN)

A set of interconnected conductive structures that provides an electromagnetic shield for electronic systems and personnel at frequencies from dc to low rf. The term *electromagnetic shield* denotes any structure used to divert, block, or impede the passage of electromagnetic energy. In general, a BN need not be connected to earth, but all BNs considered in this document require an earth connection.

building principal ground (BPG)

The main point within a building at which the ground reference potential is established. The BPG is directly referenced to earth by such means as water pipes and/or electrodes driven into the earth.

common bonding network (CBN)

The principal means for effecting bonding and grounding inside a telecommunication building. It is the set of metallic components that are intentionally or incidentally interconnected to form the principal bonding network in a building. These components include: structural steel or reinforcing rods, metallic plumbing, ac power conduit, ac equipment grounding conductors, bonding conductors, and cable racks. The CBN has a mesh topology and is connected to the building grounding electrode system.

DMS single point ground (DMS SPG)

A single point where the framework bonding equalizer (FBE), the logic return equalizer (LRE), the serving ac equipment grounds (ACEG), the integrated collector bar (ICB), and the serving dc-power plant battery return reference (BRR) are connected to ground. The DMS SPG is usually one of the following types of busbars: building principal ground (BPG), floor ground bar (FGB), dedicated SPG bar, or a dedicated section of the serving dc-power plant battery return (BR) bar. In some old (non-ISG) configurations, the framework ground bus (rather than the FBE and LRE) is connected to the DMS SPG.

floor ground bar (FGB)

A copper bar on each floor of a building provided for equipment grounding. It is connected to the VGR and effectively extends the the BPG to each floor level.

ground

A metallic connection, whether intentional or incidental, between an electric circuit or equipment and the earth, or some conducting body that serves in place of the earth. Typically, a ground is a connection to earth obtained by a grounding electrode.

integrated collector bar (ICB)

An insulated copper plate used for bonding to the DMS SPG all metallic objects that are outside the IBN but within 2 m (7 ft) of the IBN and that are not already connected to the DMS SPG. These metallic objects include any noninsulated metallic objects that could be intentionally or unintentionally connected to the building CBN and cannot be insulated from that CBN.

isolated bonding network (IBN)

A bonding network that has a single point of connection to either the CBN or another IBN.

isolation

The arrangement of parts of equipment, a system, or a facility to prevent uncontrolled electrical contact within or between parts.

no-break ac load

An ac load that cannot tolerate any interruption.

protected ac load

An ac load that should operate during a prolonged loss of commercial power and that can tolerate only minimal interruption times. An interruption can vary from a few milliseconds up to approximately five seconds.

single point ground (SPG)

A single connection used to reference equipment or a system to ground. In the IBN arrangement, no dc current flows through the single point connection unless a fault condition exists.

TOPS MPX workstation

The TOPS MPX workstation is a product provided by Nortel Networks. It is used with a DMS-200 or DMS-100/200 switch to provide operator services. The TOPS MPX workstation was a successor to the TOPS MP workstation. The TOPS MPX has in turn been superceded by the TOPS MPX-IWS workstation.

TOPS MPX-IWS workstation

The TOPS MPX-IWS workstation is a product provided by Nortel Networks. It is used with a DMS-200 or DMS-100/200 switch to provide operator services. The MPX-IWS workstations are successors to earlier Type-1, Type-2, and Type-3 MPX workstations.

vertical ground riser (VGR)

A continuous conductor extending ground potential throughout the height of a multifloor building. The FGBs on various floors are connected to the VGR.

1.2. Abbreviations and acronyms

The following list is provided as a reference for a quick identification of abbreviations and acronyms used in this document.

ac:

alternating current

ACEG:

alternating current equipment ground

AWG:

American Wire Gauge

BPG:

building principal ground

CBN:

common bonding network

CEC:

Canadian Electrical Code

CO:

central office

CSA:

Canadian Standards Association

dc:

direct current

DMS:

Digital Multiplex System

DSU:

data service unit

EMI:

electromagnetic interference

ESD:

electrostatic discharge

FGB:
floor ground bar

FSP:
frame supervisory panel

IBN:
isolated bonding network

IGP:
isolated ground plane

IGZ:
isolated ground zone

ISG:
isolated system ground

IWS:
intelligent workstation

kcmil:
thousand circular mils

LAN:
local area network

MGB:
main ground bus (BCC terminology)

MGB:
master ground bar (REA terminology)

MPX:
Multipurpose Position Extended

NEC:
National Electrical Code

NRTL:
nationally recognized testing laboratory

NTP:

Nortel Networks technical publication

REA:

Rural Electrification Administration (see RUS)

RUS:

Rural Utilities Service (formerly REA)

SPG:

single point ground

TOPS:

Traffic Operator Position System

TOPS MPX:

Traffic Operator Position System MPX

TOPS MPX-IWS:

Traffic Operator Position System MPX-IWS

TR:

Technical Reference (Bell Communications Research)

UL:

Underwriters Laboratories

UPS:

uninterruptible power supply

VGR:

vertical ground riser

1.3. Cross reference of terms

The following table is a quick cross-reference of terms used by Nortel Networks, the BOCs, RUS, and others.

Table 1-1
Cross reference of terms

NT	BOC	RUS	OTHERS
building grounding system	CO GRD	central office protection grounding	COG
			CO ground
building principal ground (BPG)	OPGPB	master ground bar (MGB)	COG
	PGP bus		CO GRD bus
			facility ground
			OPGP
			principal ground point (PGP)
			reference point 0
			zero potential reference point
common bonding network (CBN)	integrated ground plane	integrated ground zone	integrated ground system
DMS SPG	main ground bus (MGB)	master ground bar (MGB)	main ground bar (MGB)
floor ground bar (FGB)	CO GRD	floor bar	COG
	CO ground bar		COGB
	CO ground bus		C.O. GRD
isolated bonding network (IBN)	isolated ground plane	isolated ground zone (IGZ)	isolated ground system (IGS)
vertical ground riser (VGR)	vertical equalizer		C.O. ground riser
	vertical riser		equipment ground riser
			GRD riser
			riser
			VERT EQLR

2. Hardware

The TOPS MPX hardware provided by Nortel Networks is UL Listed or UL Recognized and CSA Certified. Any additional equipment should be tested for compliance with applicable standards by a qualified NRTL.

The MPX system uses the following hardware (see Figure 2-1):

- workstation
  - — display monitor
  - — terminal base unit
  - — keyboard
  - — headset jack assembly
- modem
- power strip (surge suppressor)
- MPX equipment frame

TOPS MPX equipment can be installed in areas that have conventional flooring, raised flooring, or dropped ceilings.

The following recommendations apply to any additional equipment used at a TOPS MPX operator position:

- Equipment housing should be plastic to reduce electrostatic discharge (ESD) occurrences.
- Power to additional operator equipment should be provided by the receptacles serving associated TOPS MPX operator positions.

2.1. Workstation

Workstations and associated MPX equipment frames must be located in the same building. Operator workstations can be located on a different floor from the MPX equipment frames provided the separation does not exceed 366 cable meters (1200 cable feet).

Nortel Network's current development of the TOPS workstation is in line with Bellcore's IWSS (Intelligent Workstation System) vision of a versatile,

programmable workstation with an open interface for a multiple-service, multiple-vender, operator center. The TOPS intelligent workstation currently in use is called the TOPS MPX-IWS workstation, which has a terminal base unit equipped with a 486 25/50-MHz CPU, 8 Mbytes of RAM, and a 104-Mbyte disk drive unit. This MPX-IWS workstation can replace earlier MPX workstations. Both MPX-IWS and earlier MPX workstation positions may be found in an operator services center.

2.1.1. Current MPX-IWS positions

There are four designated MPX-IWS positions: a database gateway (router) position, a DMS gateway (router) position, an operator position, and a maintenance/operator position (Figure 2-2).

The database gateway (router) position provides the communication link between TOPS workstations and the external database. This MPX-IWS position replaces the earlier Type-1 MPX position.

The DMS gateway (router) position has voice and data links to the DMS host switch. This MPX-IWS position replaces the earlier Type-2 MPX position, also known as a VPC (virtual position controller). Database and DMS gateway positions each use a modem.

An operator position has only a voice link to the DMS switch and does not use a DSU or modem. The MPX-IWS operator positions replace earlier Type-3 MPX operator positions. An operator position is also further functionally distinguished as a general operator position, a service assistance position, or an in-charge position.

One MPX-IWS operator position can be a maintenance/operator position. This position is used with a dial-up modem for remote maintenance or administration access.

2.1.2. Earlier MPX positions

Earlier MPX worstations are used in three types of positions: a Type-1 position, a Type-2 position, and a Type-3 position (Figure 2-3).

The Type-1 position provides communication between TOPS operator positions and the external database. The Type-2 position has voice and data links to the DMS host switch. Each Type-1 and Type-2 position uses a modem. Type 3 has only a voice link to the DMS and does not use a modem.

Note: In order to support the current IWS-based applications, earlier MPX type workstations require hardware upgrades.

2.1.3. Headset interface

The headset interface of a TOPS workstation is designed for headsets that meet the *Generic Requirements for Telephone Headsets Used at Bell Operating Company (BOC) Operator Consoles*, Issue1, TR-NPL-000314, published by Bell Communications Research (Bellcore).

2.2. Modem

A 9.6-kp/s dial-up modem is used with an MPX-IWS maintenance/operator position for 4-wire telephony transmission.

2.3. Power strip

A power strip (surge suppressor) is used to distribute ac power to MPX-IWS and earlier MPX workstation equipment. Each workstation requires a power strip.

2.4. MPX equipment frame

Voice and data links from workstations are cabled to the MPX equipment frame (figures on the following pages). This frame, usually located in a wiring closet, has one or more token ring LANs for inter-communication among clustered workstations. The frame also has connector hardware for communication to the DMS host switch.

Figure 2-1
TOPS MPX hardware

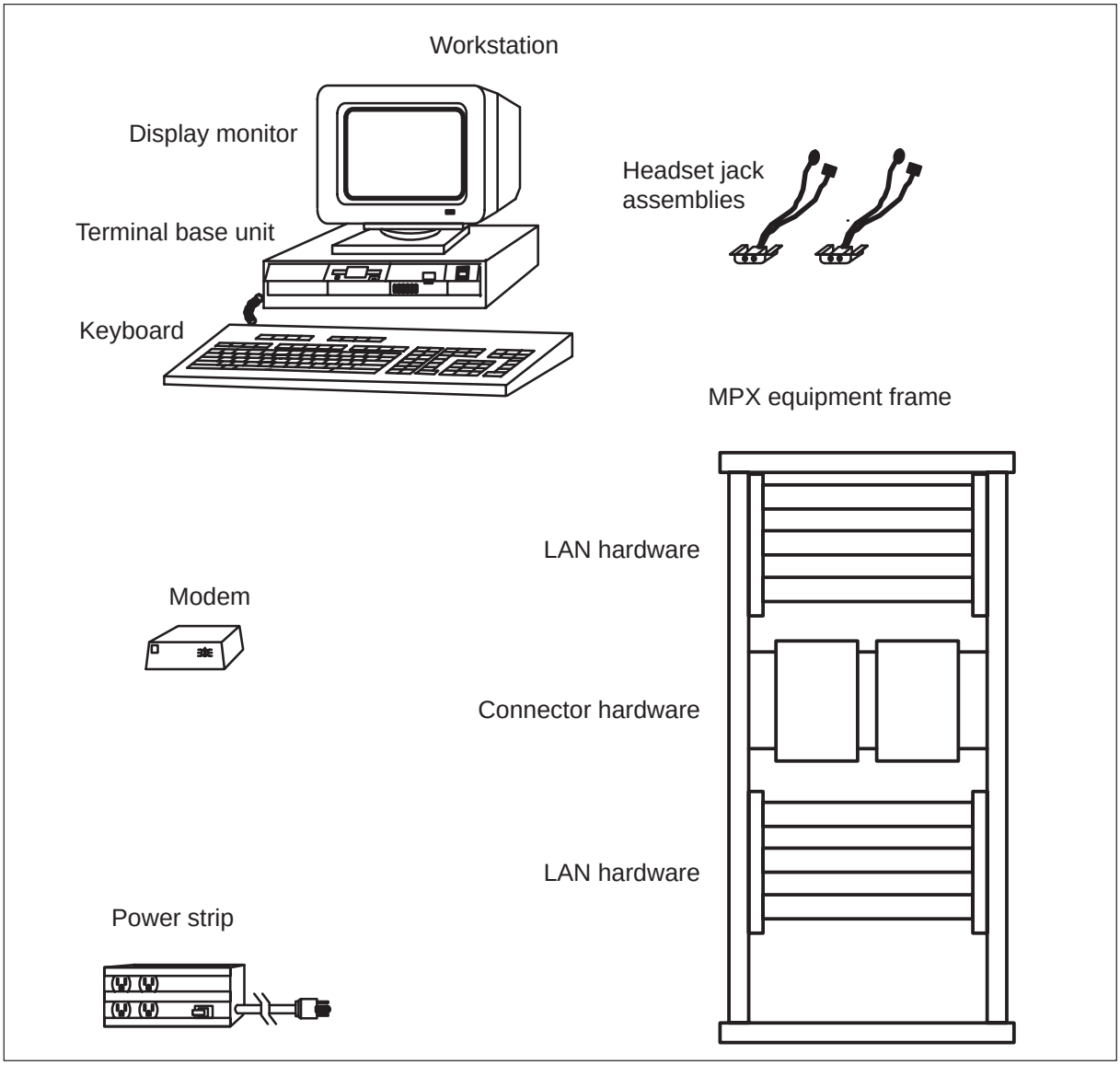


Figure 2-2
MPX–IWS workstations

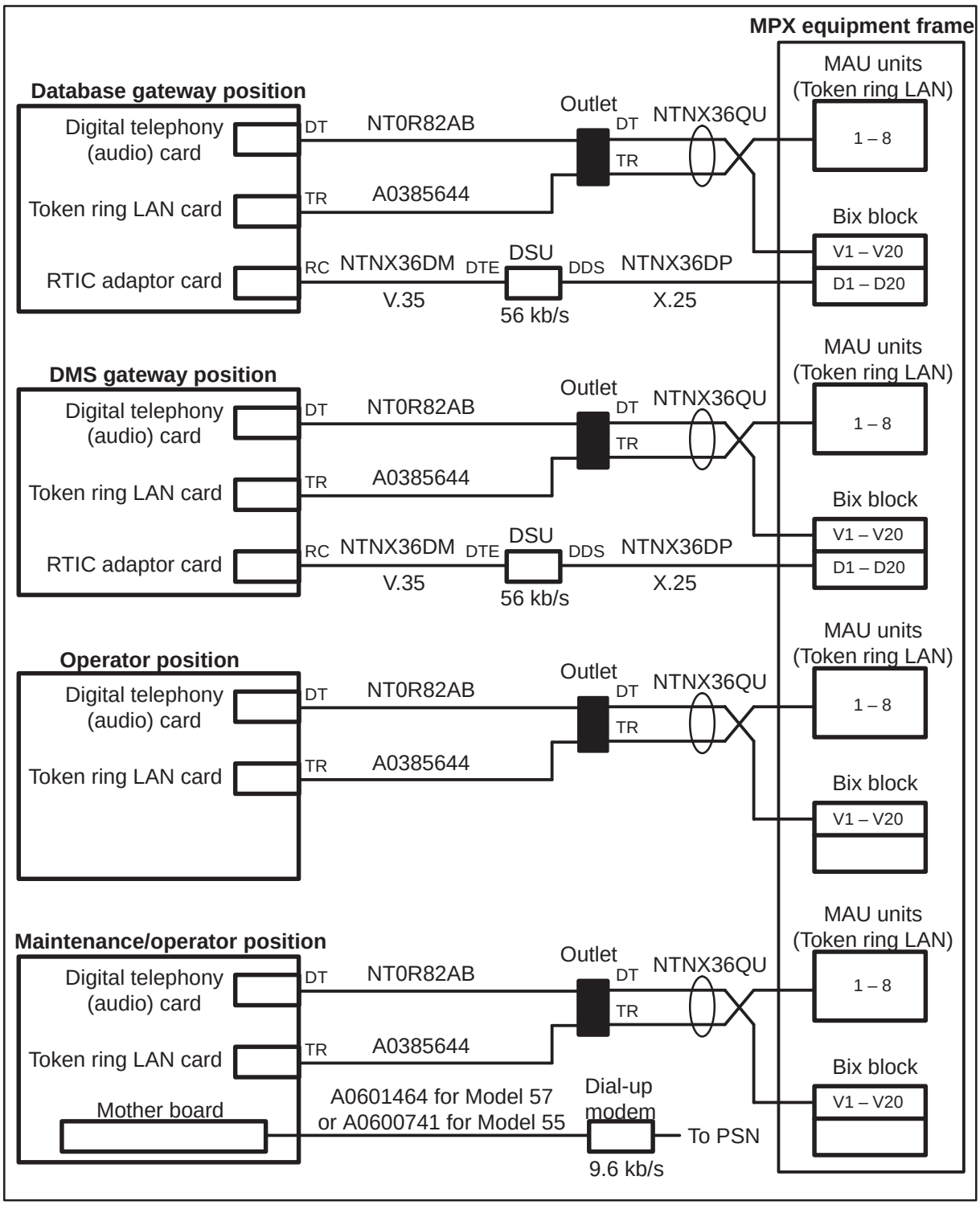
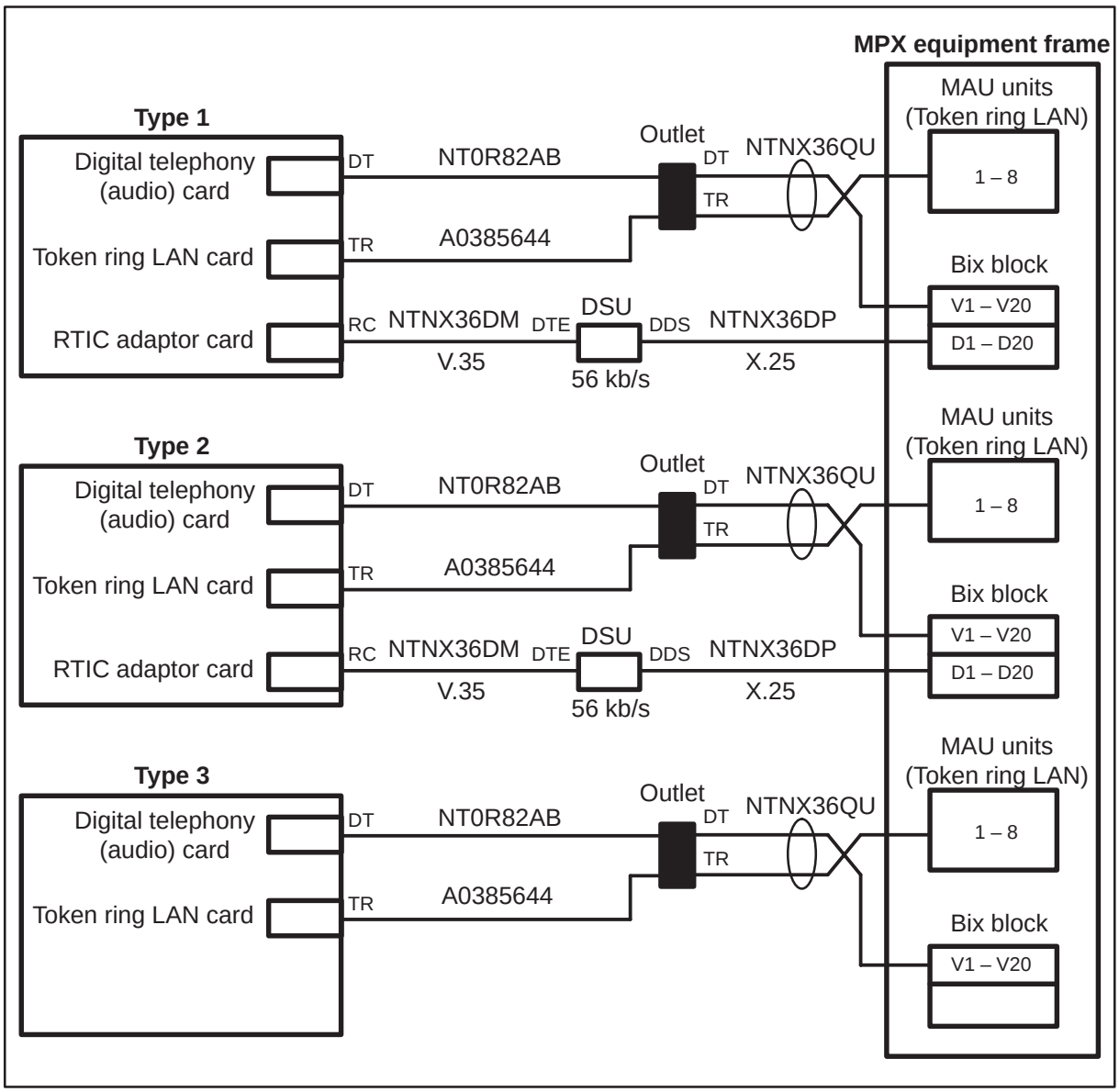


Figure 2-3
Earlier MPX workstations



3. Power distribution

The requirements described herein ensure a controlled and protected distribution of power to the TOPS MPX system (this includes both MPX-IWS and earlier MPX workstation equipment). Power sources for the TOPS MPX shall conform to applicable requirements of *DMS-100 Family Power Distribution and Grounding Systems User Guide*, 297-1001-156 and the following paragraphs.

3.1. AC power

A 120 V ac, 60 Hz power source provided by the operating company is used to power the TOPS MPX system. NTP 297-1001-156 contains guidelines for use of the following ac power equipment:

- commercial ac
  - — ac panel dedicated to TOPS MPX equipment, or
  - — branch circuits (when very little ac power is needed)
- special ac
  - — stand-alone inverter
  - — uninterruptible power source
  - — standby engine alternator
  - — isolation transformer

Operating companies usually treat TOPS MPX workstations and associated equipment as no-break loads powered from appropriate ac power sources. A dedicated distribution panel is usually used to feed branch circuits to the equipment.

When operator equipment is collocated with its associated host DMS switch in the same building, ac power is usually supplied from an inverter deriving its –48 V dc input from the same power plant used by the host switch. Operator equipment remote from the host switch is usually powered from an uninterruptible power supply (UPS). The inverter or UPS must have the capacity to power all the workstations. A 20-position operator services center with Type-1 and Type-2 workstations, for example, requires an inverter or UPS with at least a 7-kVA rating (20 x 120 x 2.6).

The UPS should be an on-line (inverter preferred) type that transfers to alternate power within 50 milliseconds of an undervoltage or overvoltage condition. Also, the reserve time of the UPS should maintain power through typical durations of commercial power outage. Output protection in the UPS shall be coordinated with the overcurrent protection in the distribution panel. The UPS is normally placed in close proximity (within one floor) of the operator equipment.

3.2. Workstation

Workstations have power cable and plug assemblies attached to the rear of the display monitor and to the terminal base unit (Figure 3-1). These power cables plug into a power strip (surge suppressor) used with each workstation. The workstations are ac powered (120 V, 60 Hz). Current drains for MPX-IWS and earlier MPX type positions are shown Tables 3-1 and 3-2.

3.2.1. Modem

The modem is powered through a cable and plug assembly which plugs into the power strip (Figure 3-1).

3.2.2. Power strip

A power strip is used with each workstation. The power strip is a transient voltage surge suppressor with straight-blade, 3-wire receptacles for power plugs from the display monitor, terminal base unit, and the modem.

The power strip has a 12-foot, 3-wire power cord terminated with a straight-blade connector plug. This connector plugs into an ac-powered receptacle provided by the operating company (the following figure).

A 15 ampere load may be drawn from any of the outlets.

CAUTION
Loss of service
The total load on all outlets must not exceed 15 amperes. Overloading the outlets could interrupt power to the operator equipment.

3.3. MPX equipment frame

Power is not required at the MPX equipment frame, so a frame supervisory panel is not used. Also, MPX equipment frames do not have cable troughs. If required, cable racks are installed in accordance with site floor plan drawings.

Figure 3-1
Workstation power

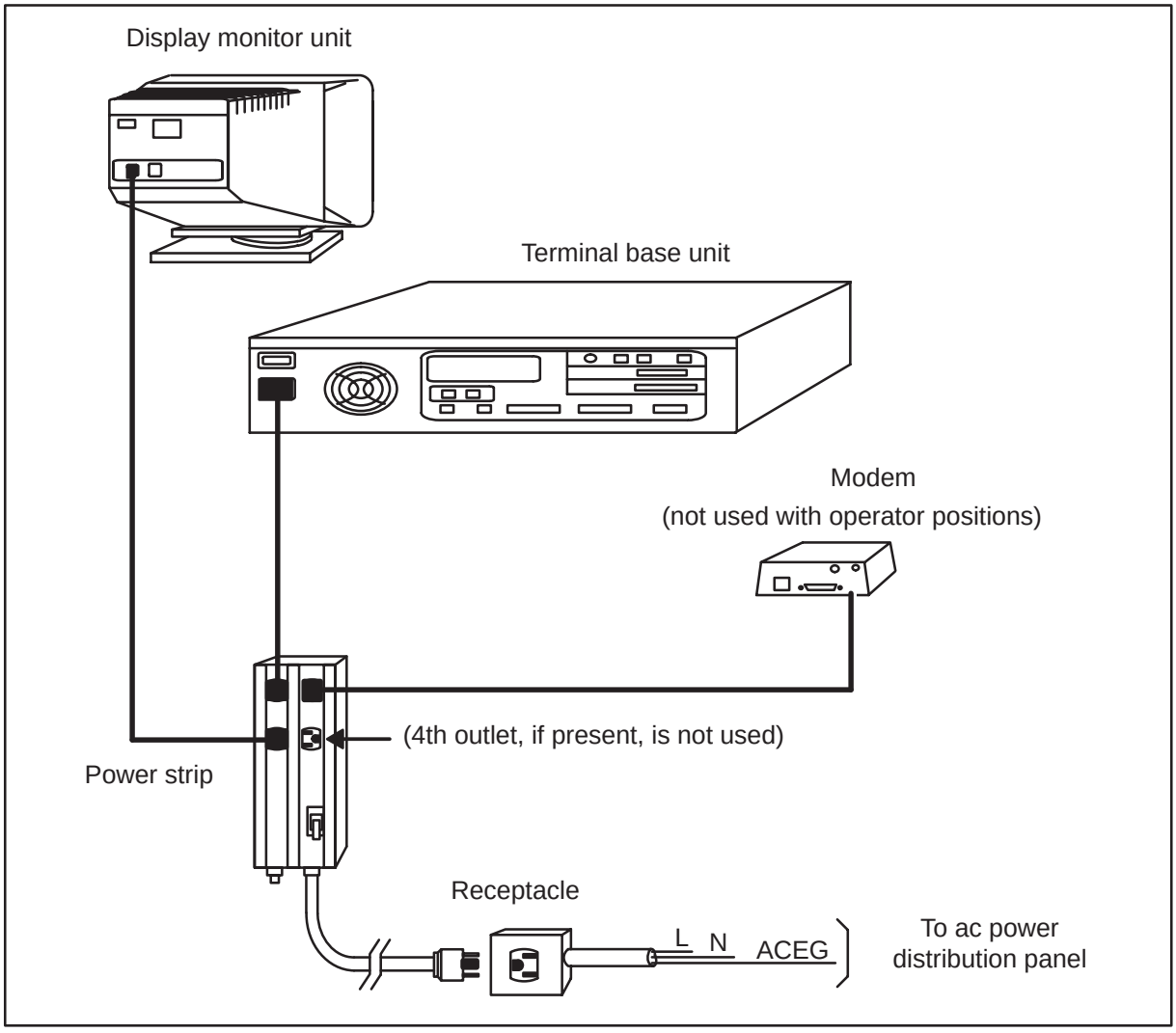


Table 3-1
Current drains for MPX-IWS workstations

MPX-IWS Workstations	Database Gateway or DMS Gateway	Operator	Maintenance/ operator position
Terminal Base Unit (IBM PS2 Model 57)	0.6 A	0.6 A	0.6 A
Display Monitor IBM Model 9524	1.0 A	1.0 A	1.0 A
Modem	0.5 A	N/A	0.5 A
Total current drain	2.1 A	1.6 A	2.1 A

Note: The current MPX-IWS terminal base unit has a 486 25/50-Mhz central processor, 8 Mbyte of RAM, and a104-Mbyte hard disk drive unit.

Table 3-2
Current drains for earlier MPX user workstations

MPX Workstation	Types 1 and 2	Type 3
Terminal Base Unit (IBM PS2 Model 55SX)	1.1 A	1.1 A
Display Monitor	1.0 A	1.0 A
Modem	0.5 A	NA
Total current drain	2.6 A	2.1 A

Note: The Model 55SX terminal base units can be upgraded to a TOPS MPX-IWS terminal base unit with an upgrade kit. An upgraded Model 55SX is not given a new PEC; instead, the workstation is labelled to indicate an upgrade has been applied.

3.4. TOPS IWS ethernet hardware equipment

The NTNX51DA TOPS IWS ethernet hardware requires ac power installation according to provisions of the NEC and any local code variances. Power installation must also meet the following requirements

- a nominal voltage of 120 V
- a nominal frequency of 60 Hz
- a single phase supply
- The ac equipment ground (ACEG), or safety ground, must be a separate conductor routed with the phase and neutral conductors. Do not substitute the casing of conduit or similar metallic elements that contain the feeder for this ground.

- A separate No. 6 AWG conductor shall be provided to permanently ground the frame to the common bonding network.

The current carrying capacity for the frame is based on the following:

- the NTNX51DA frame supports between two and ten Baystack 150 hubs, each hub having a current drain of 0.4 A at 120 V ac (50 W)
- the NTNX51DA frame supports two ASN routers, each router having a current drain of 3.3 A at 120 V ac (400 W)

To determine the total current carrying capacity, use the following formula

- total current carrying capacity in Amps = (0.5 A x number of hubs) + (3.3 A x number of routers)
- for a fully configured frame, the maximum current drain is (0.5 x 10) + (3.3 x 2) = 11.6 A
- according to the NEC, if the total is 12 A or less, a 15 A protected circuit will suffice

The Baystack 150 Hub (NTAR25BF) requires power from the customer-provided OSC UPS.

The ASN router (NTAR25AY) requires power from the customer-provided OSC UPS.

The IWS operator position (platform, monitor, modem, and CD-ROM drive) requires 120 V ac, 2.4 A (288 W) maximum. This power is supplied from the customer-provided operator service center (OSC) uninterruptible power supply (UPS).

The IWS operator positions are connected to a surge suppressor (NTNX5180 or NTNX5181) at each IWS position. The surge suppressor provides filtered outlets for powering the platform, monitor, modem, and CD-ROM drive.

All ASN routers and Baystack 150 Hubs in an NTNX51JA frame are connected to a common power strip (surge suppressor) A0788832. The power strip provides filtered outlets for powering up to 12 devices.

4. Grounding

Grounding for the TOPS MPX system (this includes both MPX-IWS and earlier MPX workstation types) provides immunity, within general industry accepted standards, from operational and transient phenomena that could be hazardous to personnel and to equipment. The grounding of hardware and power sources for the TOPS MPX shall conform to applicable requirements of *DMS-100 Family Power Distribution and Grounding Systems User Guide*, 297-1001-156 and the following paragraphs.

Workstations and MPX equipment frames should be installed in the common bonding network (CBN). When required by an operating company, TOPS MPX equipment can be installed in an isolated bonding network (IBN). A single point ground (SPG) must be assigned for TOPS MPX equipment located in an IBN. The SPG is the common ground reference for all TOPS MPX equipment and associated power supplies.

4.1. CBN grounding

The monitor and terminal base unit of a workstation installed as part of the CBN are grounded by way of the ac equipment ground (ACEG) conductor of their associated power cords.

Customer-provided furniture and privacy panels with metallic content used with the TOPS MPX may be bonded to a floor ground bar (FGB).

In a raised floor installation, a ground plane/grid that is bonded to the FGB may be used to bond customer-provided furniture and privacy panels.

Conductors sized at least No. 10 AWG are recommended for bonding customer-provided furniture and privacy panels. These bonding conductors may be terminated to a collector cable sized at least No. 6 AWG and bonded to an FGB.

The metal raceway and ac distribution panel serving operator positions are not required to be insulated. Also, insulation between equipment frames and the floor is not required. Typical CBN configurations are represented in Figures 4-1 and 4-2.

Figure 4-1
CBN grounding: typical single-floor installation

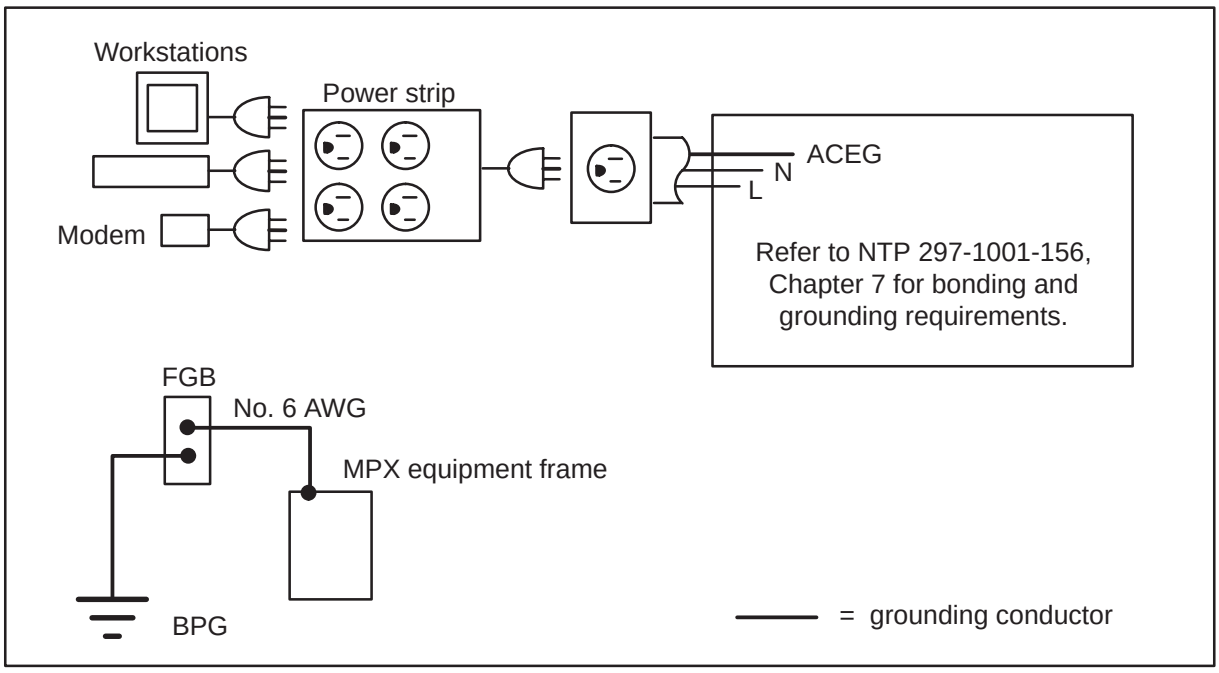
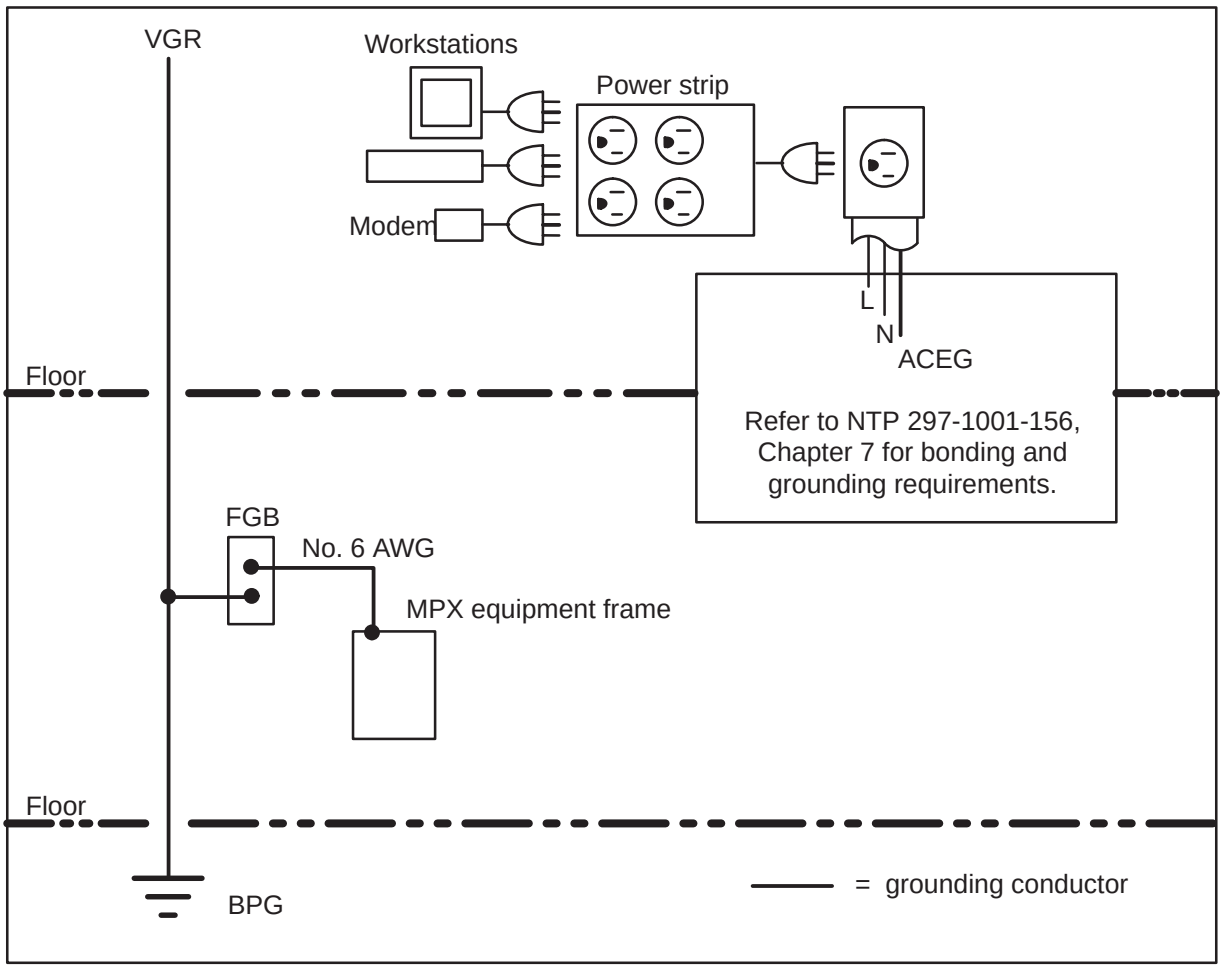


Figure 4-2
CBN grounding: typical multifloor installation



4.2. IBN grounding

Although the recommended location for the workstations is in the CBN, workstations can be installed in an IBN if required by an operating company.

The workstation monitor and terminal base unit are grounded by way of the ACEG conductor of their associated power cords.

In an IBN, customer-provided furniture and privacy panels with metallic content are typically bonded to an SPG. This SPG may be a separate busbar dedicated to the workstations, or it may be the DMS SPG when the operator workstation area is located within one floor of the associated DMS host switch.

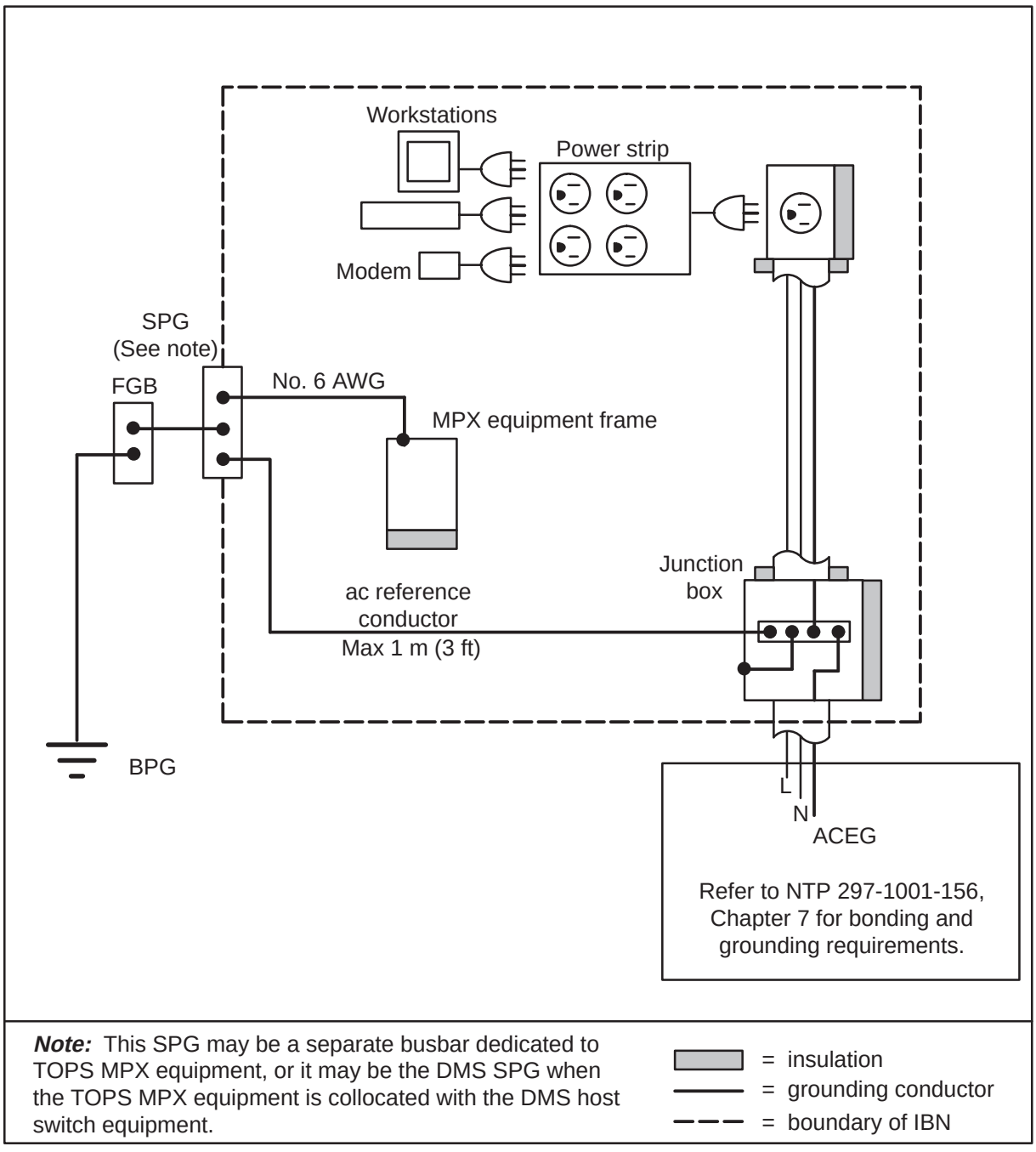
Conductors sized at least No. 10 AWG are recommended for bonding customer-provided furniture and privacy panels. These bonding conductors

may be terminated to a collector cable that is sized at least No. 6 AWG and bonded to an SPG.

All equipment located in an IBN must be insulated from the floor and intentionally grounded only to the SPG. Typical IBN grounding installations for the TOPS MPX are represented in Figures 4-3 and 4-4. The following grounding requirements apply:

- The ac grounding conductors of the distribution panel serving operator positions should be bonded to the SPG with a conductor no longer than 1 m (3 ft), unless otherwise agreed to by the operating company.
- Other than the SPG connection, it is not permissible to make additional connections from operator equipment and associated metal raceways to the CBN.
- The metal raceway of the ac power distribution serving an operator position is insulated from the CBN.
- TOPS MPX equipment located in an IBN shall not share the same enclosed floor area with other TOPS MPX or equivalent devices located in the CBN. A minimum of 2 m (7 ft) shall separate the outermost boundary of an IBN from the CBN. Operator headset cords and similar extendable metallic units are included in determining the outermost boundary of an IBN.
- Personal lights, fans, heaters, and other ac powered equipment should not be placed within 2 m (7 ft) of any workstation. If this 2 m (7 ft) separation is not possible, the following guidelines must be observed:
  - — Insulating screens or barriers should be installed between the TOPS MPX and other equipment in the CBN.
  - — Metallic objects (other than TOPS MPX equipment) shall be bonded to the SPG either directly or through an integrated collector bar (ICB). This bonding is not required if these metallic objects are insulated from contact by an insulating screen or are already bonded to the SPG.

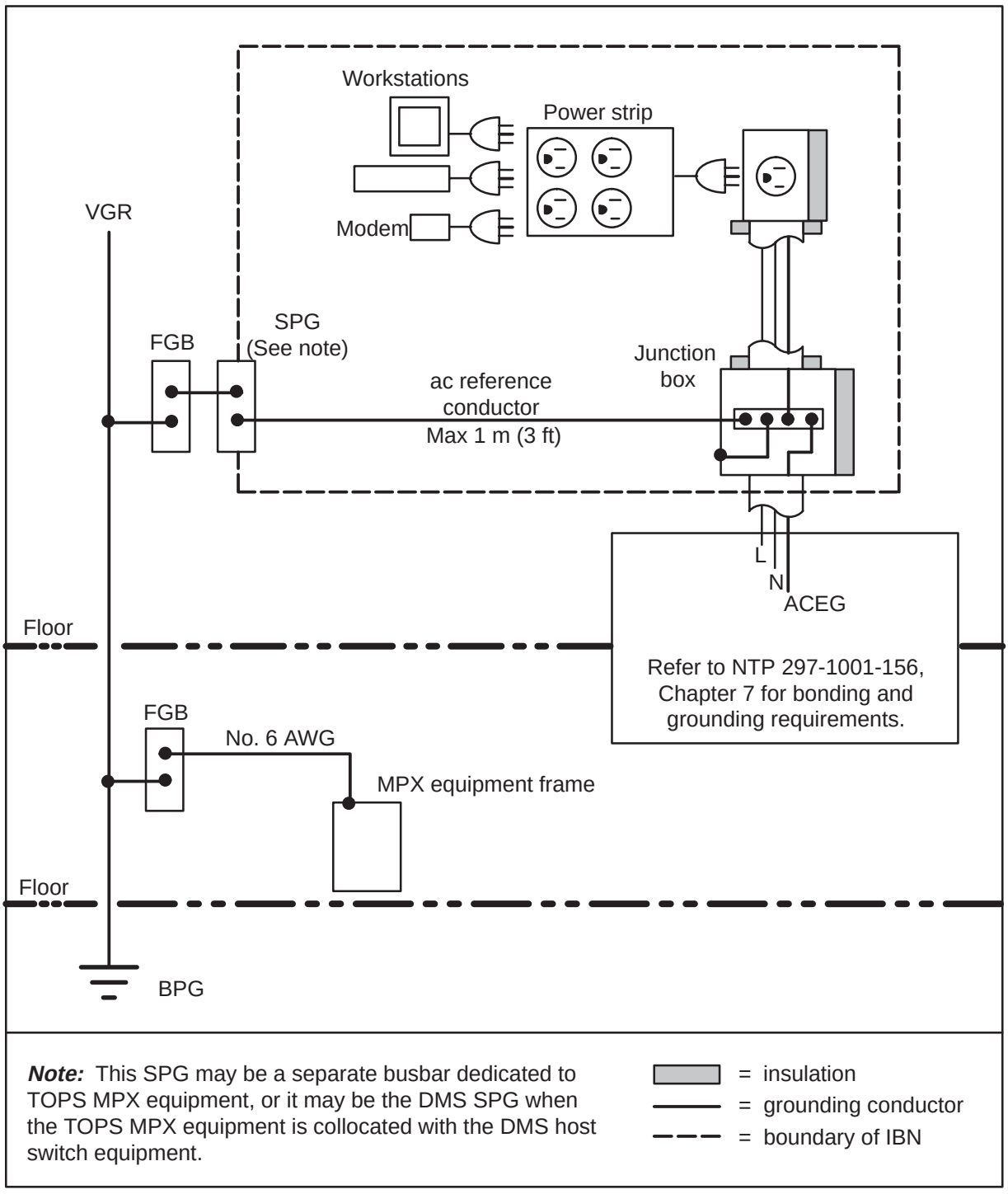
Figure 4-3
IBN grounding: typical single-floor installation



Note: This SPG may be a separate busbar dedicated to TOPS MPX equipment, or it may be the DMS SPG when the TOPS MPX equipment is collocated with the DMS host switch equipment.

= insulation
= grounding conductor
= boundary of IBN

Figure 4-4
IBN grounding: typical multifloor installation



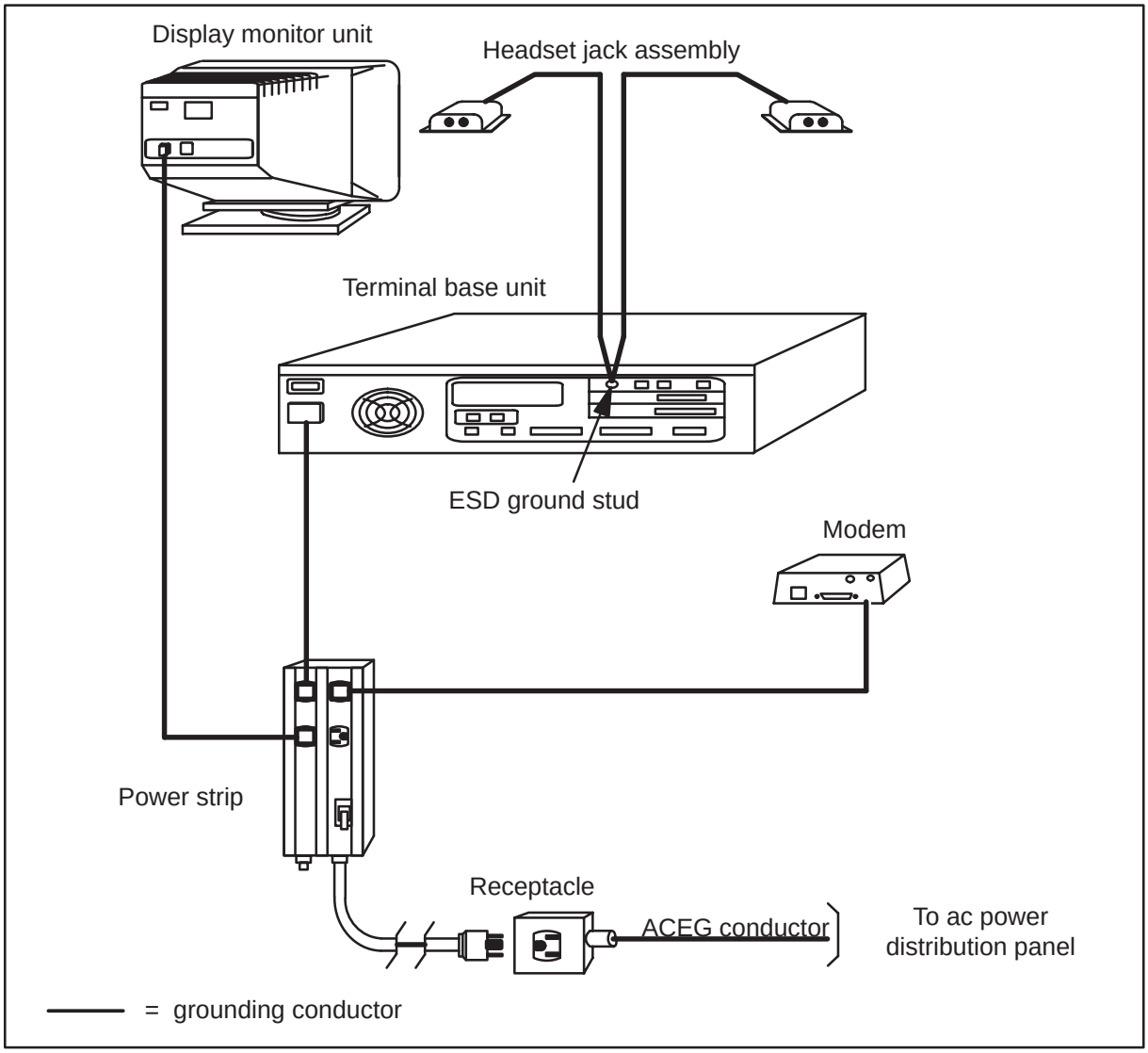
4.3. Workstation

Operator position equipment shall be located within one floor of the point at which their ac distribution panel is grounded.

The workstation is plastic-encased to prevent electrostatic discharge (ESD) and to protect personnel from an electrical hazard.

The display monitor and the terminal base of the workstation both have ac power cords. The modem also has an ac power cord. The workstation and modem are grounded by ACEG conductors in these power cords. Refer to Figure 4-5.

Figure 4-5
Grounding workstation



An ESD ground stud on the digital telephony card located in the terminal base unit is used to connect the ESD ground straps of the two headset jack assemblies. If required by the operating company, this ESD ground stud may also be bonded to a nearby ground reference (such as a floor ground grid) of the building grounding system.

If a conductive bezel or anti-glare screen guard with an ESD ground wire is provided for the display monitor, the ground wire should be connected to a nearby ground reference or to the ESD ground stud on the digital telephony card located in the terminal base unit.

A large group of workstations can be arranged to suit the floor plan of an operating company. If desks and any privacy panels with metallic content are supplied by the operating company, they should be bonded to the CBN.

4.4. MPX equipment frame

The MPX equipment frame is usually placed in a wiring closet or equipment room near the operator workstation area. Although the frame is passive (requires no external power input), it must be bonded to the building grounding system. Usually, it is located in the CBN (Figures 4-1 and 4-2).

If the MPX equipment frame is placed in an IBN, the frame must be isolated from the floor and bonded to the SPG (refer to Figure 4-4). When the MPX equipment frame is collocated with the DMS host switch, the DMS SPG can also be used as the SPG.

4.5. TOPS-IWS ethernet hardware equipment

The NTNX51JA 24-inch miscellaneous frame (GMIS) frame contains the signaling components of the TOPS IWS operator position and operating company switching equipment. These components are ac-coupled to provide grounding separation. The recommended grounding topology for the IWS equipment is the common bonding network (also known as integrated ground plane). The requirements of the grounding and bonding network are described in *Power Distribution and Grounding Systems User Guide*, 297-1001-156.

Note: The NTNX51DA TOPS-IWS system must not be installed in the operating company isolated ground plane.

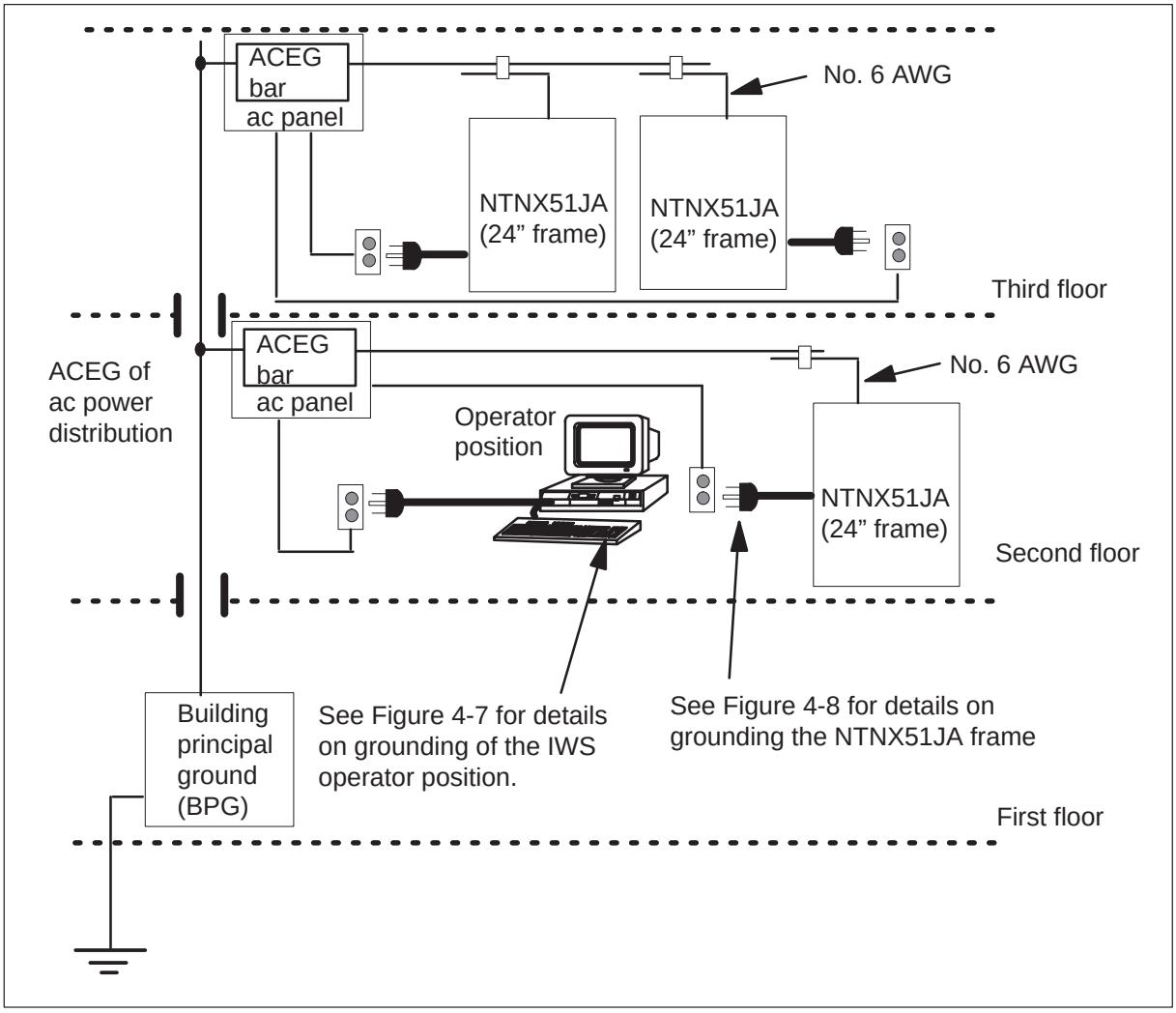
The frame should be grounded to the ACEG bar of the ac panel that feeds the frame. The frame can be grounded to the ac outlet receptacle if the receptacle is metal.

In general, all signaling between components of the NTNX51DA system (the IWS operator position, ethernet hubs, and ASN routers) and operating company switching equipment (such as channel banks and timing source

generator) are ac-coupled to provide ground separation. Grounding details are provided for individual components in this section.

The common bonding network grounding for the IWS system is shown in the following figure.

Figure 4-6
CBN grounding of the NTNX51DA



4.5.1. TOPS IWS operator position grounding

The TOPS IWS operator positions are grounded by way of the ac equipment ground (ACEG), commonly referred to as the green safety wire. The ACEG provides a chassis ground for the platform, monitor, and surge suppressor through the ac power cord. The ACEG carries no load. A green wire from the headset jack assembly connects to the platform chassis. This green wire

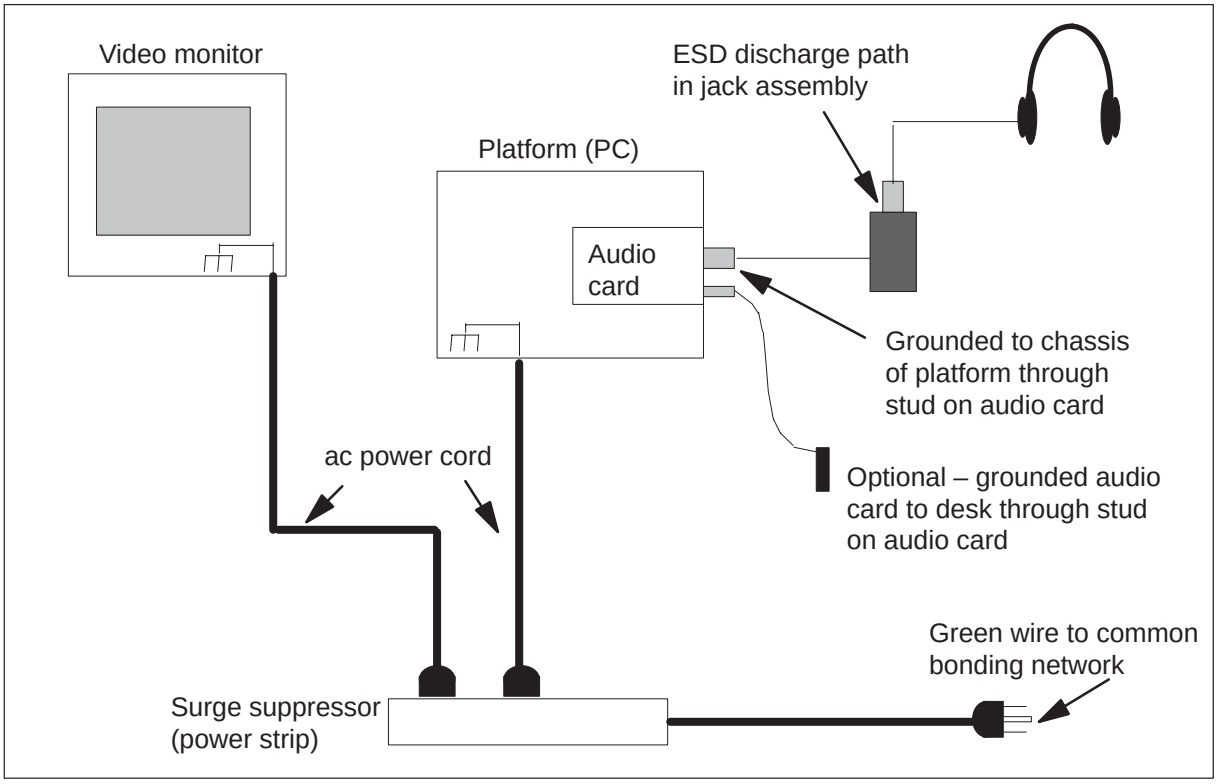
provides a discharge path through a surge suppressor for the sleeve lead of the headset plug.

Grounding the PCI audio card

The peripheral component interconnect (PCI) audio card has two ground lugs on the face of the card. If the audio card must be grounded to the same ground plane as the furniture, use the ground lug on the left side of the card. Use the ground lug on the right side of the card to ground the headset jack assemblies.

Note: No other equipment should be grounded to the audio card.

Figure 4-7
TOPS IWS operator position grounding



4.5.2. NTNX51JA open frame grounding

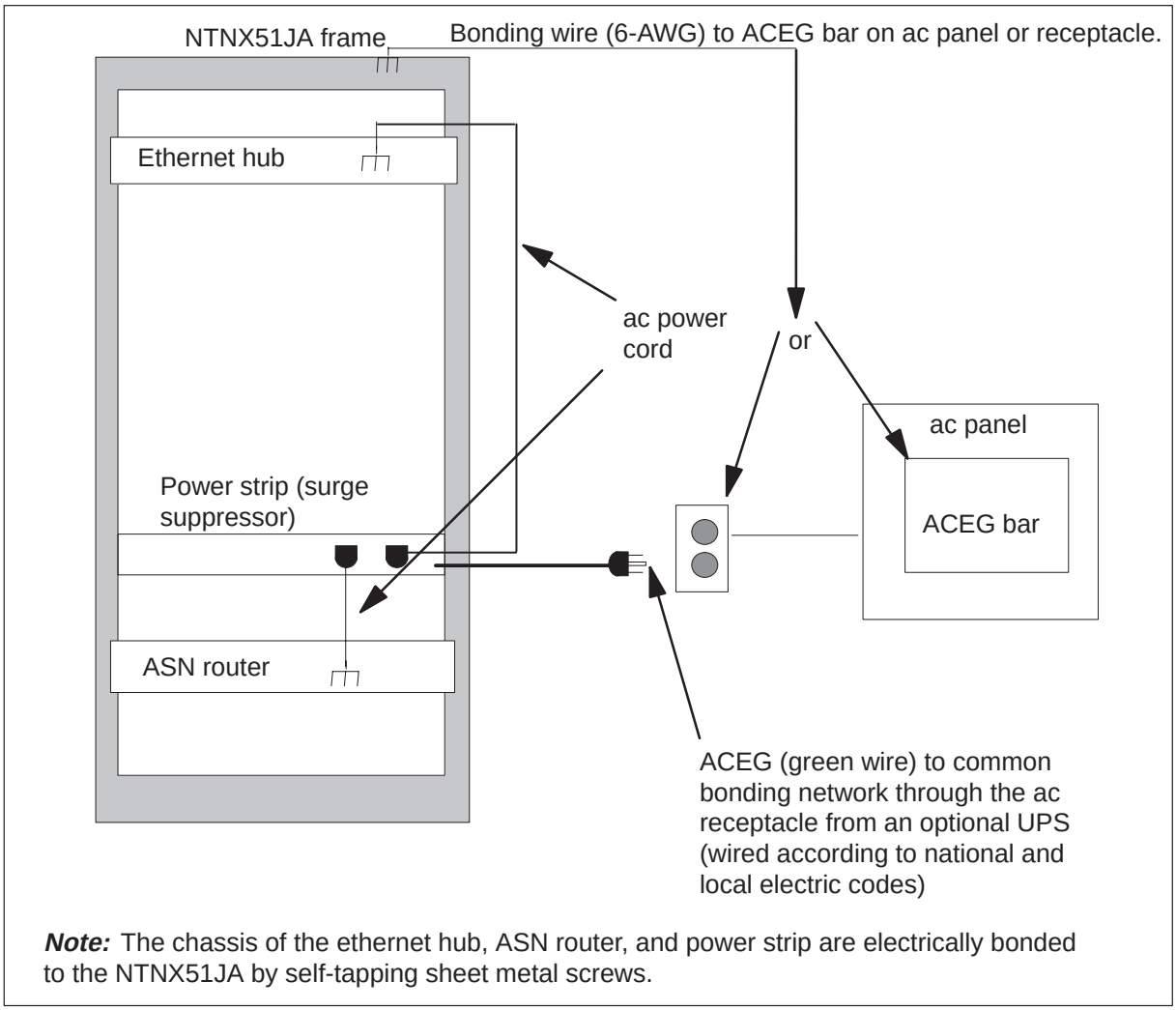
The NTNX51JA open frame contains building interoffice connect (BIX) blocks, ethernet hubs and Access Stack Node (ASN) routers. The following grounding requirements apply:

- The BIX blocks are passive crossconnect blocks made of plastic. The BIX blocks carry ac coupled data signals on intraoffice pathways. No special grounding considerations apply to the BIX blocks.

- The ethernet hubs and ASN routers are active ac-powered components directly (chassis) grounded to the NTNX51JA frame. An ACEG wire also provides ground protection through the ac power cord.

The following figure shows the safety grounding for the NTNX51JA and installed components.

Figure 4-8
NTNX51JA grounding



Note: The chassis of the ethernet hub, ASN router, and power strip are electrically bonded to the NTNX51JA by self-tapping sheet metal screws.

The following requirements apply to the frame installation:

- If the frame is in a lineup with other frames, connect the frame ground to the overhead framework ground bus with a No. 6 AWG cable. If that is not possible, the frame can be grounded to the outlet receptacle if it is metal.

- Do not ground the NTNX51JA to the operating company isolated ground plane.
- If the NTNX51JA frame is stand-alone frame, provide a No. 6 AWG grounding cable to the ACEG bus of the ac distribution panel or the receptacle that feeds the frame.
- The grounding cables shall be terminated with 2-hole compression type lugs at both ends. If connections to painted surfaces must be made, the paint shall be removed and the lug mounted flat onto the conducting surface. Do not use a star or lock washer.
- The ac power cables for the Hubs shall be run on the inside of each frame. The power cables can be run on both sides of the frame.
- The customer may provide an uninterruptible power supply (UPS), however it is not required.

4.5 Electrostatic discharge

Control of relative humidity can be an effective means for electrostatic discharge (ESD) mitigation. Rooms containing workstations should be maintained within the range of 40 to 55 percent relative humidity.

Normal carpeting can cause excessive build-up of electrostatic charge. The workstation is plastic-encased to prevent ESD and to protect personnel from an electrical hazard. In addition, properly installed ESD-dissipating vinyl or carpet floor covering is recommended for use in the operator position area. An ESD ground mat at each operator position can be used instead of an ESD-dissipating floor.

Service personnel working on a workstation should stand on ESD floor mats and/or wear ESD wrist straps. If servicing is performed at a work bench, the bench top should be covered with a grounded ESD dissipating mat. Circuits to the workbench should be equipped with ground fault circuit interrupters (GFCIs).

Only carpeting that is intended for ESD control and that meets American Association of Textiles, Chemists, and Colorists (AATCC) Test Method 134 without the use of anti-static sprays should be used in the operator area. Anti-static carpet sprays are not dependable, need frequent replenishing, and can damage plastic surfaces and finishes of equipment in the operator area. Also, ordinary floor wax should not be used on ESD-dissipative vinyl flooring. Refer to recommendations of the manufacturer for care of the flooring.

DMS-100 Family

TOPS MPX

Power Distribution and Grounding Guide

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