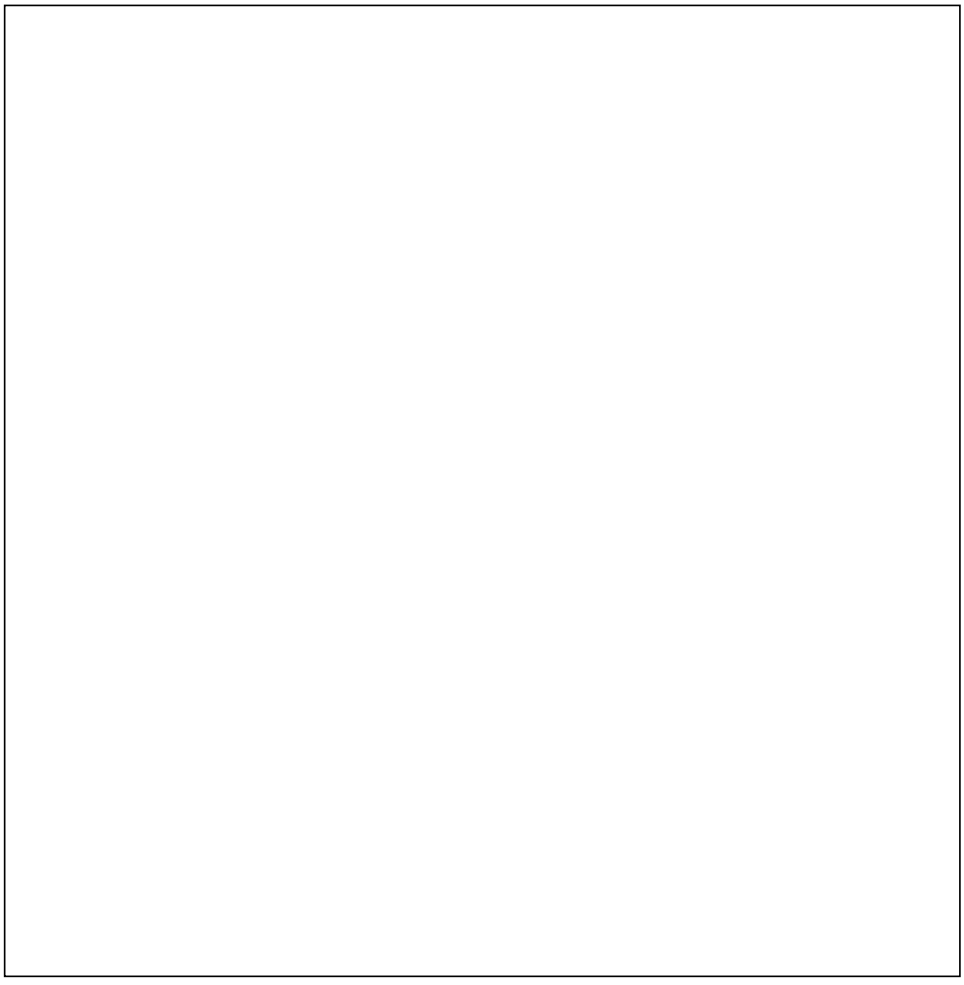
PLN-2281-001

DMS-100 Family

# TOPS MP/04
# Technical Specification

Standard 02.01 July 1992



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# Publication history

**July 1992** Content changes to *Power and Grounding*

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Revision bars in the table of contents identify the sections where technical information has been changed. Revision bars in the outside margin of a page indicate text that has been added or revised.

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# About this document

The *DMS-100 Family TOPS MP/04 Technical Specification* describes functional and operational characteristics of the TOPS MP and TOPS 04 systems. These systems provide automated, operator-assisted services with a DMS-200 stored program switch, which supports full switching system capabilities.

## Applicability of this document

This document applies to all DMS-100 Family offices.

## Where to find information

This technical specification should not be considered an inclusive document. The manual is intended to supplement material presented in Northern Telecom Practices (NTPs) which describe the TOPS systems. Should a conflict in the content occur, the content-specific NTP is the final authority.

For an overview of the DMS-100/200 configuration, refer to the *DMS-100 Family Technical Specification*, PLN-1001-001 for additional information.

***Note:*** More than one version of this document may exist. The release of this document supercedes all previous issues. To determine which version of a document applies in your office, check the release information in *Northern Telecom Publications Master Index*, 297-1001-001.

# Introduction

The *DMS-100 Family TOPS MP/04 Technical Specification* describes operational and functional capabilities, as well as current features of the TOPS systems. The TOPS systems provide automated and operator-assisted operator services, such as automatic call distribution, recorded billing details, information retrieval, and call completion. This concept integrates a TOPS system with the DMS-200, a stored program controlled toll switch. A TOPS system also provides full switching system resources, to include digit analysis, routing, call detail recording, and maintenance and administration. There are two TOPS system configurations.

The TOPS multipurpose (MP) configuration is the most advanced operator position in the ongoing evolution of automated operator-assisted systems. This universal operator position includes a new keyboard design which further reduces the number of keystrokes an operator enters. An enhanced screen displays call handling data for toll, directory assistance, intercept, and revenue-generating service databases. TOPS MP versatility allows force management, in-charge, assistance, and operator positions to use identical keyboard and terminal equipment. Through its fully integrated interface with the DMS-200, a high-speed data access card allows drive data transmission to external databases. The TOPS MP meets operating company service requirements with maximum efficiency and reliability.

The TOPS 04 configuration is an enhanced version of earlier TOPS positions. Features that improve operator comfort, security, and ease of maintenance for this configuration are included in this technical specification.

Both TOPS configurations reduce maintenance and administration costs associated with operator services. They also allow operators to use the same terminal for toll, directory assistance, an operator reference database, and access to new services. These TOPS systems also minimize the number of manual operations performed by an operator. The DMS-200 supervises each call by releasing or returning the call to the operator as required. These calls are connected to an operator position only when operator assistance is required.

The following paragraphs describe each chapter of the *DMS-100 Family TOPS MP/04 Technical Specification.* Both TOPS MP and TOPS 04 are described separately within each section of this document.

### Chapter 1

The *Introduction* contains an overview of TOPS and provides a brief description of TOPS MP and TOPS 04.

### Chapter 2

*TOPS System Configurations* describe each TOPS system configurations. Operator centralization, local and remote office configurations and floor plan designs also are included in this section.

### Chapter 3

*TOPS Equipment* details equipment used in both TOPS MP and TOPS 04 systems.

### Chapter 4

*Features* describes both standard and optional features which are available with each TOPS system.

### Chapter 5

*TOPS Call Processing* includes call processing functions which occur when TOPS processes a call. Also included in this chapter are examples of typical call types and flowcharts illustrating the call process.

### Chapter 6

*Administration* describes the administration and operational functions of the TOPS system. Information in this section chapter office administration, force administration, and hotel billing information center administration.

### Chapter 7

*Provisioning* outlines provisioning requirements, as well as procedures for provisioning a TOPS office. Both hardware and software provisioning are included.

### Chapter 8

*Maintenance* describes hardware and call processing maintanance for the TOPS systems.

### Chapter 9

*Transmission* details transmission levels and characteristics for the TOPS systems. Guidelines for measuring and adjusting specific analog transmission parameters, which ensure call processing quality, and data transmission levels also are included in this section.

### Chapter 10

*Power and Grounding* outlines power and grounding requirements for a TOPS system. This power distribution system controls and protects distribution of ac and dc power to dc-powered TOPS positions. The grounding system, which must provide immunity from hazardous operational and transient voltages, also is detailed here.

### Chapter 11

*Operator Training* for the TOPS systems describes two computer-controlled simulators TOPS. These traffic simulators that deliver calls to each position for the operator to process. The TUTOR-3B training adapter, a computer-assisted instructional system developed for Northern Telecom Inc., simulates call handling at TOPS 04 operator positions.

This technical specification does not provide pricing or feature packaging information for the DMS-100 Family systems. Quantification of parameters is provided only where it is necessary for evaluation of a capability or feature.

This issue of the *DMS-100 Family TOPS MP/04 Technical Specification* supersedes and replaces all prior issues. The ordering number for this document is PLN-2281-001.

Additional copies of this document may be ordered by contacting your operating company documentation coordinator or by calling the Northern Telecom merchandise ordering department. Include purchase order numbers when calling the toll-free number (800)347-4850.

Purchase orders may be sent to the following address.

> Merchandise Order Specialist, Department 6611, Northern Telecom Inc., P.O. Box 13010, Research Triangle Park, NC 27709.

# TOPS System Configurations

The TOPS system configurations are based on either a DMS-100/200 switch or a DMS-200 switch. TOPS MP, TOPS 04, and the auxiliary operator services system (AOSS) can be supported by the same DMS-100 Family switch. The DMS-100/200 TOPS configuration provides toll and local services, such as Meridian digital centrex (MDC) service. A DMS-200 system provides toll services which include the processing of operator-assisted calls at the operator position. The system also provides transfer and tandem capabilities for other calls routed directly to an inter-exchange carrier (IC) operator.

When a TOPS system is configured, both software and hardware must be integrated into the existing DMS network. All operator positions must be associated with or dedicated to components of the DMS network. Elective TOPS features, such as billing, rating, hotel/motel, and coin calls also must be integrated into the DMS software. Either TOPS system configuration is based on the needs of the operating company and its statistical analysis of traffic data.

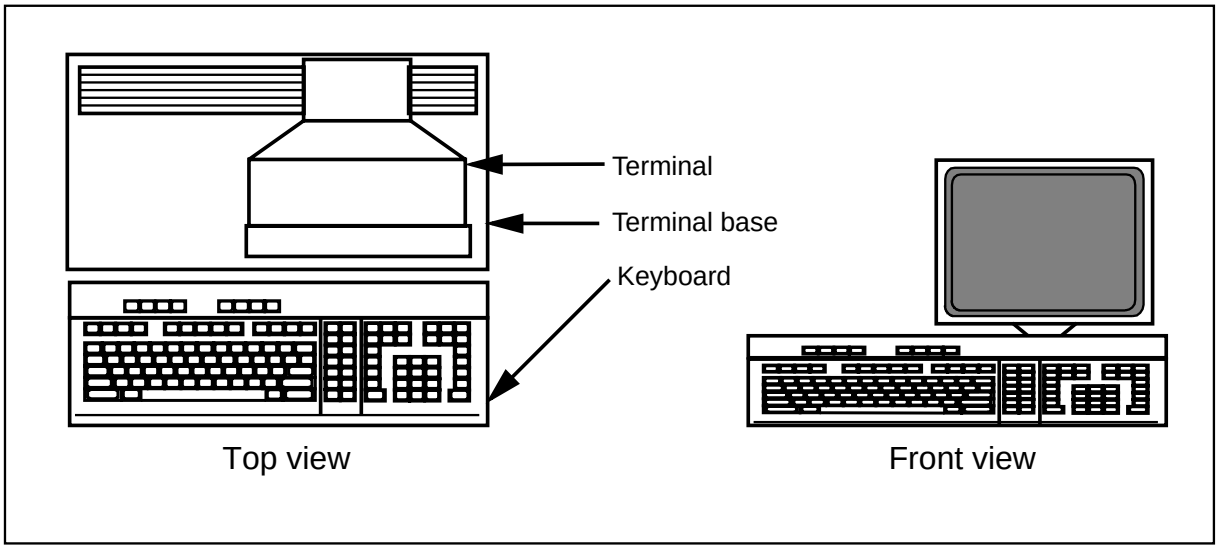
Refer to *Provisioning*, Chapter 7, for a description of centrum call seconds (CCS) engineering, and hardware, software and operator centralization provisioning as it relates to these system configuratios.

## TOPS MP configurations

TOPS MP is compatible with all other DMS-100 Family operator systems. TOPS MP operator positions can be collocated with other toll operator positions, such as TOPS, in the same operator services center.

The TOPS MP is available in two configurations: the desktop model, shown in Figure 2-1, and the integrated workstation. The desktop model consists of a cathode-ray tube (CRT) terminal, keyboard, and a headset interface. The workstation is a modular position which consists of this equipment as it is integrated into a new, fully adjustable sit/stand ergonomic desk.

TOPS MP Desktop Model




The modular desktop model is placed on a work surface like a personal computer. The keyboard requires sufficient space in front of the TOPS MP terminal to provide a work area which supports the 20.5 by 10 by 2 inch keyboard. The TOPS MP terminal requires a work area of 22 by 13 inches. The height of the terminal is approximately 19 inches from the base to the top of the CRT.

Power and signal cabling enters the TOPS MP terminal from the rear. Headset cabling, to support two headset jacks, is connected to the rear of the terminal base. All modular terminals must be grounded to the appropriate office ground using Northern Telecom specifications to ensure safe and proper operation. All TOPS furniture is fully grounded. This furniture meets Bellcore grounding specifications.

The integrated TOPS MP workstation encompasses a fully adjustable sit/stand operator position. Designed into the workstation are ease of operation, safety, and operator comfort. These operator workstations meet the intent of *Standards for Safety of Office Furnishings UL 1286.* The workstation is a free-standing, adjustable sit/stand desk which is approximately 29 inches wide and 51 inches long. Floor planning space should allow approximately 25 square feet per workstation, without side panels, and should include aisle and administrative space requirements. The optional side panels are designed for acoustic and visual privacy. Floor space planning should allow approximately 28 square feet for applications with side panels and aisle and administrative space requirements.

The DMS-100/200 TOPS configuration provides toll and local services, such as Meridian Digital Centrex (MDC) service.

The TOPS MP terminal consists of a monitor controller, keyboard, and a terminal. As many as four terminals can be connected to a TOPS position controller (TPC). Each MP terminal communicates with the TPC through a high-speed line interface (HSLI) link. The TPC can connect to the host switch through one of three modules: an 8-wire trunk module, digital carrier module, or a digital trunk controller module.

The TPC is a microcomputer system that processes voice and data signals to communicate with the DMS-100. The TPC also manages the screen display for each MP terminal.

The TPC terminates on the peripheral model with two sets of 4-wire, voice grade analog trunk facilities for each terminal. One 4-wire trunk carries analog voice signals. The other trunk carries data signals encoded in the 202 modem format using frequency-shift keying (FSK). As many as four TPCs can be housed in a position controller equipment (PCE) cabinet. A high-speed data access (HSDA) card and TOPS message switch (TMS) ensures data transmission to external data bases from the TPC.

The TMS, located in the TOPS MP integrated system, functions as a link concentrator and and a message switch. The TMS is used in the standard DMS frame lineup, which consists of dual NT6X LTCI shelves with TMS packfill mounted in the NT0X25 TMS frame.

TMS software supports the 1980 Consultive Committee on International Telegraphy and Telephony (CCITT) recommendations for the X.25 protocol for permanent virtual circuits between the TMS and all of its TOPS subtending nodes. TMS software in the multiprotocol controller is used to implement levels 1,2 and 3 of the seven-layer model for open system interconnect for X.25 data communication. The implementation of X.25 in the TMS is environment independent. The TMS can operate on any system.

> ***Note:*** Although the TMS uses integrated services digital network (ISDN) hardware, the TMS neither uses or implements any ISDN links in the TOPS MP standard system environment.

For information on the implementation of levels 1, 2 and 3 for the X.25 protocol, refer to the *Multi-Protocol Controller General Description*, 297-1001-139. For information on configuring and provisioning a TOPS MP Integrated TMS system refer to the *TOPS MP Planning and Engineering Guide*, 297-2281-155.

Because the TOPS MP is configured on the DMS, the system can be connected to the DMS with either analog or digital facilities. TOPS MP can also be configured through trunk modes, except when a TMS is used.

When analog facilities are used, the TPC is connected to a trunk module (TM) using up to four sets of trunks, with one set for each terminal. One set

of trunks contains one 4-wire trunk for voice signals and one 4-wire trunk for data signals. The TM converts the voice and data signals into a format which can be used by the DMS switch. At an 8-wire trunk module (TM8), trunks from the TPC can be terminated with either NT1X54AA or NT2X72AA trunk circuit cards. The TM8 can terminate up to 30 analog trunks. Both trunk circuit cards provide 600 ohm termination of 4-wire analog trunks. The cards differ in padding type, which is the means of attenuating transmission levels.

The NT1X54AA provides both software-controlled pads and preset pads. The NT2X72AA provides preset pads only.

Because voice and data trunks are paired on an individual TOPS MP position basis, these trunks should terminate with trunk circuit cards of the same type. The trunks also should be provisioned consecutively with even-numbered voice trunks and odd-numbered data trunks.

The TOPS MP always connects directly to the TPC via HSLI. Channel banks are not required for an analog/TM8 configuration. Figure 2-2 illustrates a TOPS MP analog configuration with TM8 and analog trunks.

**Figure 2-2** TOPS MP Analog Configuration with TM8 and Analog Trunks

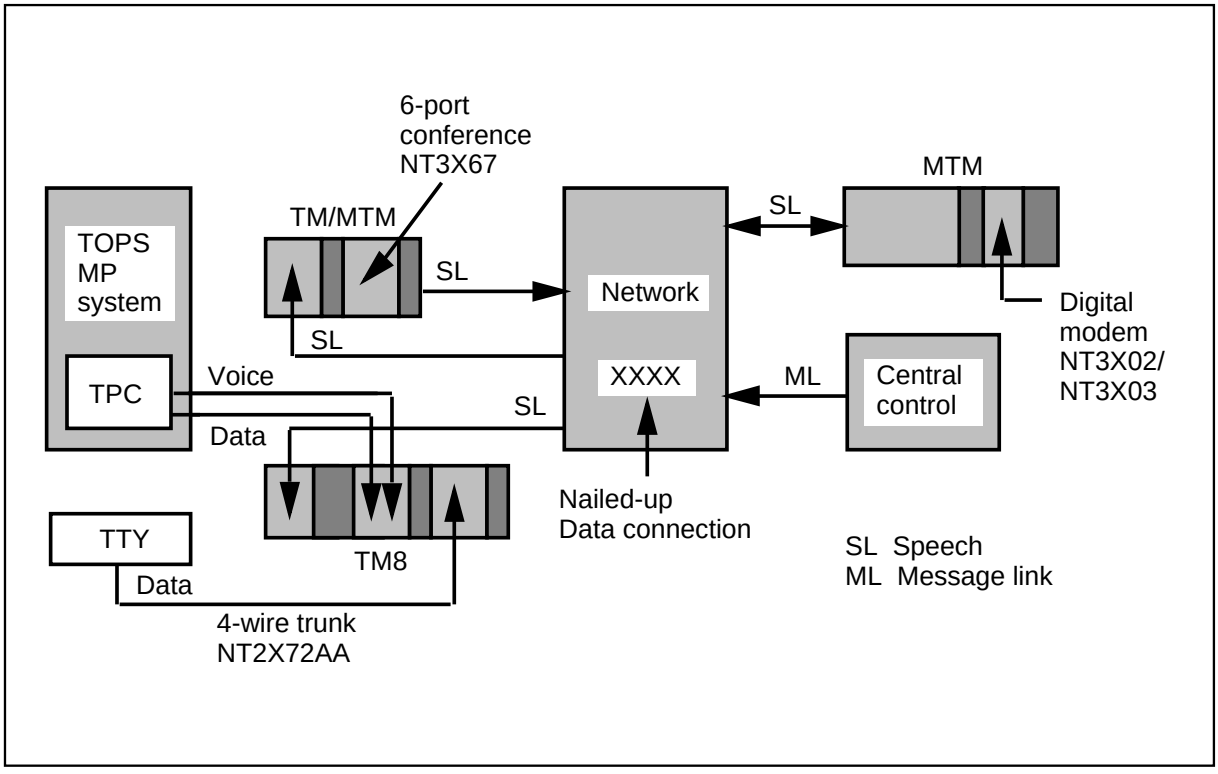
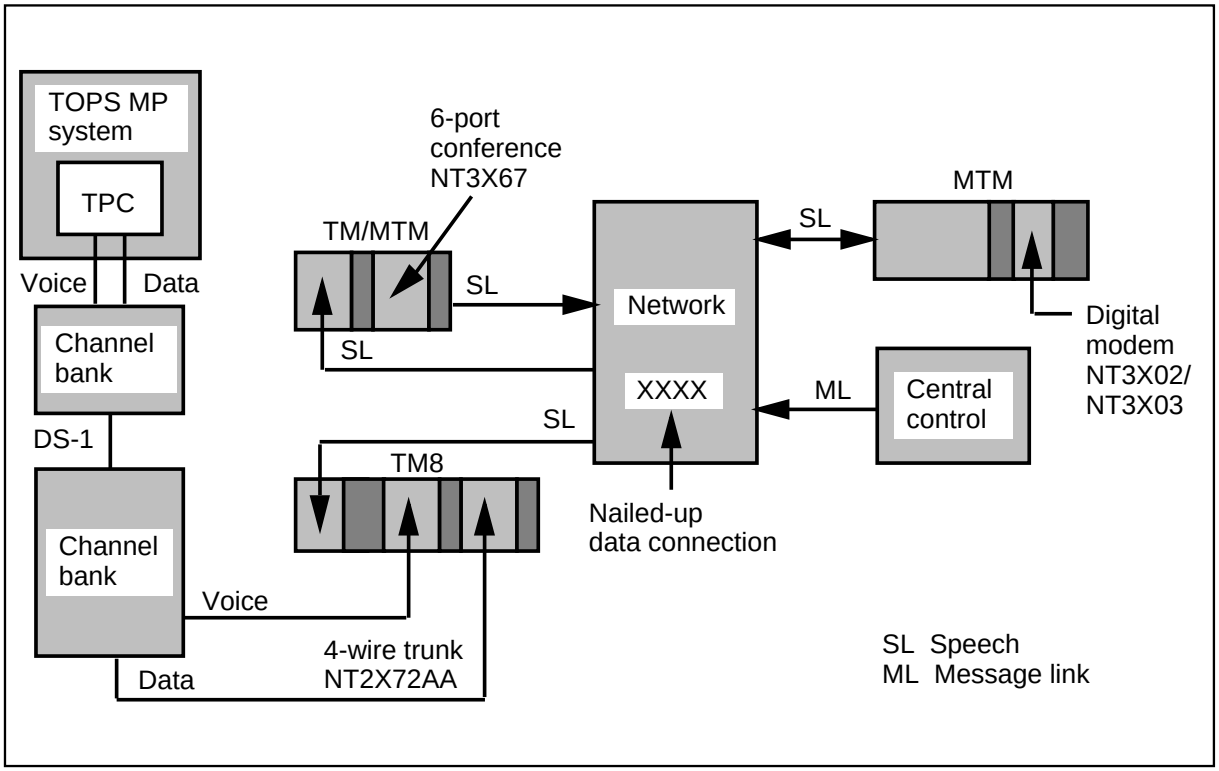


Figure 2-3 illustrates a hubrid analog and digital configuration using a TM8. In this configuration, the TPC connects to the TM8 using channel banks and a DS-1.

When digital facilities are used with a TM-8 two channel banks are required. One is connected to the TPC. The other channel bank is connected to the peripheral module.

**Figure 2-3x**TOPS MP Analog Configuration with TM8 and DS-1




At the channel banks, voice and data trunks terminate on QPP357 channel units. The QPP357 channel unit provides 600 ohm termination of 4-wire analog trunks. Of the 24 channels available, 12 are used for voice and 12 are used for data. One DS-1 facility can support up to 12 TOPS MP terminals.

If digital facilities are used, the TPC connects to a digital trunk controller (DTC) through a channel bank. The channel bank converts voice and data signals from analog to pulse code modulation (PCM) speech. These digital signals are then sent to the DTC over a DS-1 digital link.

The DTC peripheral terminates up to 20 DS-1 facilities, or 480 digital trunks. When a TPC is connected to the host switch using a DTC, DS-1 facilities provide the transmission path for voice and data signals. The two digital trunk circuits for each position are assigned four circuits apart. The

channel bank, a DE-3/DE-4 or equivalent, provides the interface between digital facilities and analog trunks to the TPC. The analog interface to the TPC remains the same, regardless of the peripheral type or the transmission facilities which are used.

The use of digital facilities, in place of analog trunks, is dictated by a combination of factors which include cost and the distance between the host switch and the TOPS MP office, as well as transmission quality considerations. TOPS MP positions can be a maximum of 1000 miles from the host switch.

Figure 2-4 illustrates a digital configuration using the DTC trunk module. In this illustration, a single channel bank and a DS-1 digital carrier facility replace analog trunks.

**Figure 2-4** TOPS MP Digital Configuration with DTC

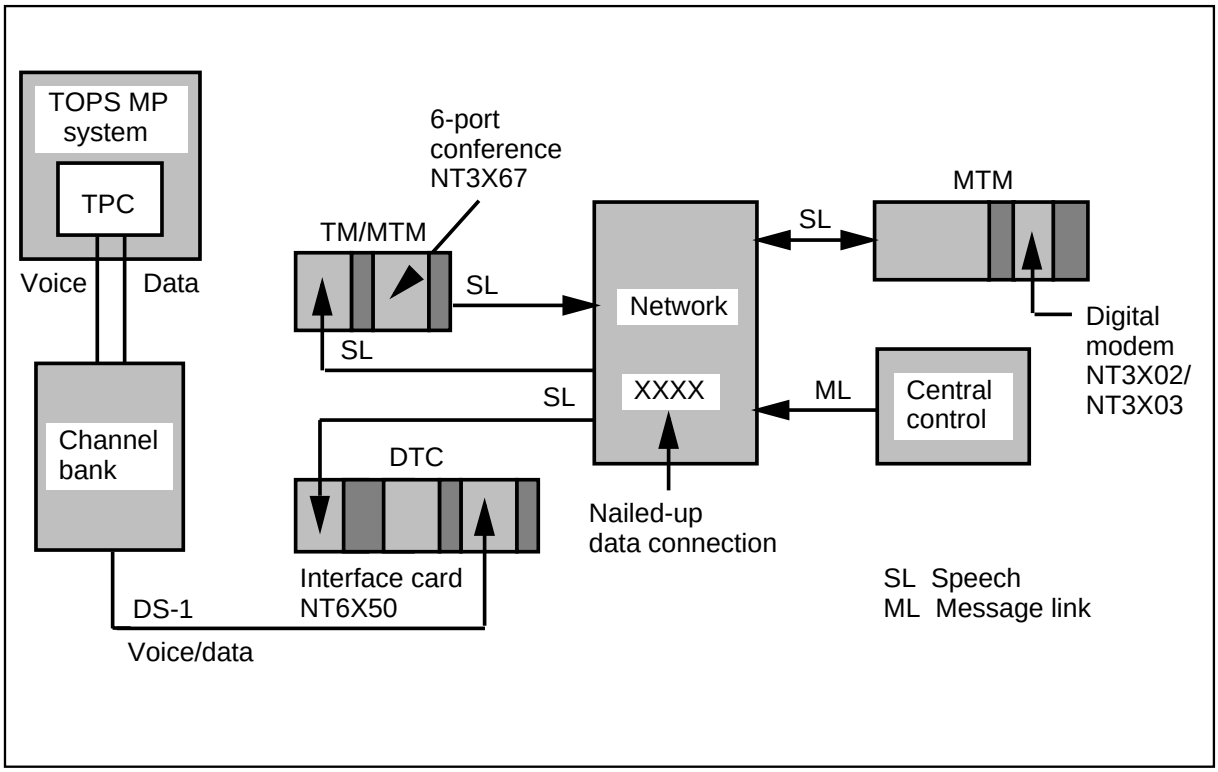
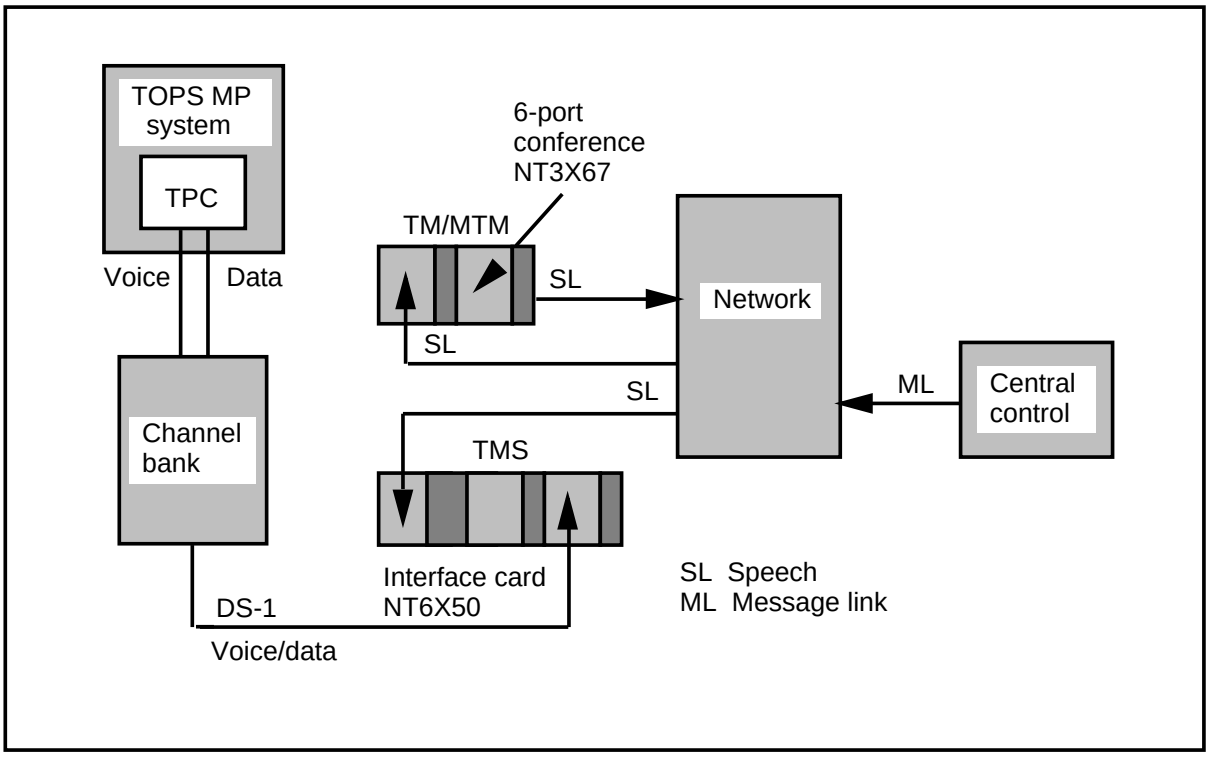



Figure 2-5 illustrates a digital configuration using the TMS. Like Figure 2-4, a single channel bank and a DS-1 digital carrier facility replaces analog trunks to the TMS.

**Figure 2-5** TOPS MP Digital Configuration with TMS




## TOPS 04 configurations

The TOPS 04 position allows the operator to simultaneously exchange voice communication with the subscriber and call processing data with the switching system. Figure 2-5 and Figure 2-6 illustrate an overview of an analog and digital TOPS 04 system.

**Figure 2-6x**TOPS 04 Analog System Overview

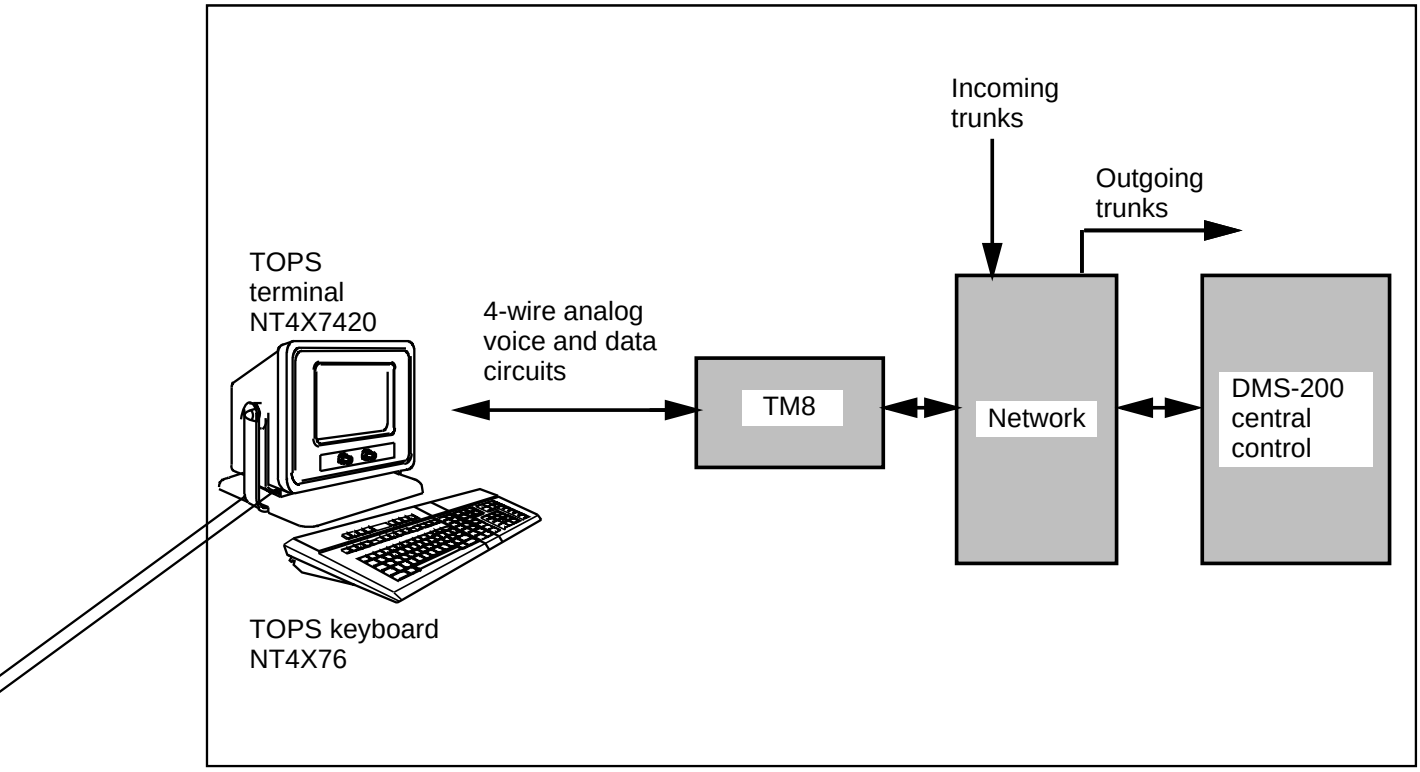
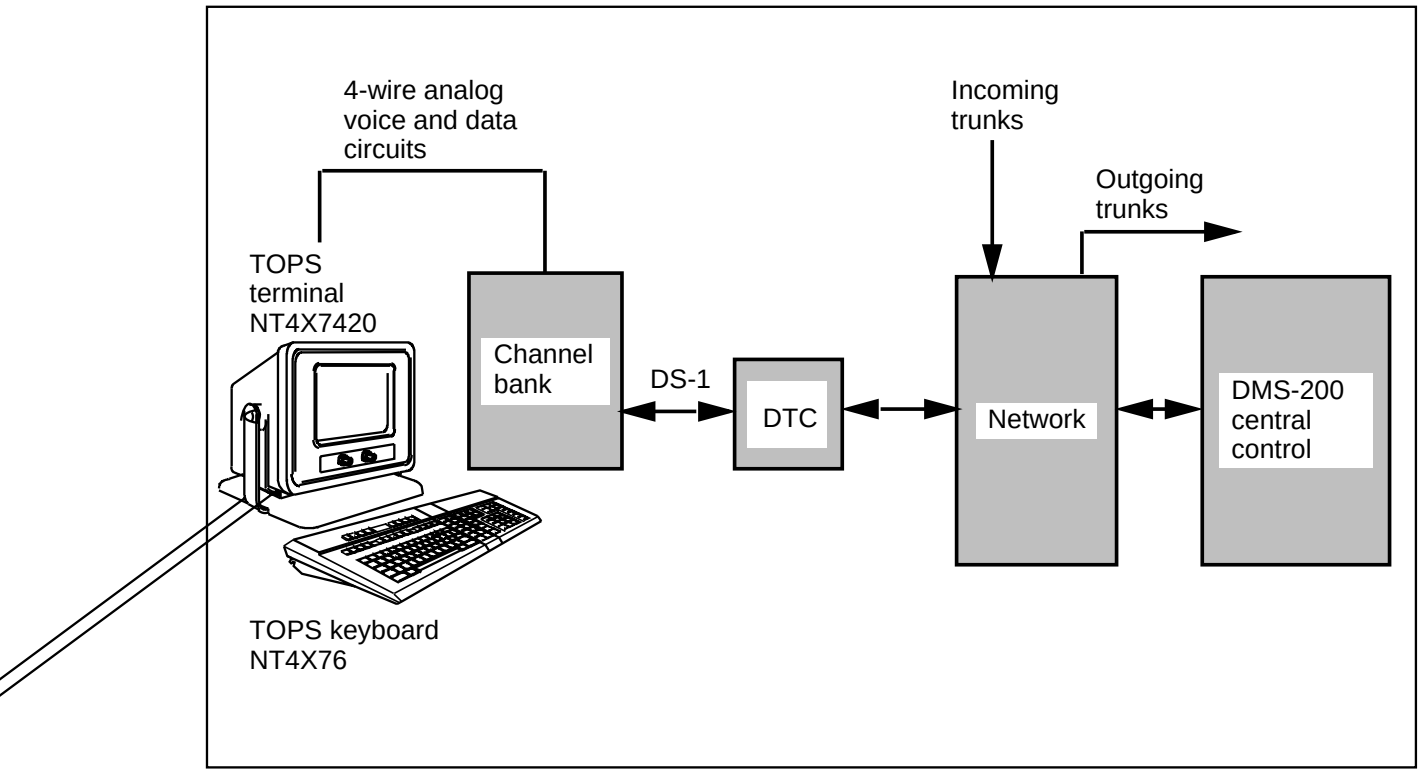
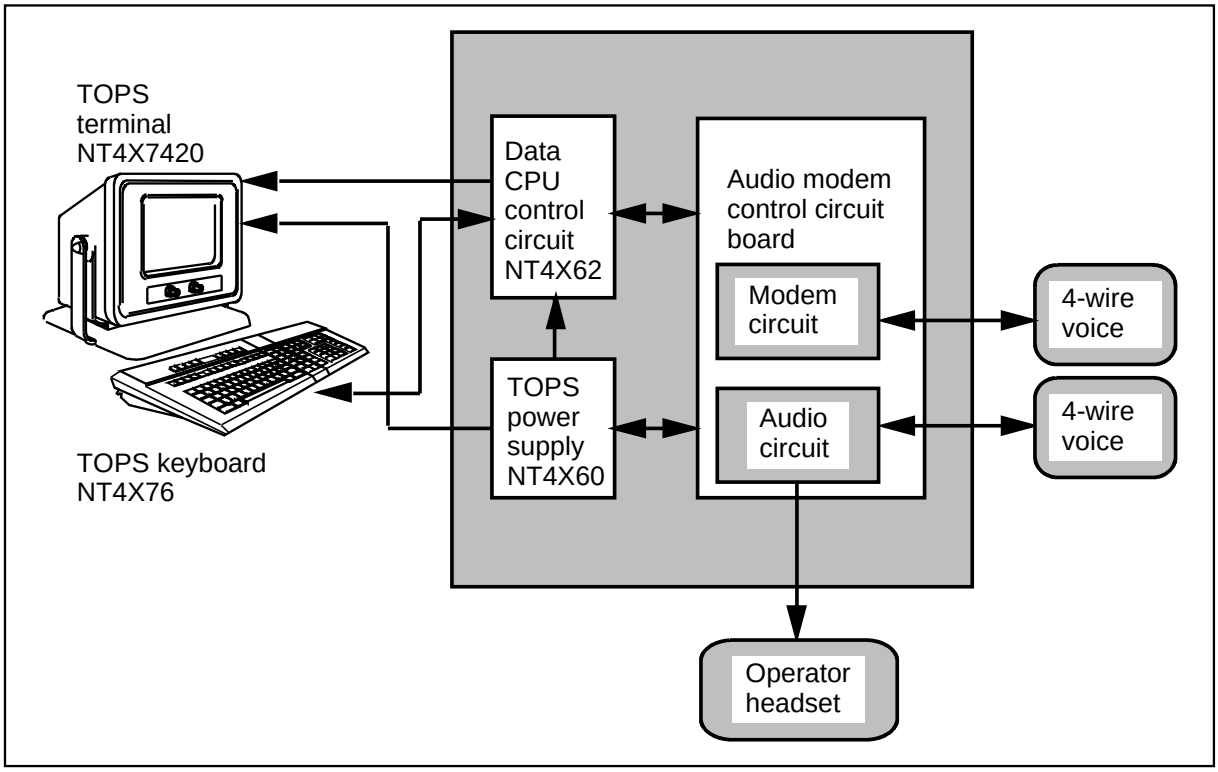


**Figure 2-7** TOPS 04 Digital System Overview




The TOPS 04 controller unit hardware interface, illustrated in Figure 7, depicts the controller unit, the TOPS 04 terminal and keyboard, and the operator headset. The controller unit, which is virtually self-contained, includes the central processing unit (CPU), power supply, and audio modem control circuit board. The controller unit requires ac power only. A group of positions, which can be arranged singly or in clusters, can be situated where operators are available, but remotely located from the switching center.

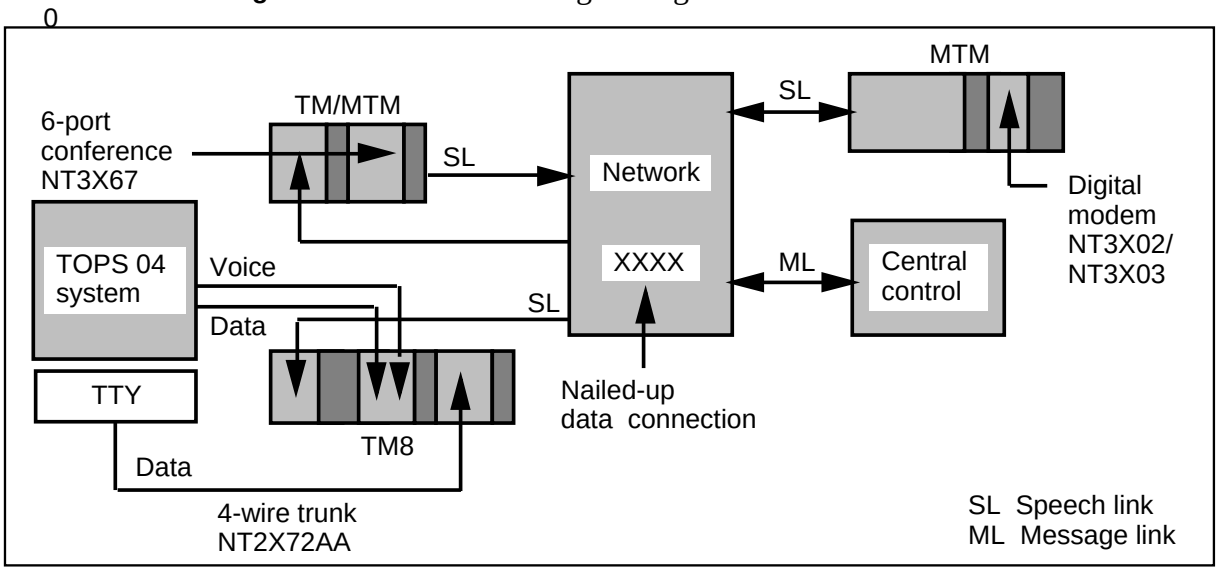
**Figure 2-8xx**TOPS 04 Controller Unit Hardware Interface




The TOPS 04 system can be connected to the DMS network using analog or digital facilities. If analog facilities are used, voice and data circuits for the operator position terminate on a TM or maintenance trunk module (MTM) using two 4-wire circuits. One circuit supports voice communications, the other circuit supports data communications. The 4-wire trunk circuit pack terminates at the TM8 on the DMS-100.

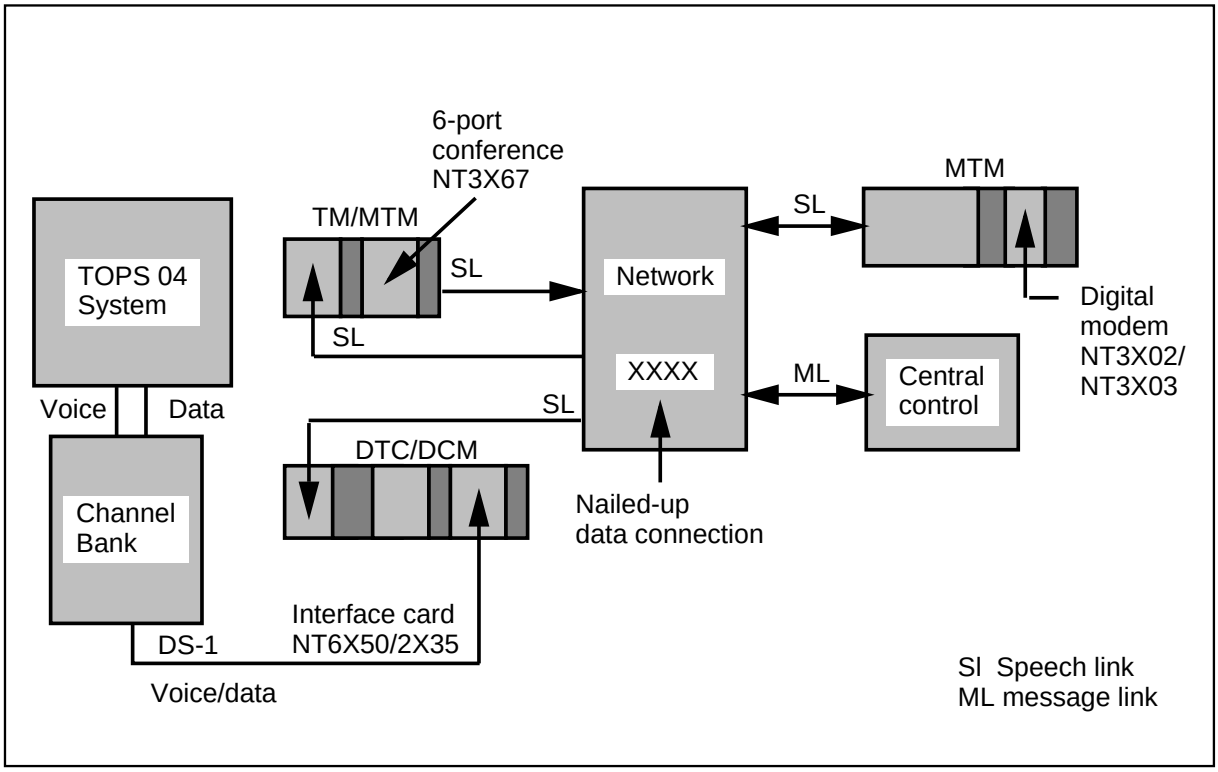
A 2X72AA trunk circuit pack contains two circuits. The voice circuit uses the even circuit in the trunk circuit pack and the data circuit which uses the odd circuit. Each trunk circuit pack interconnects with one TOPS 04 position using a voice and data path, or two TOPS 04 terminals using one data trunk per terminal. The TM converts voice and data signals between analog and PCM speech. The TOPS 04 analog configuration is illustrated in Figure 2-8.

**Figure 2-9** TOPS 04 Analog Configuration




If digital facilities are used, voice and data circuits for the operator position connect to the DMS network using a DS-1 digital link. This link is located between the channel bank and a DTC. The channel bank converts voice and data communication to analog and PCM speech. These DS-1 links provide a cost-effective method for transmitting voice and data over long distances. The TOPS 04 digital configuration is illustrated in Figure 2-9.

**Figure 2-10x** TOPS 04 Digital Configuration




## TOPS 04 data connection

Data channels for TOPS 04 printers, operator positions, and administrative positions are connected through the switching network to digital modems mounted on the TM/MTM. Operator keyboard input, received in the form of digitized FSK data, is decoded and reformatted according to DMS-200 signaling formats. Keyboard input is then routed to the central message controller (CMC) and CPU using the normal DMS-200 signaling path. Conversely, data modems convert data received from the CPU to a digitized FSK format for display at the operator position.

The modem circuit converts data signals from the DMS-200 from analog to digital. These data signals are passed to the CPU circuit board in the TOPS control unit, which produces output for the operator position. The CPU circuit board also can communicate with an optional blind operator interface (BOI).

Connections between the operator position and the digital modem associated with the position are not established for each call. Instead, connections are nailed up and dedicated to the network. This nailed-up connection is established each time a position is initialized by the system. The data channel operates in a full-duplex mode at 300 baud.

Data signals from the operator position keyboard are received in the CPU circuit board and passed to the modem circuit. The modem converts keyboard data from digital to analog for transmission to the DMS-200. All data are exchanged over 4-wire voice grade links at a rate of 300 baud.

## TOPS 04 voice connection

When a call is routed to an operator position, the voice channel for that position connects through the switching network to one port of a 3-port, or half of a 6-port conference circuit in a MTM. Two other ports are connected to calling and called parties. Voice signals between the operator and the calling party are switched directly to the DMS-200 switch, where each voice termination consists of receive and transmit sides. The transmit side can be connected simultaneously to several destinations. This broadcasting capability provides a receive-only connection to administration positions used for monitoring operator activity.

The monitor connection consists of transmit ports for the operator voice circuit, and the operator voice circuit itself, and the operator port for the 3-port conference circuit associated with an administrative position. Equal access calls on lines with or without features are routed to the DMS-200 side of the switch.

Two-way operator office trunks (TWOOT) allow interconnection between a DMS-200/TOPS 04 and a community dial office (CDO). Currently, two-way TOPS and operator trunk groups are used instead of TWOOT.

The DMS-200 uses kick-pulse discrimination to distinguish traffic from those CDOs that cannot generate appropriate start signals for operator-assisted (0+) and direct-dial (1+) calls. A 4-second timeout is used to distinguish zero minus (0-) calls from the 0+ and the 1+ traffic on the same TWOOT.

## TOPS 04 floor plan design

TOPS 04 positions are single units which can be arranged in several ways. This section describes only two of the many arrangements which are possible. Different arrangements can be developed within the same office to satisfy local requirements. The main criterion for establishing the location of TOPS 04 positions is the efficient use of existing space while providing a pleasant work environment for the operators.

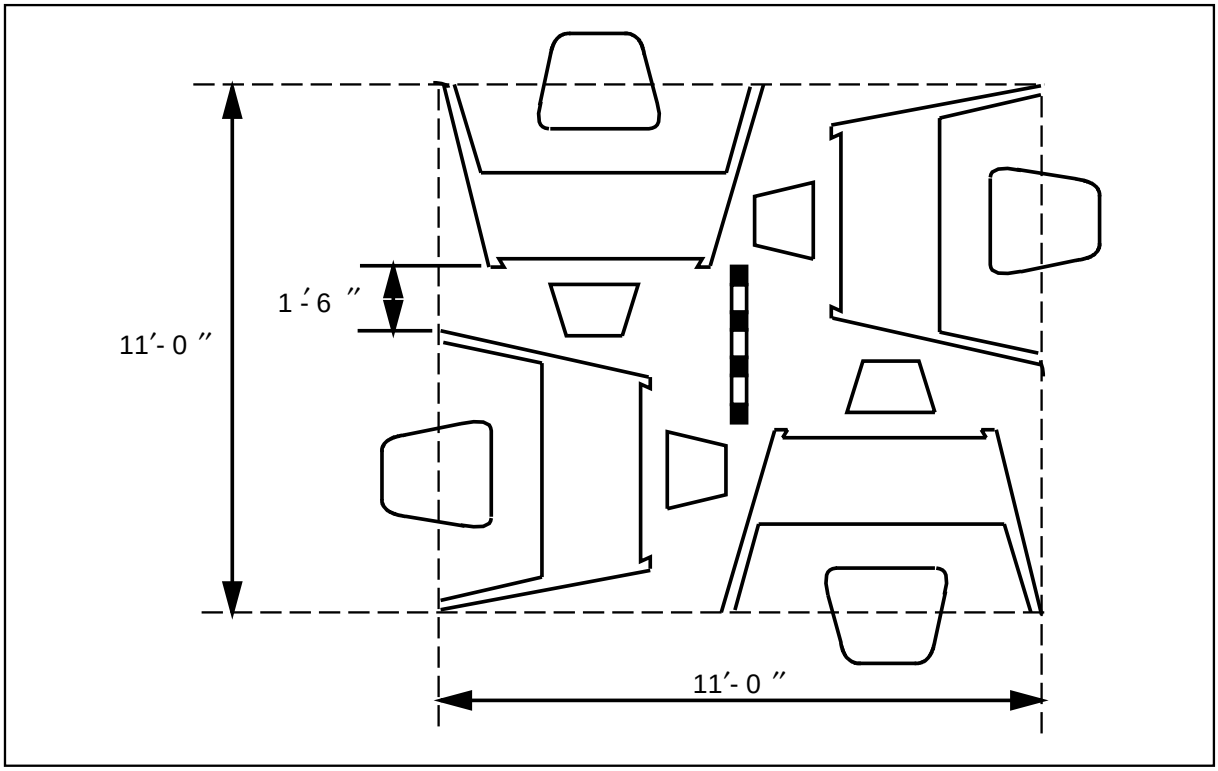
### Design objectives

Overhead lighting, windows, or contrasting color patterns must be considered when designing an office to reduce reflection on operator screens. Another principle design objective for the layout of a traffic office is the structuring of smaller work groups to eliminate a factory or assembly line atmosphere.

### Floor space requirements

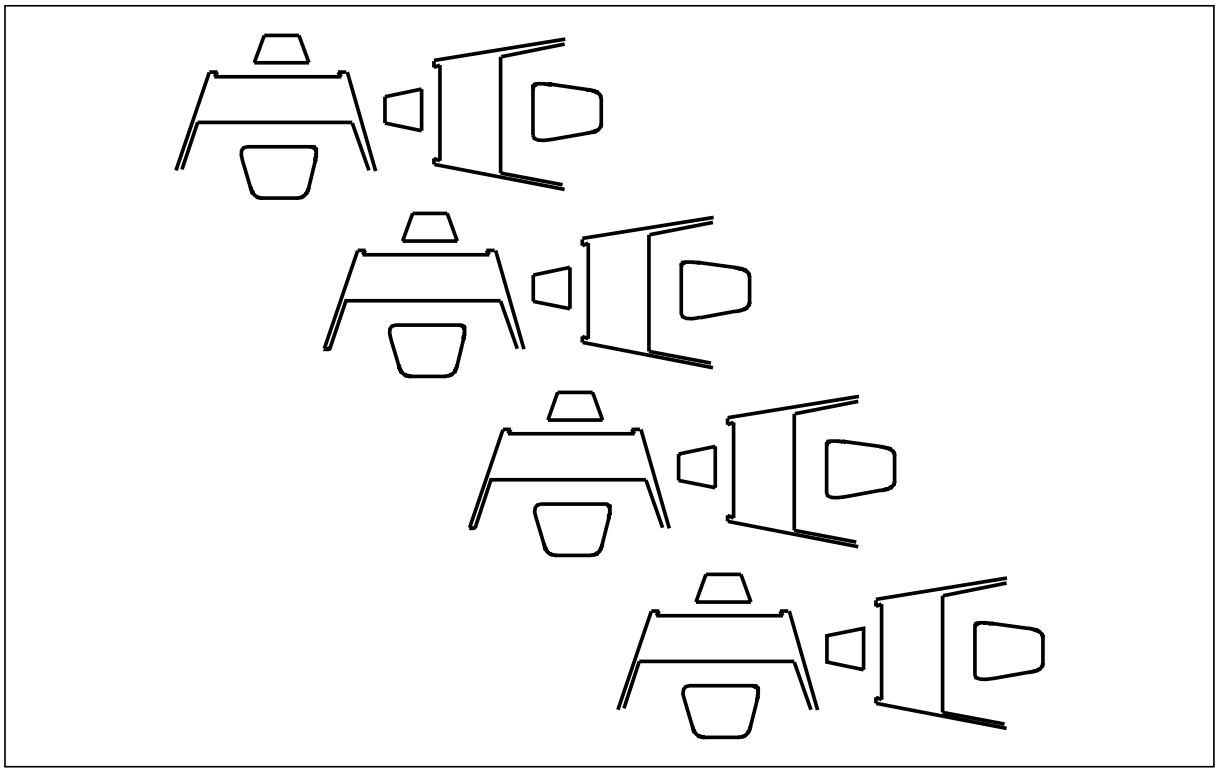
The TOPS 04 position, including aisle space, requires approximately 50 square feet of floor space. This is based on the use of a 4-way cluster arrangement, which is illustrated in Figure 2-10. The dimensions shown indicate minimal separation between units.

**Figure 2-11** Typical 4-Way Cluster



A four-position cluster occupies approximately 120 square feet of space, not including aisle space or space for a center decoration. Each position within the cluster faces the side of an adjacent position. This position magnifies the group relationship while providing a visually enclosed space for each individual within the cluster. TOPS 04 positions also can be arranged in row clusters, as illustrated in Figure 2-11.

**Figure 2-12** TOPS 04 Row Cluster



## Traffic office configurations

The configuration of a traffic office is dependent on the requirements of the operating company. The TOPS system can provide single and multi-traffic system configurations which support every level of TOPS system administration. The operator centralization feature enhances the capabilities of a multi-traffic system. These three system configurations are described here.

One traffic office consists of one or more operator teams which are grouped together for statistical or managerial purposes. These operator teams comprise one work force. Each work force can include from 1 to 30 traffic offices. Operator positions within a traffic office can be grouped together or scattered randomly throughout the office.

### Single-traffic office

In a single-traffic office, force-level management functions are handled by the in-charge manager. In this configuration, the in-charge manager uses the system administration data system (SADS) teletypewriter (TTY) for all administrative functions. The SADS TTY combines the capabilities of both the force administration data system (FADS) and the traffic office administration system (TADS) TTY. The in-charge position and the SADS TTY configuration is illustrated in Figure 2-12. Figure 2-13 illustrates a block diagram of a TOPS single-traffic office.

**Figure 2-13** TOPS In-Charge Position and SADS TTY

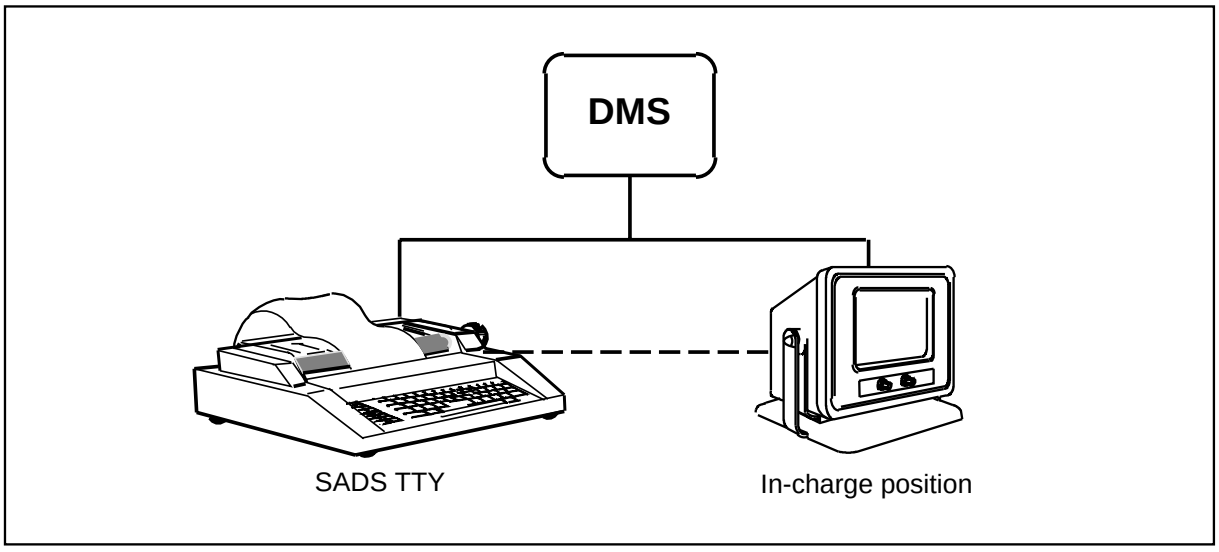
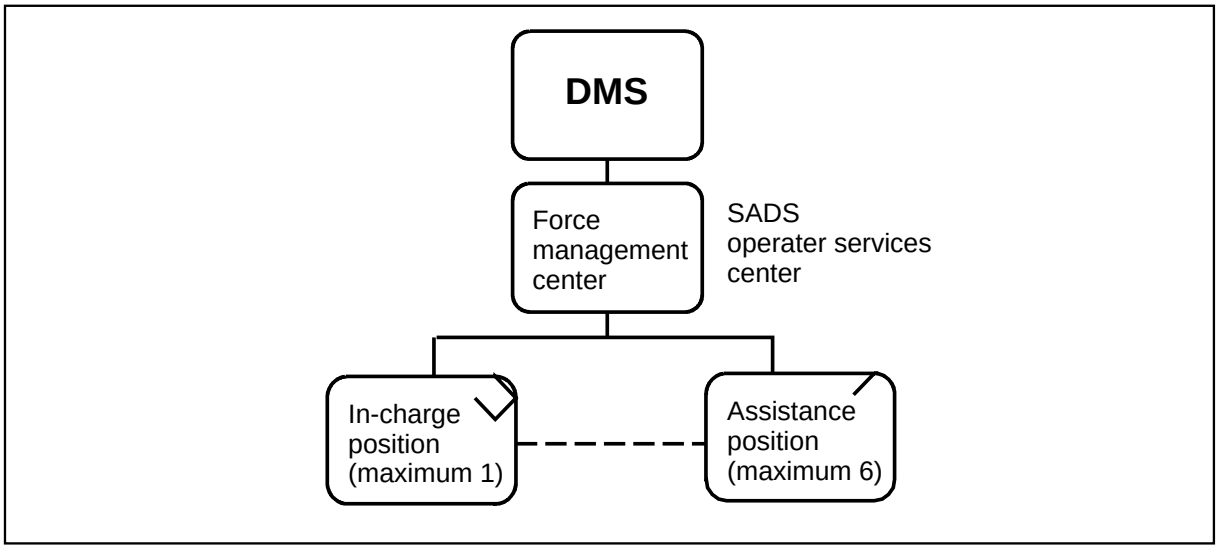


**Figure 2-14** TOPS In-Charge Position and SADS TTY




**Multi-traffic office**

A TOPS multi-traffic office, as illustrated in Figure 2-14, comprises one or more in-charge positions and a force management position which can support a maximum of 30 traffic offices for each DMS-200 switch.

In a night closedown configuration, the relationship between host and remote switches is reconfigured. Figure 2-15 illustrates a block diagram of a TOPS multi-traffic office.

**Figure 2-15** TOPS Multi-traffic Office Force-Level Management

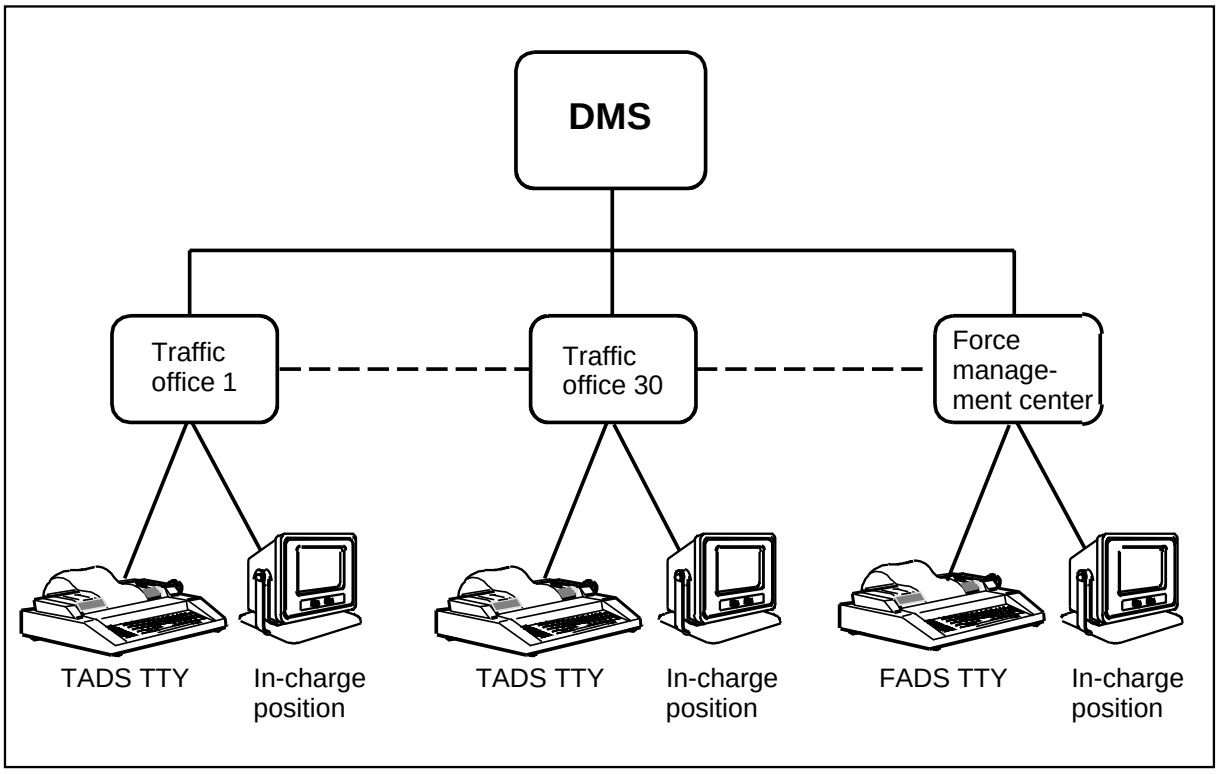
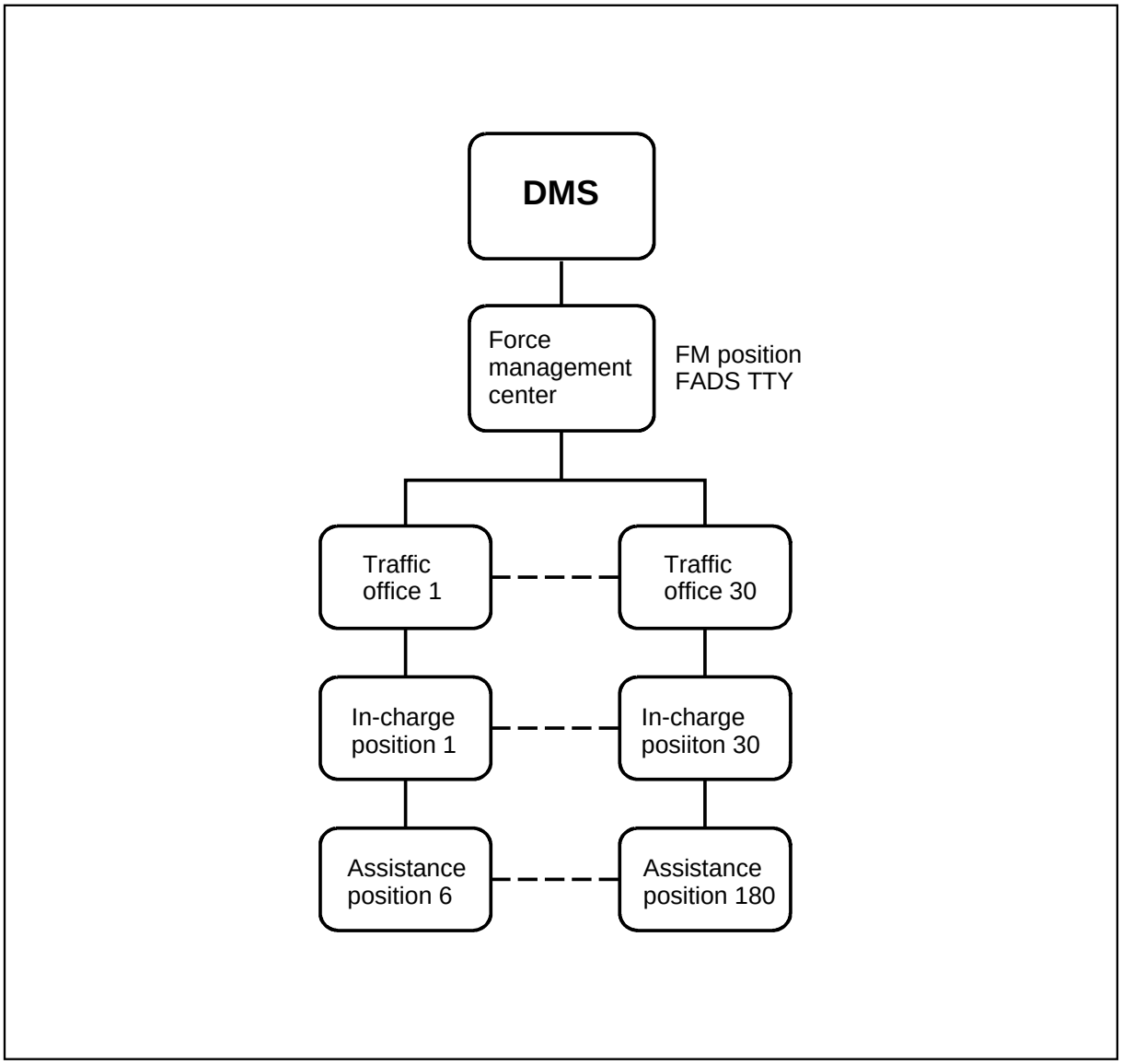


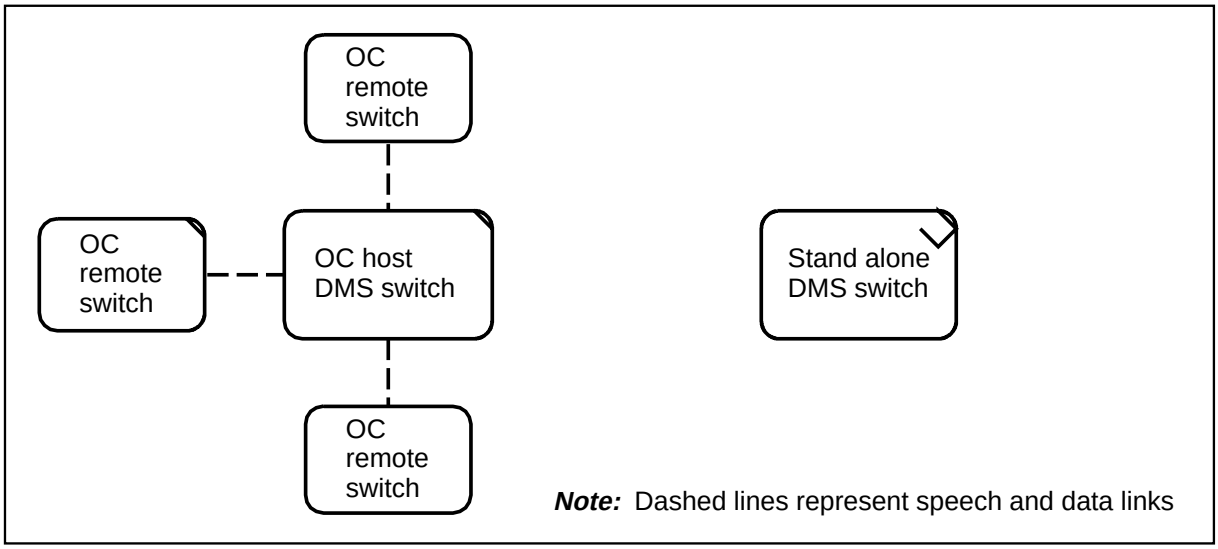
**Figure 2-16** TOPS Multi-traffic Office Configuration




### Operator centralization

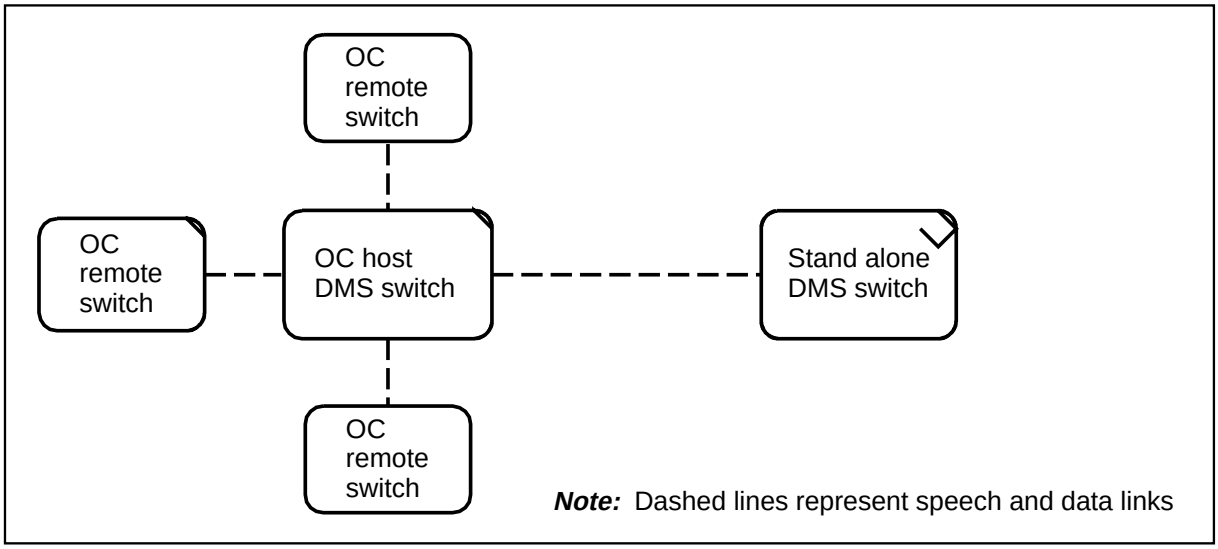
When a TOPS system includes the operator centralization (OC) feature, operators at one centralized location can process calls from several remote toll centers. These operators handle traffic which originates from the remote toll office in the same manner as traffic from the host switch. Each OC host switch can provide operator services 24 hours a day. During light traffic periods, typically between the hours of midnight and 6 a.m., fewer operators are required. The TOPS OC network configuration is illustrated in Figure 2-16.

**Figure 2-17** TOPS OC Network Configuration




In a night closedown configuration, the relationship between host and remote switches is reconfigured. A TOPS OC network in a night closedown configuration is illustrated in Figure 2-17.

**Figure 2-18** TOPS OC Network Reconfigured for Night Closedown



# TOPS Equipment

## TOPS MP system

The TOPS MP system combines traditionally separate functions for toll and directory assistance services into a single operator workstation. This integration eliminates the need for separate offices and work forces, and allows operators to perform toll completion for directory assistance or directory-assisted calls.

The TOPS MP system allows the operating company to define any MP terminal as an operator, assistance, in-charge, or force management position. To configure a position, the TOPS position controller (TPC) administrator confirms the TOPS MP terminal is maintenance busy or offline. The TOPS MP terminal can now be configured.

### TOPS MP screen

TOPS MP screen displays detailed call information to the operator. Eight shades of gray make up the background and character definition. At logon, the operator can select either light characters on a dark gray background or dark characters on a light gray background. The intensity and contrast can be adjusted at any time during logon or call processing. Also, the volume of the headset can be adjusted at the logon screen.

#### Operator position

The operator position includes a 12-inch monochrome screen. The screen consists of 29 lines with 90 characters each. The top three lines are used for the display of system status, messages, time, and date. The bottom two lines are reserved for the display of soft key labels. The remaining 24 lines are designated for the application section. This area is used for the display of information related to toll services or database applications. For toll services, the application area has three functional areas: call processing, window, and menu.

**Call processing area** The call processing area contains all available information relevant to the call currently being handled. Call type, calling number, called number, special billing number, carrier identification, and miscellaneous information appear in designated fields. The operator can add or modify information by positioning the field cursor in a desired field. Pressing one of the cursor control keys positions the cursor in a field. Default cursor positioning saves a significant number of operator keystrokes.

**Window area** The window area contains supplemental information for the handled call or for specific call types. For example, a coin telephone call window containing appropriate charges which opens automatically when a coin call is processed.

**Menu area** The menu area of the TOPS MP screen displays menus the operator can select for call handling options. If required, the menu and window partitions may overlap. Menus provide access to toll functions, directory assistance, outgoing trunks, trouble codes, and charge adjustments.

### Assistance positions

Assistance positions use the same screen type. Screen areas for each position are the same, except for an assistance status information menu which appears on the right of the screen. The assistance status information menu indicates a position busy or available status, and miscellaneous conditions such as Call Waiting (CW) or Central Automatic Message Accounting (CAMA) suspended. For a description of Assistance position messages, refer to *Operator Guide*, 297-2281-300.

### In-charge position

The in-charge position displays the same menus as the operator position, except for an in-charge status information menu which appears on the right of the screen. The in-charge position displays related data.

- number of operators requesting assistance
- position number of operators receiving assistance
- number of positions in traffic office
- upon request, position numbers for operators in the preceding states
- status of positions providing operator assistance
- calls waiting and calls deflected

Positions in the traffic office include seven possible states.

- occupied
- operator made busy
- unoccupied position/call in progress
- unoccupied position/call disconnect
- controlled traffic
- out-of-service positions
- accessed loop

### The force management position

The force management position is used as an operator position in addition to force-level management responsibilities. Because of the nature of the position, the screen offers different menu types.

In a single-traffic office configuration, the in-charge position also is used as the force management position. Information required by the force manager displays the menu selection window on the right side of the screen. In a multi-traffic office configuration the force manager uses a specially designed screen, which is divided into five major areas.

- A broadcast message banner at the top of the screen displays all broadcast messages.
- An office statistics window, is updated every ten seconds. Data displayed in this window represents the total number of positions for traffic offices connected to the host office. Position information displays the number and status of call types for any of the following.
  - occupied positions
  - occupied positions in control-led traffic mode
  - operator made-busy positions
  - operator made-busy positions occupied by a transfer 1 operator
  - operator made-busy positions occupied by a transfer 2 operator
  - loop-accessed operator positions
  - occupied transfer 1 operator positions
  - occupied transfer 2 operator positions

  - unoccupied positions with a call in progress
  - unoccupied positions with a terminated call
  - out-of-service positions
- The large window in the center of the screen contains the data for 1 to 30 individual operator teams in a TOPS MP system. This area displays the operator team status for any of the following.
  - occupied positions
  - operator made-busy positions
  - operator made-busy positions occupied by a transfer 1 operator
  - operator made-busy positions occupied by a transfer 2 operator
  - loop accessed operator positions
  - occupied transfer 1 operator positions
  - occupied transfer 2 operator positions
- A team statistics window displays data pertaining to the status of the system.
  - A call waiting (CW) indicator displays ratio of calls in non-transfer CW queue to occupied non-transfer operator positions which have reached a predefined threshold.
  - A CW1 indicator displays the ratio of calls in the transfer 1 queue to occupied transfer 1 operators which have reached a predefined threshold.
  - A CW2 indicator displays ratio of calls in the transfer 2 queue to occupied transfer 2 operators which have reached a predefined threshold.
  - A call deflect (CD) indicator displays ratio of queued non-transfer calls to occupied non-transfer positions which have passed the predefined threshold. This indicator displays when call has deflected.
  - A CD1 indicator displays ratio of queued transfer 1 calls to transfer 1 operator positions which have passed the predefined threshold.
  - A CD2 indicator displays ratio of queued transfer 2 calls to positions occupied by a transfer 2 operator which have passed the predefined threshold.
  - A 25 percent controlled traffic (CT) message indicates number of positions occupied by operators in a controlled traffic mode have reached 25 percent for all occupied positions.
  - An ALL T AND C POS OD message indicates when all time and charge teletypewriters have been removed from service

  - A CAMA SUSPENDED message indicates machine accounting has been suspended
  - A NO ASST POS message indicates no assistance positions are logged on and the in-charge position is not available for general assistance requests
  - A NO ST REG message indicates when all operator study data registers are in use
- A softkey definition banner appears at the bottom of the screen. In the banner, application-dependent softkeys are defined

The force management screen is described in the Force Management Guide, 297-2281-310.

### TOPS MP keyboard

The TOPS MP keyboard remains the same for each position type. The keyboard contains 126 keys which are grouped into four major categories.

- QWERTY keys
- softkeys
- call processing cluster keys
- future development keys

The QWERTY keys, which are standard typewriter keys, are part of the TOPS MP keyboard. Eight software-defined softkeys are located at the top of the keyboard. The function of these keys change according to call treatment. The current definition for a softkey appears in a banner at the bottom of the screen.

Call processing cluster keys make up a 10-key numeric keypad surrounded by 22 additional call processing keys. Sixteen of the 22 keys define standard call processing functions. The remaining 6 keys are customer defined. Call processing keys are shaded to distinguish them from the other keys on the keyboard. Twenty seven of the 126 keys on the keyboard remain undefined for future use. Refer to the *Force Management Guide*, 297-2281-310, for a description of the TOPS MP keyboard and key functions.

### TOPS MP terminal

The TOPS MP terminal consists of a terminal controller, telephony board, keyboard interface, screen interface, and power supply. The terminal controller board contains the central processing unit (CPU), high-speed line interface (HSLI) circuitry, video display logic, and miscellaneous support and interface circuitry. The telephony board interfaces with the operator headset and performs conversions between pulse code modulation (PCM) voice and analog signals. Keyboard interface circuitry encodes operator keystrokes and outputs the data to the terminal controller. The monitor

interface provides video output for the system. The power supply regulates dc power to the terminal.

The terminal controller interfaces to the TPC, telephony board, screen, and keyboard. The terminal controller provides three functions.

- multiplexing and formatting of vocal/keyboard input and command messages for TPC transmission
- de-multiplexing of pulse code modulated (PCM) voice and messages received from the TPC
- interpreting received commands and controlling of video display formatting and audio tone generation

The HSLI circuitry formats a HSLI serial data stream. This formatting includes the following functions.

- parallel/serial conversion
- multiplexing/de-multiplexing of PCM voice and message data
- HSLI signal encoding, decoding, and conditioning
- link error detection and correction
- data buffering

Video display logic includes video random access memory (RAM) and scanning logic. Video RAM contains a bit map of the screen image. Three banks of video RAM are dedicated for this purpose. Scanning logic continuously reads video RAM and transmits a stored digital grayscale value for each pixel to the screen interface. Analog video circuitry in the terminal is controlled by a 6-channel digital/analog (D/A) converter. These D/A channels control brightness, black level, and terminal or filament on/off control.

The terminal controller receives keying input through the keyboard interface. The terminal controller is responsible for the functionality of the keyboard. The keyboard only sends key depression and release data to the terminal controller.

### TOPS MP headset jack interfaces

The headset jack interfaces with a telephony board, which converts PCM voice to analog signals and generates audio cues. The analog interface between the voice circuit and the headset provide dynamic amplitude limiting, user-selected sidetone loss, and buffering and amplification for the headset and microphone.

### TOPS MP position controller

The TOPS MP position controller (TPC) is a controller unit which processes voice and data signals for communication between an MP terminal and the

DMS-200 switch. The TPC also controls the screen display for each TOPS MP terminal. The TPC communicates with the TOPS Administration and Maintenance Interface (TAMI) when maintenance or administrative tasks are being performed. The TAMI, which serves as a port residingwhich resides in the TPC, typically is not hardwired. Maintenance and administrative tasks which require the TAMI are performed at a VT-220 compatable terminal. Each TPC has a dedicated modem and is accessed with a VT-220 compatable via this modem. The TPC contains seven major components.

- single-board computer circuit card
- 4-Mbyte RAM circuit card
- up to four HSLI circuit packs, or one per MP terminal
- parallel input/output circuit card
- winchester disk drive and controller
- floppy disk drive and controller
- two optional high-speed data access cards

A single-board computer (SBC) circuit pack is the processor for the TPC. Based on the Motorola 68010 microprocessor, the SBC circuit card controls all data processing functions for the TPC, to include TPC software, and data exchanges with the TAMI . One megabyte of RAM is included on the SBC.

A 4-Mbyte RAM extension circuit card stores the TPC operating system, application software, and data files. The TPC software and data files are loaded into RAM, the SBC, and memory circuit pack from either the Winchester drive or the floppy disk.

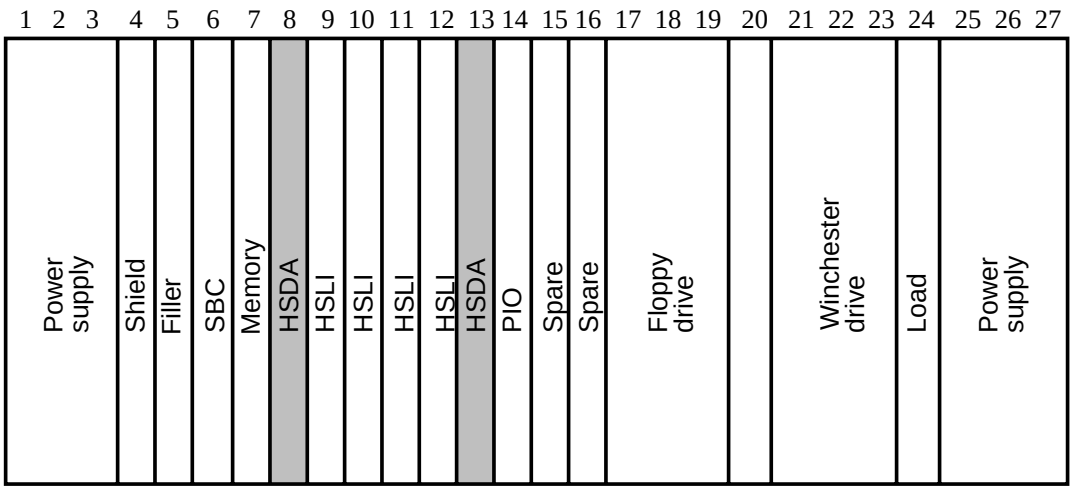
The HSLI circuit pack provides the interconnection between DMS-200 voice and data circuits and the TPC. The HSLI also provides an interface for the operator terminal and the TPC, as well as the TPC and computer-based training (CBT) configuration.

Data can be transferred between the RAM circuit card and either the Winchester or floppy disk drive. The HSLI circuit pack is dedicated to each TOPS MP terminal. The HSLI circuit pack provides the interface between the DMS-200 voice and data circuits and the TPC, between the operator terminal and the TPC, and between the CBT system and the TPC. One HSLI circuit pack is dedicated to each TOPS MP terminal.

Data can be transferred between the RAM circuit card and either the Winchester or floppy disk. The PIO circuit pack is the data interface for the transfer of data between RAM and the 5.25-inch Winchester disk drive or the floppy disk.

The Winchester disk drive receives the TPC operating system, application software, or data files from floppy disks. This software or data can be loaded into the RAM circuit card. The floppy disk drive accepts 5.25 inch floppy disks. These disks may contain either the TPC operating system, application software, or data files. A typical TPC shelf is illustrated in Figure 3-1.

**Figure 3-1** Typical TPC Shelf




| Circuit pack | Product engineering code |
|---|---|
| Power supply | NT2X70AE |
| Shield/load | NTNX54BA |
| Memory | NTNX63AA/AB |
| Single board computer (SBC) | NTNX64AA |
| High speed line interface (HSLI) | NTNX62AA |
| High speed data access (HSDA) | NTNX66AA |
| Parallel input/output (PIO) | NTNX65AA/BA |
| Floppy drive controller | NTNX68AA/CA |
| Winchester drive controller | NTNX68AA/BA/DA |

***Note:*** Shaded areas indicate packs for directory assistance and HSLI cards

There can be up to four TPCs housed in one position controller equipment (PCE) cabinet. This cabinet is fully compliant with electromagnetic interference (EMI) requirements and is designed to meet earthquake zone 4 seismic specifications without external mechanical bracing. The PCE cabinet dimensions are 6 feet high by 28.5 inches wide by 28 inches deep. There are six components of the PCE cabinet.

- frame supervisory panel
- fan cooling unit

- PCE bulkhead with backplanes
- four TPC shelves
- EMI-protected cable interface
- internal cable harnesses

A frame supervisory panel (FSP) is provided in each TPC cabinet for power distribution, fusing, circuit breakers, and visual alarms. Each cabinet has 6-dc powered fans with electronic fan speed indicators. These fans provide forced air cooling through the cabinet. The cabinet conforms to the floor loading requirement of 115 pounds per square foot, as outlined in the *Bellcore Technical Reference* TR-EOP-000063.

Aisle spacing requirements for the PCE cabinet are for a 36-inch access aisle width and a 24-inch service aisle width, measured from the cabinet base. The PCE cabinet provides cable access using either an overhead cable distribution network or a raised floor access system.

## TOPS MP furniture

The TOPS MP system furniture can be obtained in a integrated or modular design. The integrated design consists of operator workstation components, controller, screen, keyboard, and headset jacks mounted on a console- style desk. The screen mounting allows the variation of the viewing angle and distance from the operator. The modular style is a free-standing unit which can be placed on customer-supplied furniture. Figure 3-2 illustrates TOPS MP desktop model.

**Figure 3-2** TOPS MP Desktop Model

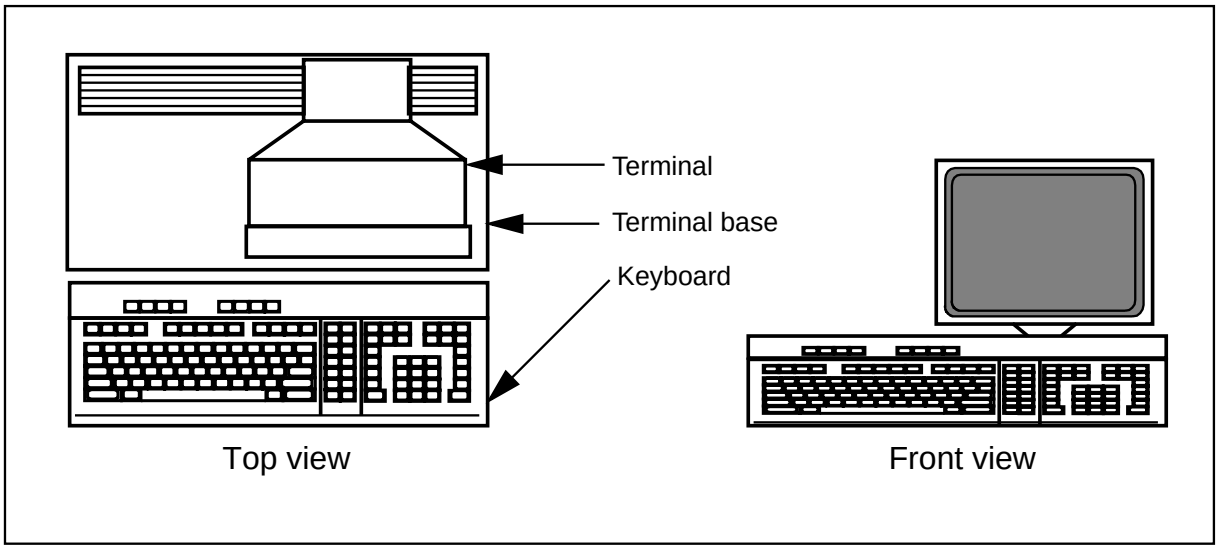
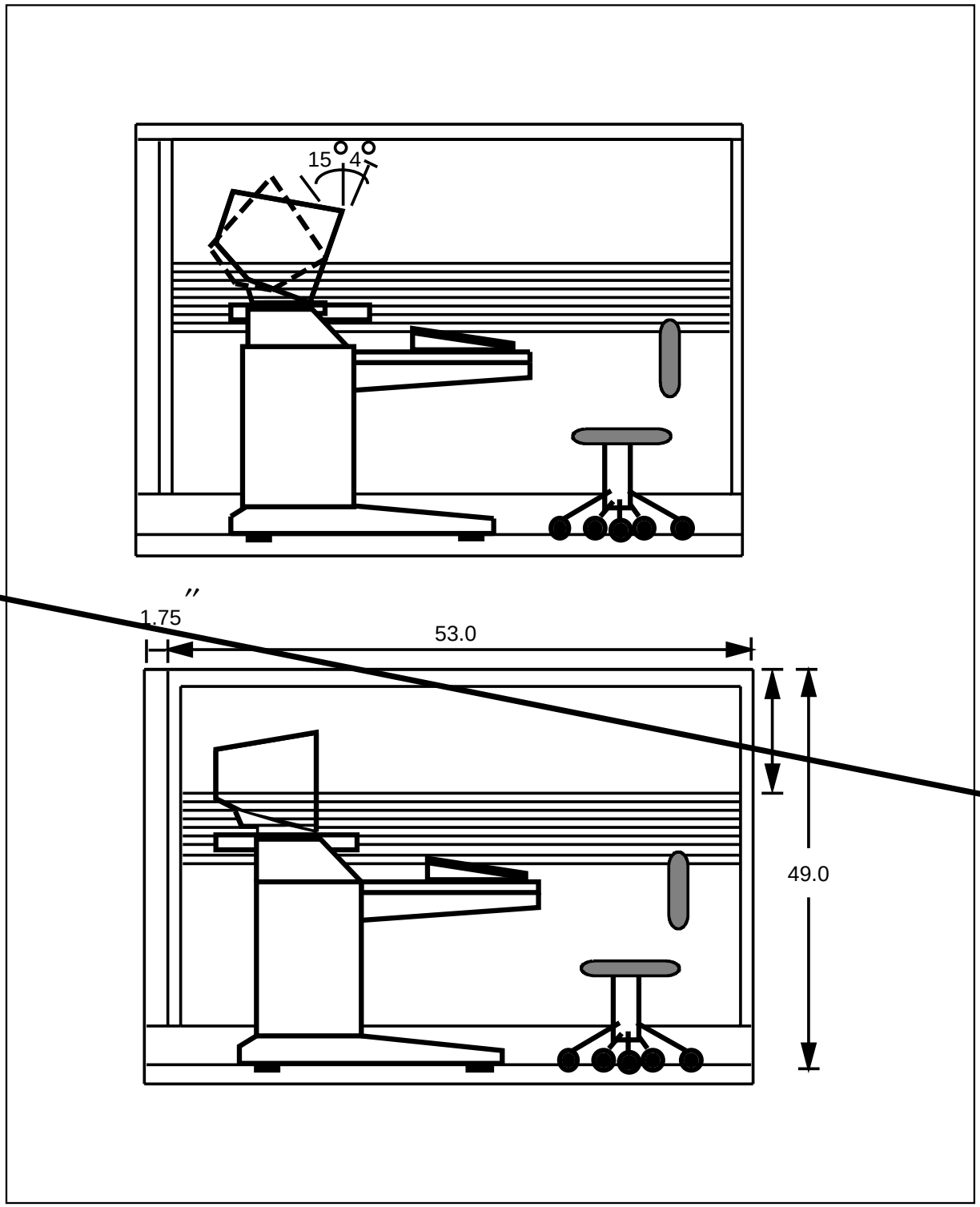


Figure 3-3 illustrates the TOPS MP integrated workstation, which encompasses a fully adjustable sit/stand operator position. Designed into the workstation are ease of operation, safety, and operator comfort. The operator workstation meets UL 1286, *Standards for Safety of Office Furnishings* requirements. The operator workstation is a free-standing adjustable sit/stand desk measuring approximately 29 inches wide by 51 inches long. It is made by Herman Miller, Inc. Floor space planning should allow approximately 25 square feet per workstation, without the side panels, plus aisle and administrative space.

The optional side panels, also made by Herman Miller, Inc., are designed for acoustic and visual privacy. Approximately 28 square feet should be allowed for TOPS MP applications with side panels, plus aisle and administrative space.

**Figure 3-3** TOPS MP Integrated Workstation



## TOPS 04 system

The TOPS 04 system allows the operator to simultaneously exchange voice communications with the customer and call processing data with the DMS-200 switching system. The TOPS 04 position consists of a screen, a detachable keyboard, a controller unit, and two sets of headset jacks.

The components for operator and administrator positions are the same. However, there are differences in screen displays and the number of useable keyboard function keys. TOPS 04 components are described in the following paragraphs.

### TOPS 04 screen

The TOPS 04 system screen is used for operator, assistance, in-charge, and force management positions. Menu displays are dependent upon position type.

#### Operator position

The operator position screen measures 12 inches diagonally. This position displays messages to and from the operator. The screen consists of 16 rows and 64 columns. The TOPS firmware generates messages displayed on the screen.

Messages appear in either the steady or flashing mode, and are displayed in specific areas of the screen reserved for the particular message. Flashing messages prompt the operator to take appropriate actions. Information that is not essential to the processing of a call is displayed only on demand.

The operator position screen is divided into functional areas which provide call information.

- time of events
- time and charges data
- call data keyed in by the operator
- class-of-service of the incoming calls
- digits received/keyed in by the operator
- supervisory status of loops
- supervisory status of forward called number connections
- supervisory status of backward calling number connections
- broadcast messages generated from force management or traffic office TTY

### Assistant position

The assistance position screen displays up to 16 different messages which indicate five condition types.

- request from operator
- calling party is on hook
- called party is on hook
- number of calls waiting exceeds CW threshold for system
- assistance position is monitoring

### In-charge position

The in-charge position screen displays up to 38 different messages. These messages include the following conditions.

- request from operator
- calling party is on hook
- called party is on hook
- number of calls waiting exceeds CW threshold for office
- in-charge position or one or more assistance positions are in monitoring mode
- office is in traffic overload and selected calls are deflected to recorded announcement
- operator positions are in make busy state
- selected operators are in controlled traffic mode
- all assistance positions are make busy or not available for general assistance requests
- any off-hook operator position with loop accessed has no call path attached

### Force management position

The force management position screen displays information for each traffic office and the DMS-200 switch.

- number of positions occupied, out of service, made busy by the operator, or in controlled traffic mode
- number of positions unoccupied with call in progress where operator has left the position
- number of positions unoccupied with call in progress where call has terminated and customer is on hook
- number of positions with loop accessed where calling/called party is attached and off hook
- calls waiting threshold exceeds signal

- calls deflecting to recorded announcement signal

## TOPS 04 keyboard and keyboard functions

Keyboards and keyboard functions for the TOPS 04 system differ by position type.

### Operator position

The Operator position keyboard contains solid state switch keys which generate numeric and alphanumeric characters. One key generates control characters which are used for position maintenance only. The keyboard consists of 53 call processing keys, 6 outgoing trunk keys, and a 10-key dial pad. Nine keys are reserved for future applications. This keyboard generates a total of 125 American standard code for information interchange (ASCII) characters. The asterisk (*) and pound sign (#) keys are not part of the TOPS 04 dial pad.

The keyboard is divided into seven function keys and includes a numeric keypad. Key faces have standard characters and functional designations. Keys with related functional designations are grouped together in the same color. The operator may use one or any combination of color-coded areas of the keyboard to perform tasks such as timing, billing, coin control, position release, and automatic dialing.

- alpha-digit entry keys
- call origination keys
- call origination keys
- class charge keys
- AMA control keys
- call origination keys
- outgoing trunk keys
- network interaction control

The 10-key dial pad is located at the extreme right of the keyboard. Like a telephone dial pad, the 10-key dial pad is numbered from 0 to 9 and lettered from a to z. These keys are used to enter calling number, called number, and calling card number information.

### Assistance position

The assistance position keyboard contains 13 function keys and the numeric keypad. The keyboard design enables the service assistant to perform four functions.

- answer assistance requests
- signal an operator
- initiate outgoing calls

- monitor the performance of individual operators

### In-charge and force management positions

The in-charge and force management position keyboard consists of 23 function keys, and a numeric keypad which enables the in-charge or force management position to perform seven functions.

- signaling an operator
- initiate outgoing calls
- answer assistance requests
- request data display for in-charge position
- monitor the performance of individual operators
- no assistance position is available to handle assistance requests
- an assistance position is in man-busy state for maintenance

## TOPS 04 controller unit

The TOPS 04 system controller unit enables the operator to transmit call information to the DMS-200, receive data for display on the screen, and communicate with calling and called parties, and other operators.

The controller unit consists of a data CPU, control circuit board, audio modem control circuit board, and the TOPS power supply. Refer to TOPS *System Configurations*, Chapter 2, for a description of the TOPS CPU and audio modem control circuit board functions.

## TOPS 04 teletypewriter

Each traffic office has a keyboard-send-receive (KSR) teletypewriter TTY . The TTY is used by the in-charge manager, the service assistant, and the force supervisor to input commands or query the DMS-200 switch. The type of TTY required is dependent upon the configuration of the office. Refer to Administration, Chapter 6, for a description of various TTY functions.

## TOPS 04 furniture

The TOPS 04 system offers a two-level desk arrangement. To maximize operator comfort, a floating keyboard can be positioned anywhere on the lower level of the desk. The visual display is positioned on the upper level desk. The operator can rotate or tilt the screen to any angle to minimize fatigue. The TOPS 04 system provides flexible, modular side panels equipped with sound absorbing tack boards. These panels give the operator both visual and acoustic privacy.

## The TOPS system environment

The recommended equipment operating temperature range is 4 to 38 degrees C or 39.2 to 100.4 degrees F, with a relative humidity of 20 to 50 percent.

TOPS 04 multiple clusters should use flooring material with a static factor of 3000 volts or less, and a relative humidity of 35 to 50 percent. These conditions ensure proper operation of the electronics in the TOPS 04 console and minimize static electricity.

# Features

The features described in this section of the document are divided into standard and optional features for the TOPS systems. Features specific to the TOPS MP or the TOPS 04 are identified within the description.

## TOPS standard features

TOPS systems standard features are described in the following paragraphs.

### One-plus, zero plus, and zero minus calls

Call types 1+, 0+, and 0- are accepted and processed by a DMS-200/TOPS system configuration. These call types can be collect or billed to a credit card or third number, or the originating station. Zero plus local calls placed to a local number can be collect or billed to a credit card, third number, collect, or to the originating station.

### NPA on zero plus and 7-digit local calls

This feature inserts the number plan area (NPA) of the called party into the automatic message accounting (AMA) record generated for 0+ 7-digit local call types. The feature is invoked only when a call is marked as a local call during translations. Additionally, the feature can only be used in offices which use the Bellcore AMA format.

### Service code features

Service code features for the TOPS system accept four service codes which are used by TOPS operators under the following conditions.

- operator assistance is required to complete dialable calls
- ring down for tributary offices is required
- requests for busy line verification has been made
- emergency assistance is required

### Call identification and routing

The TOPS system identifies a call using information provided in the automatic number identification (ANI) spill, and the class of service of the incoming trunk. The call type includes the call prefix, such as 0-, 0+, or 1+, and the station class, such as coin, non-coin, or hotel.

## Call distribution and queuing

All calls routed to an operator are placed in a set of queues. The automatic call distribution (ACD) feature has nine queue priorities**.** The following apply to both TOPS systems.

- GEN non-recall
- XFR1 non-recall
- XFR2 non-recall
- XFRDA or XFR3
- GEN recall
- XFR1 recall
- XFR2 recall
- XFRDA or XFR3 recall
- CAMA

The XFRDA queue priorities apply only to the TOPS MP.

## Call monitoring

The supervisory status of the two loops can be monitored and displayed at the TOPS position, using the call monitoring feature. This feature allows the TOPS MP operator to place one call on hold while handling another call. When the operator has finished servicing the active call, the call on hold is reactivated and displayed on the operator position.

## Coin features

Coin features are available for both TOPS systems to control aspects of the initial coin charging period, overtime period, and recalls. These features are described in the following paragraphs.

### Variable initial period

The variable initial period feature allows the operating company to define the initial and overtime periods and the charges for these periods.

### Variable local coin charge

The variable local coin charge feature allows the operating company to assign a lower rate charge for local coin calls originating from institutions such as schools and hospitals.

### Automatic collection of deposit on release

The automatic collection of deposit on release feature sends coin collect requests at various stages of a TOPS coin call. The coin collect request is sent to the end office whenever the operator presses the POS RLS key.

### Coin-first return on disconnect

The coin-first return on disconnect feature enhances coin control capabilities. This feature sends a coin return signal or a keypad enable signal only when required by the end office for a 1+950+XXXX or a 1+800+NXX+XXXX coin call. These enhancements prevent additional dial delay and consumption of real time.

### Independent coin recall interval

The independent coin recall interval feature allows the operating company to change the initial recall period for coin calls. This period is independent of the initial period, which is used only for rating purposes.

### Flash recall during initial period

The flash recall during initial period feature allows a subscriber to recall the operator during the initial period of a call. Should trouble with the call occur, such as no ring, wrong number, or noise on the line, the subscriber flashes the switchhook of the coin phone.

### Inband coin control

Inband coin control uses multifrequency (MF) signals on trunks to handle coin calls. The inband coin control method feature provides three coin control functions: coin collect, coin return, and ring back.

### Expanded inband coin control

Expanded inband coin control uses MF signals between the tandem and end office for calls from coin telephones. This feature provides the following functions.

- coin collect
- coin return
- ring back
- operator released
- operator attached

### Multiwink coin control

Multiwink coin control uses multiple on-hook winks on trunks handling coin calls. The TOPS tandem switch sends multiwink coin control signals to the end office when the operator requests coin control functions. This feature provides five coin control functions for calls from coin telephones. This feature supports the same functions outlined in the expanded inband coin control.

### Line number coin control

Line number coin control provides coin collect, coin return, and ring-back coin control functions. When this feature is used, special codes are inserted between the NXX and the XXXX number of the coin control station.

### Coin supervision signaling option

The coin supervision signaling option feature allows the operating company to specify the delay between receipt of the last calling digit on a coin call and the transmission of coin signals. Delay is specified on a trunk group basis.

### Administrative features

For the purposes of this section, standard administrative features for the TOPS systems are divided into call handling, AMA, and operational measurement (OM) categories.

### Call handling

**Basic operator feedback** The basic operator feedback feature provides the operator and in-charge manager with individual operator efficiency and productivity information. With instructions to the DMS-200 switch, feedback data for total number of calls handled for each operator, the average work time (AWT) for each operator, and the overall system average work time accumulated from the start of the day are provided. This information accumulates automatically for all operators, but is output only when the operator or a manager requests feedback data. The feedback data can be output to the operator position or the system administration data system (SADS) or the traffic office administration system (TADS) TTY.

**Extended operator feedback data** STATSPAC BCS-29 is an optional feature for the TOPS system which generates FM statistics by delivering raw data from the previous interval of time to the operating company for every operator logged on to the system.

With this feature, study registers accumulate operator data for AWT requiring a TTY. Additionally, this feature replaces the need for study registers by sending all output directly to the operating company device. The format for the device is determined by the operating company. Information for STATSPAC should include operator number, operator team number, number of logons and logoffs, operator idle time in seconds, IPS for each FM, and work volume for each FM call type. All STATPAC data is pegged at the end of a call or period of idle or busy time.

**TOPS key function enhancement** The TOPS key function enhancement feature reduces the possibility of incorrect billing information recorded on an AMA device. This reduction is obtained by not allowing the operator to change a number for a chargeable call, and recording the number on the AMA device and automatic message accounting billing (AMAB) log report, when an entered number changes but is not involved in the connection.

**Delay call denial** The delay call denial feature allows the operating company to control operator-originated backward connections. With this feature, the operating company can prevent or permit any and all delay calls.

**Expanded Operator Display** The expanded operator display feature allows the operating company to assign special instructional screens for the operator position. These instructional screens are generated by the incoming TOPS trunk group.

**Display call origination field on delay calls** The display call origination field on delay calls feature displays the call origination field when the operator attempts a delay call.

**Interposition transfer** The interposition transfer feature allows an operator to transfer a call. For example, when a bilingual operator is required, a transfer position can be set up to handle regular traffic and/or transferred calls. Two transfer keys are provided at the TOPS 04 operator position keyboard; on the TOPS MP the outgoing trunk (OGT) menu is used. A transferred call is identified to the operator.

**Mobile call handling** The mobile call handling feature enables TOPS system operator to handle mobile calls which originate within the operator serving area.

**Semi-automatic zenith** The semi-automatic zenith feature allows the operator to enter a 4 or 5-digit zenith number given by the subscriber. The number is automatically validated and the NPA of the subscriber is checked.

**Operator study data system** The operator study data system feature allows of FM for the TOPS MP to collect initial position seizures (IPS) and average work time (AWT) information by call type rather than by total IPS and AWT. This feature is an enhancement to the operator feedback system.

**Assignable grade of service** The assignable grade-of-service feature impacts call distribution. By assigning an aging parameter to the queues, some queues will have a higher priority than others when presented to an operator position.

**Multi-traffic office operation** Multi-traffic office operation augments normal single-traffic office administration with a force management position and a TTY. There is one force manager for each DMS-100/200 with two or more traffic offices.

**Verification scrambling and tone options** The verification scrambling and tone options feature provides communication security when the operator attempts verification. The operating company can scramble the conversation being verified, provide a warning tone to the calling and called party, and allow the operator to break into the call in case of an emergency.

**Queue selection on a trunk group basis** The queue selection on a trunk group basis feature allows operator-assisted calls on designated trunk groups to be forwarded directly, or be queued and forwarded to a transfer position. If this feature is not present, operator-assisted calls are first routed to a general operator before reaching a transfer position.

**Service Assistant/In-Charge Manager Queuing** This feature provides enhancements which allow more than one operator team to be in queue for directory assistance. With this feature operators may assist, complete, charge or connect subscriber calls. There can be a maximum of 6 service assistant teams. The in-charge manager also provides supervisory functions such as statistics for calls' status and traffic conditions.

**Enhanced MFADS** Enhancements to MFADS provides office data which accurately calculates workforce statistics such as occupancy, the average of occupied positions, and total board hours for multiple queues. The features answers operating company requests for expansion of queue types for collected traffic office requests.

**Automatic message accounting**

**AMA records of verification** The AMA records of verification feature generates an AMA record each time the operator performs a busy line verification.

**AMA records verification** The TOPS AMA verification feature generates an AMA billing record for each line verification made by an operator. Multiple busy line verification (BLV) during the same call generate one AMA record, unless general AMA is used.

**AMA record of specified unanswered call type** This feature allows the operating company to specify, by call type, which unanswered calls are recorded on AMA tape. The feature creates a table which works in conjunction with the NO_ANS_CALLS_ONTAPE parameter. If the parameter is set to YES, all unanswered calls are recorded. If the parameter is set to NO, only recorded, unanswered calls are set to YES in the TOPS AMA table.

If both the parameter and the table are set to NO, no unanswered calls are recorded. The feature does not eliminate the NO_ANS_CALLS_ONTAPE parameter.

**AMA failure routing options** The AMA failure routing options feature provides the operating company with routing options for toll calls used during AMA failure.

**CAMA suspension for 1+ coin and hotel calls** The CAMA suspension for 1+ coin and hotel calls feature allows the operating company to select operator number identification (ONI) and completed automatic number identification (ANI) fail calls when an operator is unavailable due to an emergency. An AMA record without the calling number is generated for the call when CAMA is suspended.

**Mechanized force administration 15-minute reports for MFADS** The TOPS system generates 15-minute reports for mechanized force administration data system (MFADS)**.** This feature is generated when a minicomputer system extracts TOPS force management statistics in 15-minute intervals from a pollable port.

**Traffic sampling** The traffic sampling feature provides information on the flow of calls through the TOPS system. Sampling occurs when billable calls are flagged and recorded on AMA tape. This call information lists downstream statistics, which are analyzed for four applications.

- operator services work volume measurement plan
- division of revenue procedures
- subscriber dialing acceptance
- engineering studies.

Three types of calls are not sampled.

- calls that do not reach an operator position
- position re-seizures
- operator-originated calls

### Operational measurements

**Position occupancy measurement** Position occupancy measurement is the percentage of occupancy of the operator team. This measurement, the ratio of that portion of operator time, is spent handling calls to the total time assigned to operator positions for handling calls.

**Operational measurement enhancements** The TOPS operational measurement enhancements feature provides a consistent approach to pegging the office tracking summary OM group. This feature improves the measuring of operator traffic by the TOPS OM groups.

**Operational measurement enhancements - phase II** This feature continues the work started by the TOPS OM enhancements feature. This phase enables an OM group to measure traffic on a host/remote basis in a host/stand-alone operator centralization office. It also updates the activity report and call disposition summary to reflect changes made in the TOPS OM and provides additional OM registers.

**Real-time enhancements** The TOPS real-time enhancements feature ensures system real-time performance for TOPS calls at the host or an operator centralization environment. There are four enhancement types.

- The start timing (ST TMG) and position release (POS RLS) key functions are now consolidated. This consolidation eliminates the ST TMG keystroke during most TOPS call handling procedures.
- Delayed outpulsing for plus-dialed calls which arrive at an operator position are now eliminated during regular operator call handling for common channel interoffice signaling (CCIS) queries.
- Dial rate calls are automatically class charged as station paid calls. This eliminates the STA PD keystroke and one separate screen update message.
- Zenith or 800 calls are automatically class charged as collect calls. This enhancement eliminates the AUTO COL keystroke and one separate screen update message.

Each enhancement reduces messaging between central control and an operator position, and decreases the overall processing time for each call.

### Hotel/motel

The hotel/motel feature enables toll calls made from a hotel or motel to be routed to an TOPS operator for identification of the calling party room number or a zero minus (0-) call. Time and charges, and other information, can be relayed to the hotel staff verbally or electronically.

### Rating system

The TOPS MP rating system feature is a collection of data tables containing customer-dependent data. The data is used to calculate rate step and charges. For certain types of calls to the TOPS workstation, charges are calculated on a real-time basis. Calls where the subscriber requests cost, coin billing, and hotel calls are quoted as rated on a real-time basis.

### Billing features

For all call types, the TOPS MP billing system feature provides a series of billing classes for the TOPS MP. Billing records associated with operator-assisted calls are recorded on the AMA system. These records contain all data necessary to bill the subscriber. AMA billing records can be recorded in the Northern Telecom or Bellcore AMA format.

### Remote TOPS maintenance

The remote TOPS maintenance feature performs maintenance and position diagnostic tests at one or more remote TOPS locations. The remote test (RTEST) system supports only one user, but allows up to four test processes to run simultaneously.

Diagnostic tests run at the trunk test position level of the MAP. From the command interpreter at the MAP, the user enters RTEST to invoke the remote test system and assigns a master position. With this feature, on-site personnel use master positions to be tested, and input commands required to perform diagnostic tests, without further assistance from central office personnel. Any combination of the diagnostic tests can be performed on operator positions.

## TOPS optional features

Optional features for the TOPS systems are described in the following paragraphs. Optional features such as TOPS equal access, operator centralization and automatic coin toll service are available as separate feature packages. These features can operate in conjunction with standard TOPS features, or as enhancements to these features will require additional translations.

### TOPS equal access

The TOPS equal access (EA) feature allows the DMS-200 access tandem switch to route calls to feature group C (FGC) and feature group D (FGD) carriers.

### TOPS interLATA carrier service

The TOPS interLATA carrier service (TICS) allows the operating company to provide operator services on a contractual basis for interLATA carriers (ICs).

### Operator centralization

The operator centralization feature allows a host DMS-200 to extend operator services for 15 DMS-200 remote offices. These remote offices can directly access and control TOPS positions on a demand basis. The remote office retains all existing trunking, translations, routing, and ticketing information. Both the host and remote office provide an equal grade of service.

### Coin features

Automatic coin toll service (ACTS) and the network operation trunking information formats, which are optional coin features for the TOPS systems, are described in the following paragraphs.

#### Automatic coin toll service

The ACTS feature minimizes operator involvement for 1+ , 7 and 10-digit coin calls. For these calls, the called and calling numbers are used to rate calls. A digital recorded announcement machine (DRAM) announces the charges for the call. Coin detection circuits (CDC) determine the amount deposited by the subscriber.

#### Network operation trunking information system format

The network operation trunking information system (NOTIS) format feature implements the Bellcore trouble recording format. The trouble report is routed to a special NOTIS device.

### Dial-up autoquote

The dial-up autoquote feature allows a hotel with this service to receive call detail information over normal phone lines. Billing records are placed in a queue. When a preset number of minutes has passed, or when a preset quantity of records has occurred, the DMS automatically sends call details to a receive-only TTY at a hotel site equipped with an auto-answer modem. Minute and record thresholds are defined by the operating company.

### Closedown

Each operator centralization (OC) host provides operator services 24 hours a day. During light traffic loads, usually midnight to 6 a.m., fewer operators are required. The closedown feature redirects the traffic load at each host switch and enhances OC by enabling the operating company to reconfigure the network between the host and remote during closedown.

## Billing features

### TOPS service billing

The TOPS service billing feature allows an operating company to define and rate numbers as service numbers.

### Bellcore AMA format

The bellcore AMA format feature allows the operating company to record call billing data on magnetic tape in a Bellcore AMA format. The Northern Telecom AMA format is the default format for the TOPS systems.

### Mechanized calling card service features

There are three mechanized calling card service features supported by the TOPS MP and TOPS 04 systems. These TOPS system features provide a data base query system which supports automatic credit card, operator credit card, collect, and third party calls.

**Mechanized calling card service feature** The mechanized calling card service (MCCS) feature allows a subscriber at a dual tone multifrequency (DTMF) coin station to apply charges to a personal calling card. After the subscriber enters the card number, the call is connected and billed to the card.

**MCCS operator-assisted calling card validation** The MCCS operator-assisted calling card validation (CCV) feature enables the operator enters the number, the BVC data base verifies the validity of that number. The status of the number appears on the operator position.

**MCCS operator-assisted manual inward validation** The MCCS operator-assisted manual inward validation (OASMIV) feature allows an operator, with access to the billing validation center (BVC) data base to verify calling card numbers for other operators who are unable to perform this task.

# TOPS Call Processing

This section describes the call processing sequence for a TOPS system. Refer to the DMS-100 Family Technical Specification, Section 4, for a complete description of call processing for the DMS-100 family switch. Refer to *TOPS 04 Operator Guide*, 297-2271-300, for a description of call handling procedures for TOPS 04 operators.

When a call arrives from an end office at the DMS-200 switch, the call can be routed directly to TOPS, to an intra-local access and transport area (IntraLATA) destination, or to an inter-local access and transport area (InterLATA) destination. The DMS-200 determines the call route by examining the prefix and the station class of the call. The call prefix indicates how the call was dialed.

For example, a zero minus (0-) prefix indicates a subscriber dialed only a zero. A zero plus (0+) additional calling digits, such as NPA-NXX-XXXX is used for alternate billing of the call. This may include call types such as collect, calling card, or billing to a third number.

The DMS-200 TOPS will accept prefixes for calls from coin, non-coin, and hotel stations. These call types include the following categories.

- domestic direct dialed (1+)
- domestic operator-assisted or AABS (0+)
- operator-handled intraLATA(0-)
- operator-handled interLATA (00-)
- operator-assisted international (01+)
- direct dialed international (011+)

The station class of a call indicates where the call originates, such as coin, hotel, or non-coin. The DMS-200 switch determines station class of a call in various ways, depending on the trunk type carrying the call. There are two incoming trunk group types: dedicated and combined.

Dedicated trunk groups carry traffic with one station class, for example, 1+, 0+, and 0- coin calls. Combined trunks carry traffic with different station classes, for example, 1+ and 0+ coin and non-coin calls. If a call arrives on

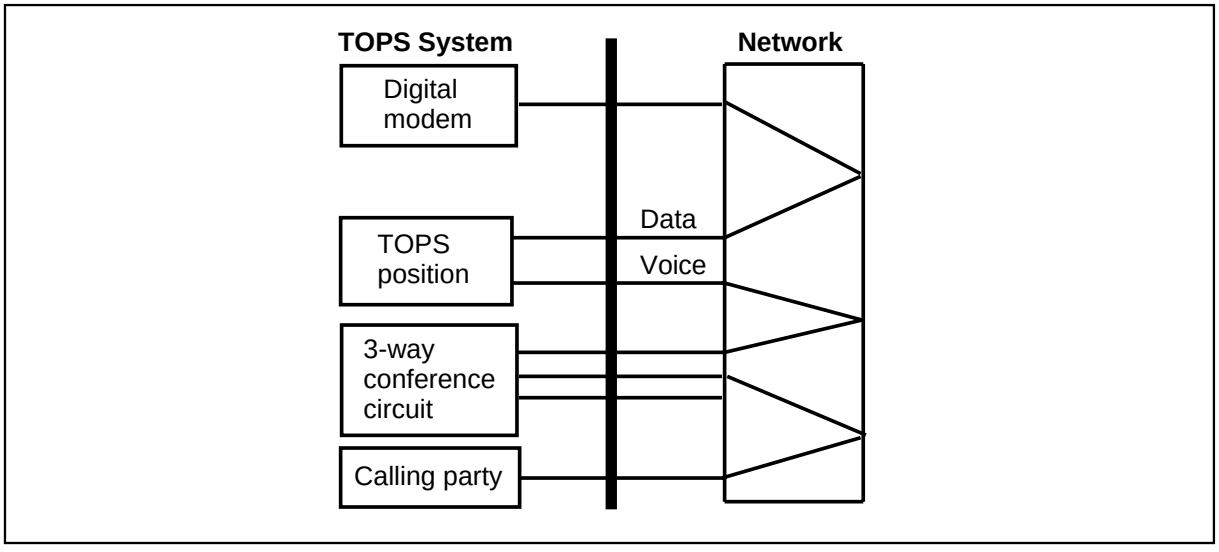
a dedicated trunk group, the DMS-200 switch uses the Table TOPS TRKGRP to determine station class. If a call is carried on a combined trunk group, the DMS-200 switch may use an automatic number identification (ANI) spill to determine station class.

The ANI spill, called number and start (ST) digits provide information necessary for billing and determine whether operator assistance is required for call completion. During TOPS call processing, ANI spill is saved in the TOPS recording unit (TRU) for reference during call setup and billing. Format for the ANI spill is determined by signaling type for the trunk carrying the call. The DMS-200/TOPS configuration accepts various types of signaling, such as traditional operator services signaling (OSS), modified operator service signaling (MOSS), equal access (EA) signaling, and exchange access operator service signaling (EAOSS). The ANI spill for calls on incoming TOPS trunk groups, which traditionally use OSS, include one key pulse, a one-character ANI ID digit, the calling number, and a start signal. To determine the station class of calls on combined trunks using traditional OSS, the DMS-200 switch examines the ST signal and the ANI digit.

## Call arrival

When the DMS-200 determines operator assistance or automated alternate billing service (AABS) is required for call completion, a 3-port conference circuit is selected and the call and operator position are connected to that port. A call arrival tone alerts the operator when the call arrives at the position. and the related data for the call appears on the screen at the operator position. Refer to Figure 5-1 for an illustration of call arrival.

**Figure 5-1** Connection to Incoming Call



## Call handling

When an operator-assisted (OA) call arrives at an operator position, the operator requests the subscriber provide call details required to complete the call. The operator enters this information from the keyboard. If the information includes the called number, the DMS-200 switch establishes the connection to an outgoing trunk. Once the connection between the incoming and the outgoing trunks is made, the operator can release the call or continue to monitor. If the operator releases the call, a 3-port conference circuit is idled and available for use by another operator position. If the operator monitors the call, the three-port conference circuit remains connected to that operator position. An automatic message accounting (AMA) record is generated when the called and calling parties go on hook. For remote operator number identification (RONI**)** calls, an AMA record is generated when the call is released by the operator. Refer to Figures 5-2, 5-3, and 5-4 for an illustration of call handling.

**Figure 5-2** Connection to Calling and Called Parties

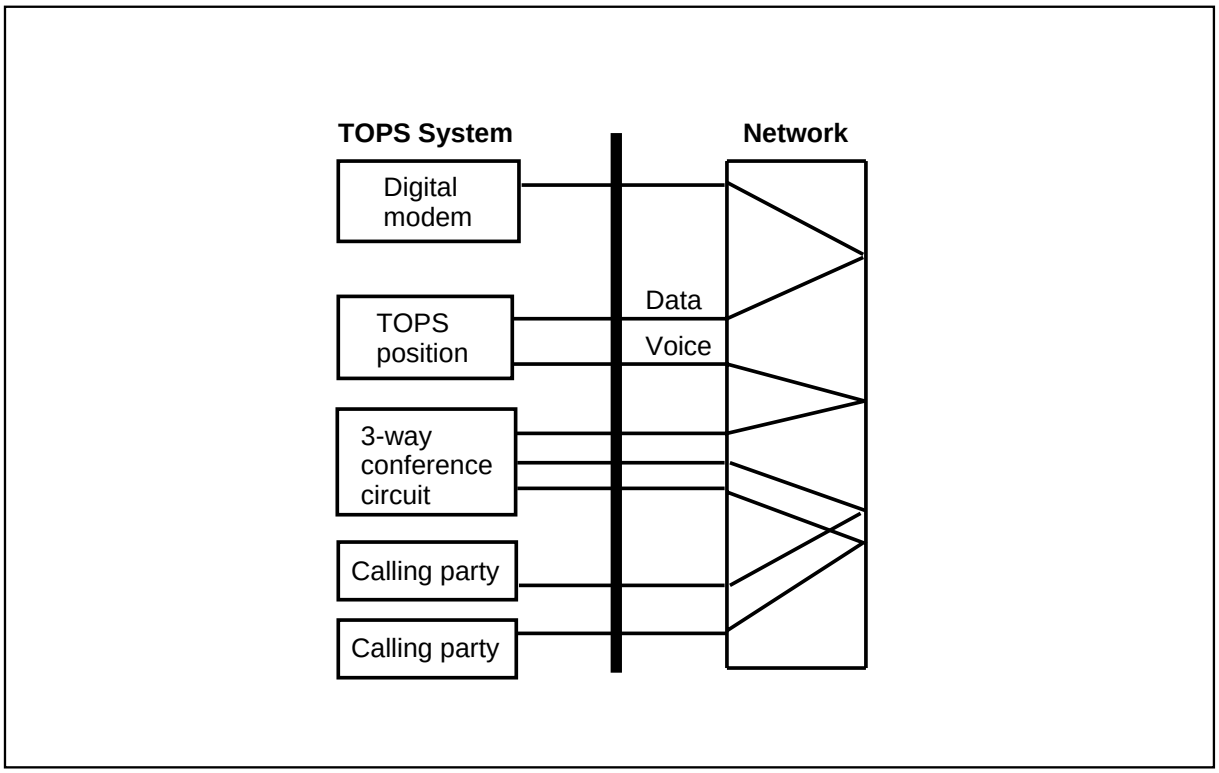


**Figure 5-3** Position Ready for New Call

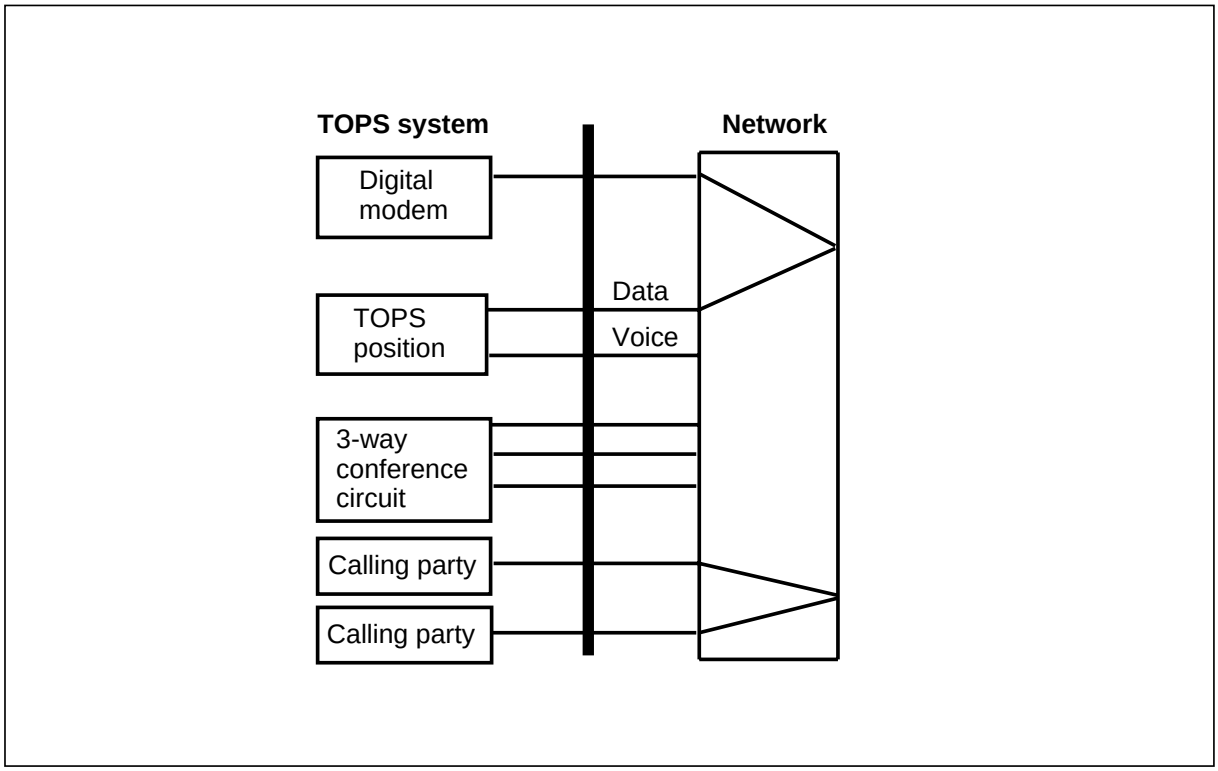
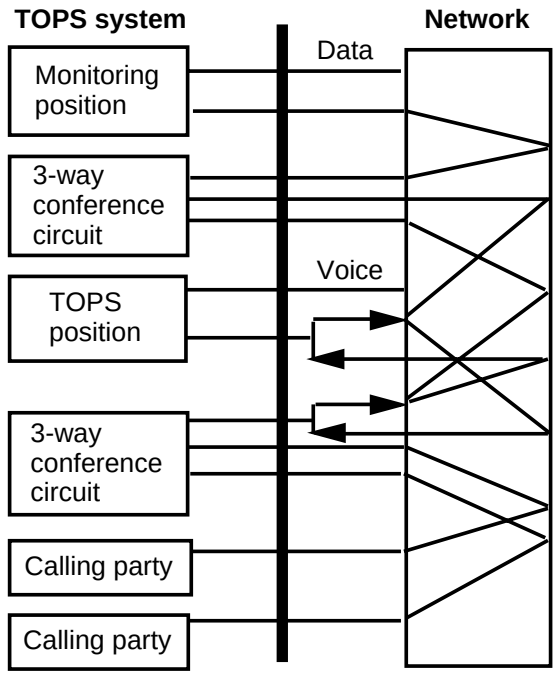


**Figure 5-4** Monitoring Connection




## Call on hold

Supervisory status for up to two calls can be monitored and displayed at the operator position. One call can be placed on hold while the operator is actively handling the other. The on-hold call remains connected to the 3-port conference circuit. Another 3-port conference circuit connects to the operator position. When the operator handles the on-hold call, that 3-port conference circuit connection to the position is restored, and call details for the call display at the TOPS operator position.

## Call monitoring

An operator position may be monitored when an operator requests verbal assistance from an in-charge or assistance position or when an in-charge or assistance position monitors an operator for service-observing purposes.

## Call distribution and queuing system

The call distribution and queuing system is designed for first-in-first-out (FIFO) operation. In each TOPS system there is a single position queue with a priority search order. When the DMS-200 switch determines a call should be routed to an operator position, it searches the position idle queue

and the position partly idle queue to determine distribution of the call. The position-idle queue is used for positions where both connection loops are idle. Currently there are nine call processing queue types.

- GEN non-recall
- XFR1 non-recall
- XFR2 non-recall
- Director assistance non-recall
- GEN recall
- XFR1 recall
- XFR2 recall
- Directory Assistance recall
- CAMA

For centralized automatic message accounting (CAMA) calls, the DMS-200 switch first searches for an available position in the partly-idle queue. If a position is not available, the switch searches for an available position in the position-idle queue.

The position partly-idle queue is used for positions which have one idle connection loop. If an idle or partly idle position is not available, the DMS-200 switch places the call in a call waiting (CW) queue. When an operator position becomes available, the DMS-200 switch searches the CW queue and connects the call at the top of the CW queue to an idle position. Recalls are connected first. Calls waiting in the queue for the longest period of time are connected next. If there are no calls waiting in the queue, the switch places the position in the appropriate position idle queue.

The DMS-200 switch monitors the number of calls in the queue. If that number exceeds the preset threshold, a CW message displays automatically at all in-charge and assistance positions. This message does not appear at an operator position until the next call arrives at that position.

If the number of calls in the queue exceeds a selected answering delay time, such as 60 second, 1+ and 0+ calls are deflected to a recorded announcement and disconnected. Recalls and 0- calls are retained for eventual connection to an operator. The subscriber will receive a recorded message. This message prompts the subscriber to reconsider waiting for an operator, unless the call is an emergency.

Thresholds for CW and deflected calls are based on the average work time (AWT) for the TOPS system and the number of occupied positions. Control of these thresholds, controlled by the force management position, governs the volume of traffic reaching the operators. The TOPS system allows all operators to handle all types of calls or gives certain operators the ability to

handle certain types of calls. The call transfer and the controlled traffic methods of call distribution are used when selective call handling is required.

## Call transfer

Specific call types require handling by an autonomous team of operators, such as second language and directory assistance operators. Any TOPS operator can place these calls in a transfer queue for routing to that team. The operator does this by using two transfer keys on the operator position keyboard. Calls can be placed directly in a transfer queue, if the call type is known, from the dialed digits or the station class.

## Controlled traffic mode

Operators can be assigned to handle a selection of call types which vary from all call types to a single call type. Operators barred from handling specific call types are placed in the controlled traffic mode by the in-charge manager.

Because overuse of the controlled traffic mode reduces overall system capacity, no more than 25 percent of operators should logged on to perform this type of call handling.

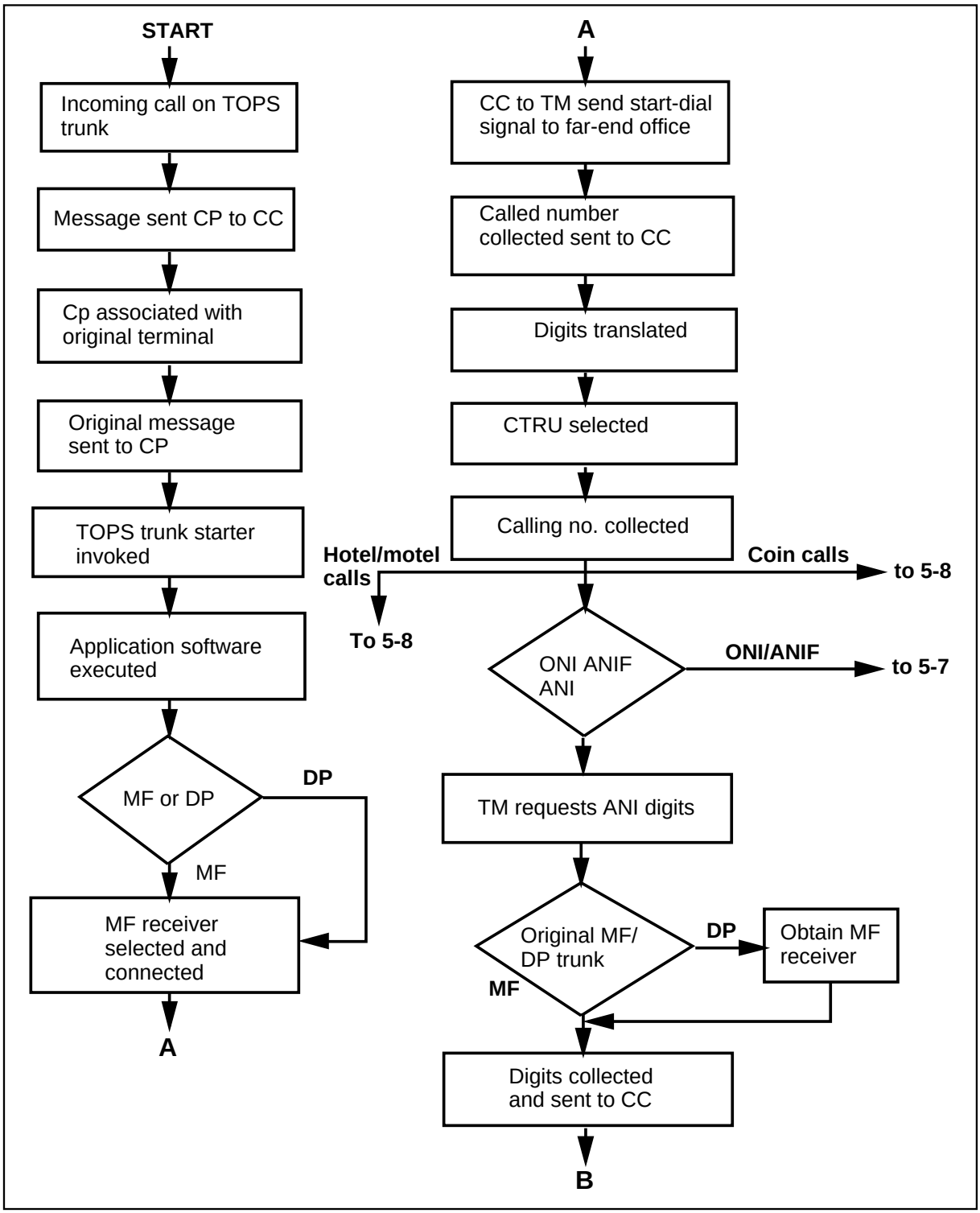
## Special call processing treatments

The TOPS call processing software provides the code for handling call processing functions associated with different types of equipment in the DMS-100 Family system. This software can be divided into three basic categories.

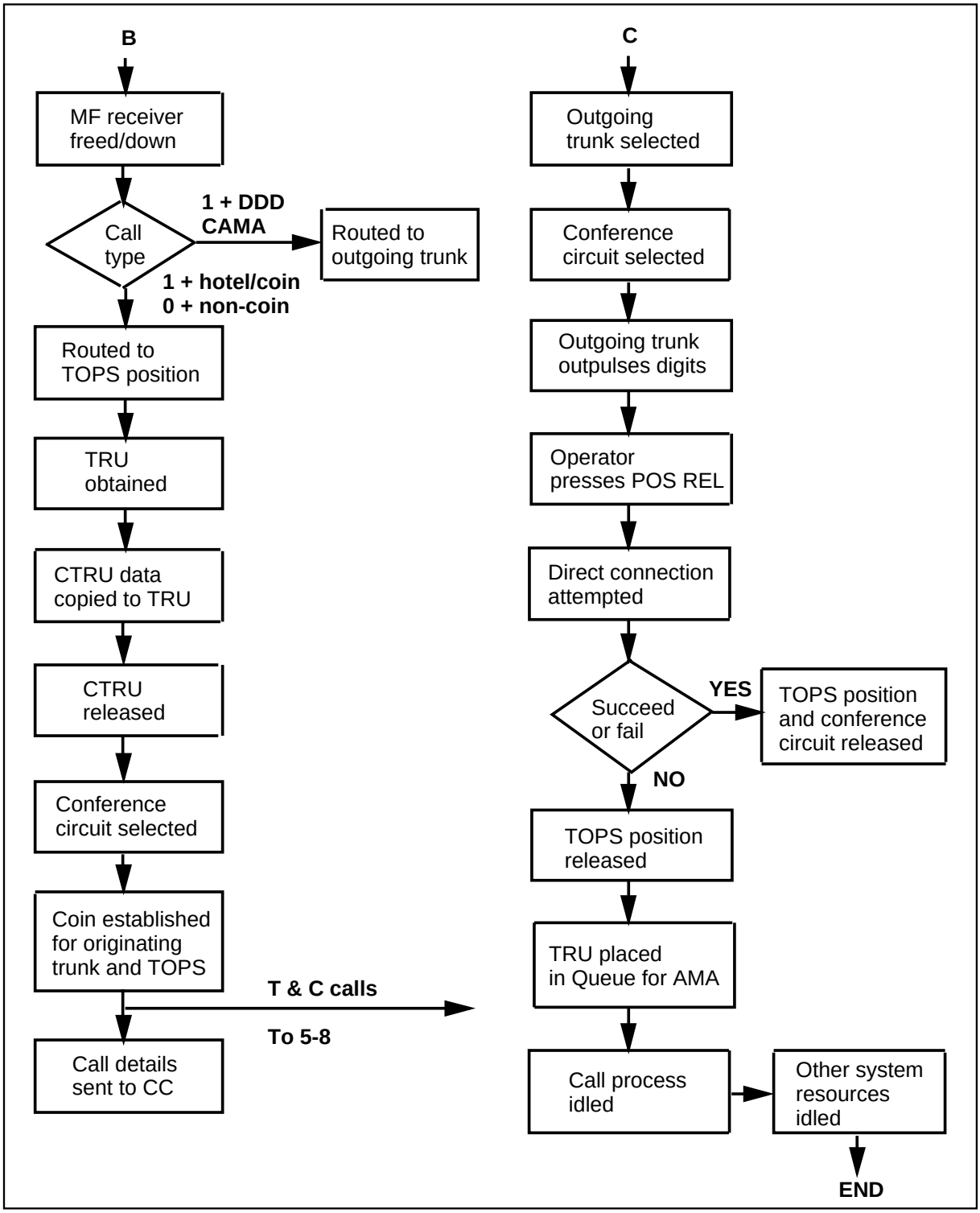
- starters
- processors
- functions

For more additional information on these three categories, refer to Chapter 4 of the *DMS-100 Family Technical Specification.* The following description of TOPS initial seizure and collection is illustrated in Figure 5-5.

**Figure 5-5** Initial Seizure and Collection



**5-5** Initial Seizure and Collection (continued)



When a seizure is detected on an incoming TOPS trunk, a message is sent to the central control (CC). A software process associated with the originating terminal and the origination message is sent to the CC. The trunk starter is invoked and the appropriate application software is executed.

If the originating trunk is a multifrequency (MF), an MF receiver is selected and connected to the originating trunk module (TM). The CC instructs the originating TM to send a start dial signal to the far-end office. The called number is collected via the MF receiver and sent to the CC, where the digits are translated. If the originating trunk is dial pulse (DP), the sequence is the same but an MF receiver is not required.

A centralized automatic message accounting TOPS recording unit (CTRU) is selected and associated with the call process, and the calling number is collected. A CTRU is a block of storage used to record call billing information. The calling number is then collected. All centralized automatic message accounting (CAMA) operator number identification (ONI) and Automatic Number Identifcation (ANI) fail calls are sent to a TOPS operator for calling number collection.

For ANI calls, the CC sends a message to the originating TM to request the ANI digits. These ANI digits are always MF and an MF receiver is required. If the originating trunk is an MF trunk, an MF receiver is already connected. If the originating trunk is a digits pulsed (DP) trunk, a MF receiver must be connected before the ANI digits are requested. After the digits are collected via the MF receiver and sent to the CC, the MF receiver is freed and the connection to the receiver is taken down. Call type is determined on the basis of the calling and called numbers. Depending on call type, the call is routed to an outgoing trunk or a TOPS operator position.

CAMA calls (1+DDD) are routed to an outgoing trunk. A network connection is established between the incoming and outgoing TMs and the necessary digits are outpulsed. Calls such as 1+ hotel, 1+ coin, and 0+ non-coin are routed to a TOPS operator or automated system. In this case, a TOPS recording unit (TRU) is obtained and associated with the call process. Data in the CTRU is copied into the TRU and the CTRU is released.

When a position is available, a 3 or 6-port conference circuit is selected and connections are established between the originating trunk and the TOPS position voice terminal via the conference circuit. Call detail information is input by the operator, which is sent to the CC via the data memory (DM) and written into the TRU.

When the operator or TOPS system determines a call should be outpulsed, an outgoing trunk is selected and a network connection is established

between the conference circuit and the outgoing TM. The outgoing TM outpulses the necessary digits to the far office.

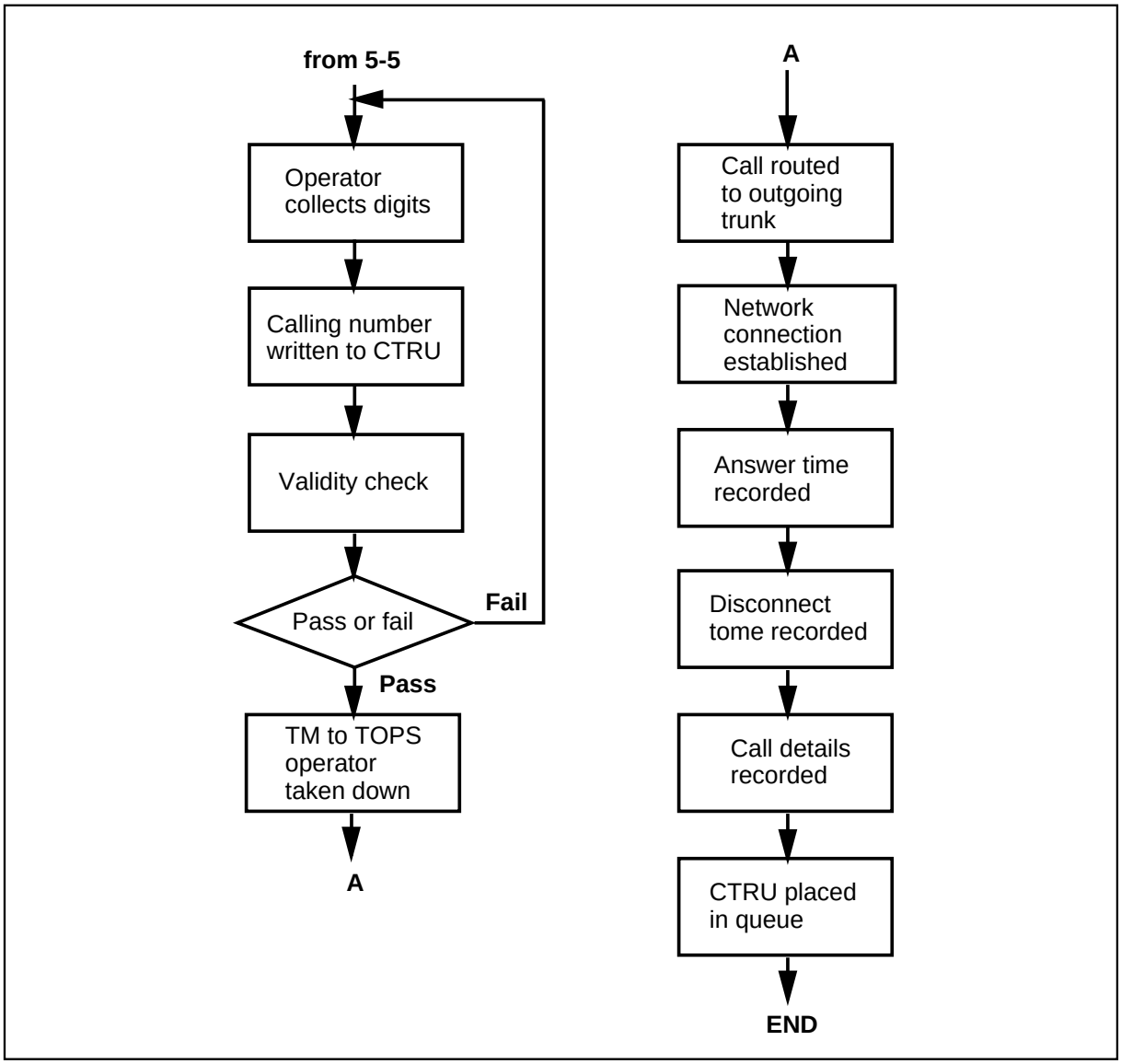
Once necessary call data has been obtained and entered, the operator presses the POS REL key and an attempt is made to establish a direct connection between the incoming and outgoing TMs. If the attempt is successful, the TOPS position and the conference are released. If the attempt fails, the TOPS position is released and the connection is maintained via the conference circuit. The CC attempts to establish a direct connection every 30 seconds.

The TRU or CTRU remain associated with their call types until disconnect. The TRU/CTRU is then placed in a queue for processing by the AMA system. The call process is idled and any other system resources associated with the call are freed.

## CAMA call processing

Figure 5-6 illustrates the CAMA call process.

**Figure 5-6** CAMA Call Process




For billing purposes, the calling number is collected automatically for CAMA ANI calls and manually for CAMA ONI or automatic number identification fail (ANIF) calls. The ANI digits are collected as described in this section.

CAMA ONI/ANIF calls are routed to a TOPS operator for collection of the calling number. When a position is available, a connection is established between the originating trunk and the TOPS position voice terminal. The CAMA call indicator CAMA displays in the upper-left corner of the operator position screen.

For CAMA ANI calls, the CAMA call indicator flashes. An audible call arrival tone is generated at the position and ASC1 or ASC2 displays. For ANIF calls, a single-beep call arrival tone is heard by the operator. The operator collects the calling number and enters it into the system. For ONI calls, a double-beep call arrival tone is heard simultaneously by the operator and the subscriber as a prompt for the calling number. The calling number is sent to the CC where it is written to the CTRU.

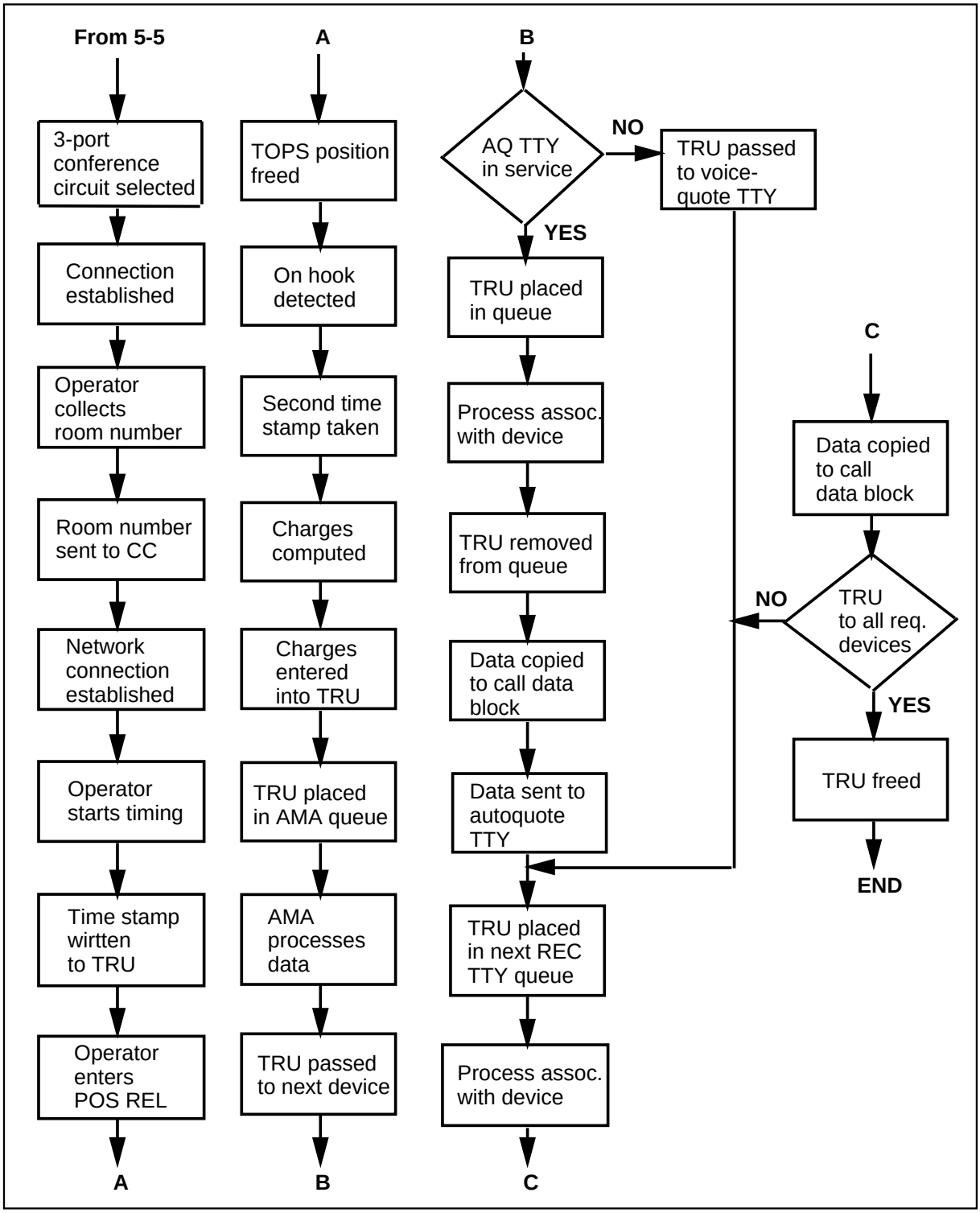
A validity check is done on the first three digits of the calling number. If the check fails, the calling number flashes on the operator position screen. The Operator collects the calling number again and presses KP BACK**,** followed by the seven-digit calling number. If the check passes, the connection between the originating TM and TOPS operator is taken down and the position is freed. An outgoing trunk is selected and the call is routed to that outgoing trunk. A network connection is established between the incoming and outgoing TM. Necessary digits are outpulsed.

When the called party answers, a message is sent to the CC and the answer time is recorded in the CTRU. When either party goes on hook, a message is sent to the CC and the disconnect time is recorded in the CTRU. Conversation time is recorded in the CTRU. The CTRU is placed in a queue for processing by the AMA subsystem.

## Coin call processing

The coin call process is a 1+ or 0+ coin-paid call from a prepay coin telephone. Initial seizure and collection of the called and calling numbers occurs as described in this section. The coin call/automatic coin toll service (ACTS) call process is illustrated in Figure 5-7.

**Figure 5-7** ACTS/HOBIC Call Processing



If there is no ACTS service, the call is routed to a TOPS operator for collection of the initial deposit. When a position becomes available, a 3-port conference circuit is selected and connections are established between the originating trunk and the TOPS position voice terminal via the conference circuit. The call indicator 1+ COIN PRE displays in the upper-left corner of the operator position screen. The charge for the initial time period also displays.

If delayed outpulsing is in effect after a specified delay period, an outgoing trunk is selected and a network connection is established between the originating and terminating trunks via the conference circuit. The operator secures the initial deposit and enters POS REL, which starts timing for the call and releases the operator position. If the initial deposit exceeds the capacity of the hopper, the operator verifies the connection before collecting the coins, in appropriate amounts, and releases the position. For 1+ and 0+ deposits, coins are collected automatically 5 seconds before the initial time period expires. Timing starts after the POS RLS key is pressed or when the called party answers, whichever occurs last. A time stamp is taken and written into the TRU.

A message is sent to the wakeup process to request a wakeup message 5 seconds before the initial time period expires. The TOPS position is freed and a direct connection is established between the incoming and outgoing TMs.

When the wakeup message is received, the initial deposit is collected and the call is routed to a TOPS position. When a position becomes available, a conference circuit is selected.

Network connections are established between the incoming and outgoing TMs and the TOPS position voice terminal via the conference circuit. The indicator NFY MIN COIN PRE displays on the operator position screen. The operator announces the end of the initial period to the customer and presses POS REL. Timing is suspended when the call is attached to an operator position and is resumed when the operator presses POS REL.

A message is sent to the wakeup process requesting another wakeup message after an assigned overtime period has expired. This overtime period is determined by the TOPS rating system. When the specified overtime period has expired or upon disconnect, whichever occurs first, the call is returned to the Operator position. If the overtime process has expired, the wakeup process sends a message and the call is routed to a TOPS position.

The TOPS position voice terminal is connected to incoming and outgoing TMs via the port conference circuit. The message OVT (MIN) COIN PRE and

the amount due displays at the operator position. The operator secures the overtime deposit and releases the position. This cycle is repeated as required until disconnect. Upon detection of disconnect, the call is returned to an operator position and the calling party is connected, via the conference circuit to the operator position voice terminal.

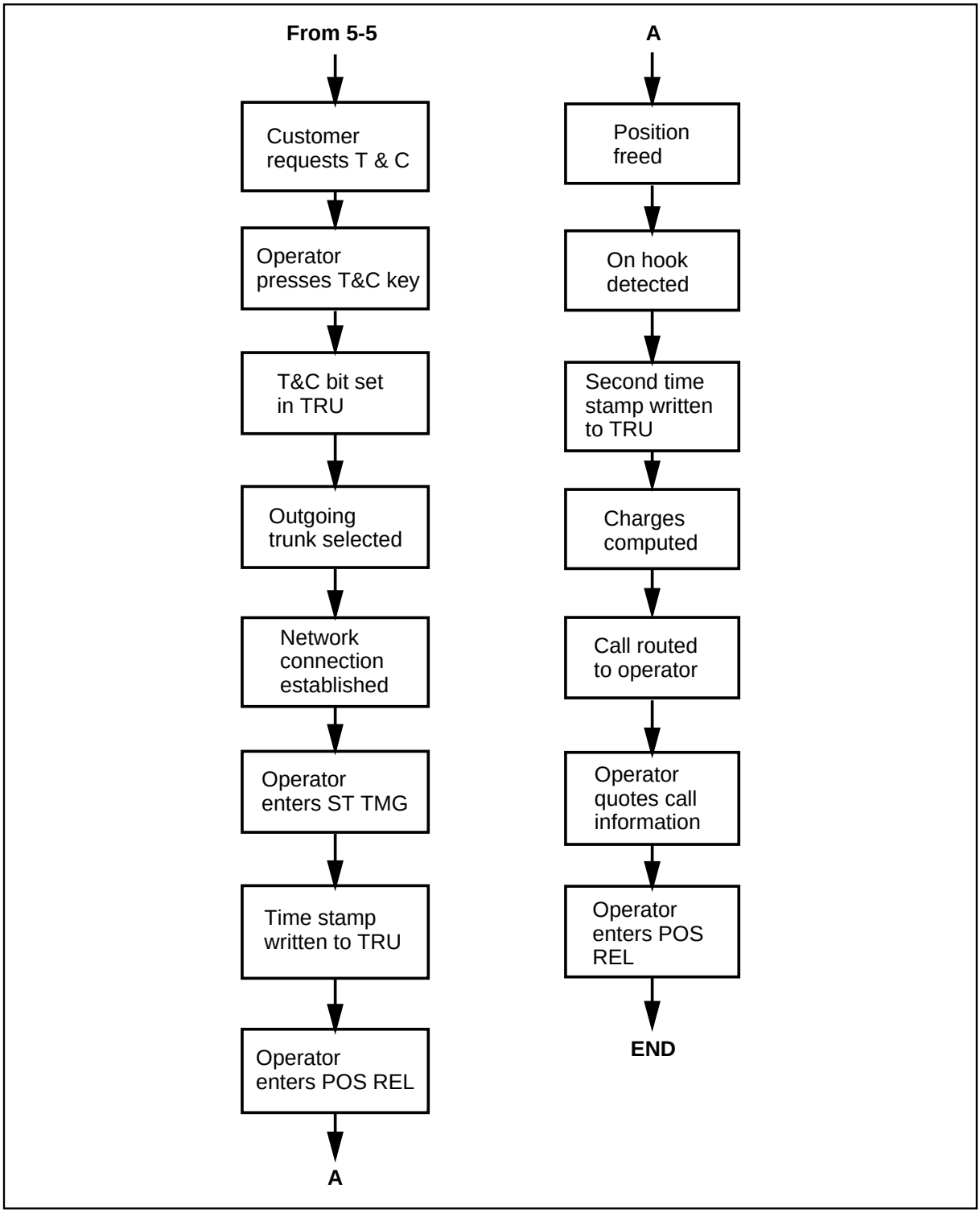
*Note*: If a disconnect occurs within 5 seconds of announcing the expiration of the initial time period, the call is not returned to the operator position. The call is taken down and any system resources associated with the call are freed.

The message OVT COIN PRE**,** the amount due, and the amount of overtime in minutes displays at the operator position screen. The operator collects the amount due and presses POS REL. The TOPS position and any other system resources associated with the call are freed. If the calling party goes on hook before the additional charge is collected, the operator operates the RING BACK, RLS BACK or START keys to ring the calling telephone and secure the overtime charge.

### Time and charge call processing

A time and charge (T&C) call processing is required when the subscriber requests information for the duration and charges for a call. The call described in this section is a regular T&C call. The initial trunk seizure, collection of calling and called numbers, and connection to a TOPS position are described in the call processing paragraphs of this section call processing section. The T&C call process is illustrated in Figure 5-8.

**Figure 5-8** Time and Charges Call Processing



When a customer requests T&C, the TOPS operator informs the TOPS system that message details are required at call completion and a T&C bit is set in the TRU. An outgoing trunk is selected and a network connection is established between the originating and terminating trunks via the 3-port conference circuit. A time stamp is taken and written into the TRU. Once all the necessary data is collected, the operator presses the POS REL key, the TOPS position is released. An attempt is made to establish a direct connection between incoming and outgoing TMs.

When either party goes on hook, a second time stamp is taken and written to the TRU. Charges are computed and entered into the TRU where the TRU is checked. If the T&C bit is set, the call is routed to a TOPS operator for quotation of T&C.

When a position becomes available, a 3-port conference circuit is selected. Network connections are established between the originating trunk and the TOPS position voice terminal. The message T&C displays in the upper-left corner of the operator screen. The call duration, charges, and calling number also display for the operator quote to the subscriber. The operator presses POS REL and the TOPS position and any other system resources associated with the call are freed after the T&C quotation.

## HOBIC call processing

The TOPS system in a hotel billing information center (HOBIC) configuration enables a TOPS operator to handle call processing tasks from a HOBIC. The TOPS Operator is responsible for the initial phase of the call, which consists of entering call details. The HOBIC operator performs the second phase, the quotation of T&C, at call completion. This section describes a guest-dialed station paid toll call. Figure 5-8 illustrates the HOBIC call process.

Toll calls made by hotel/motel guests are routed from the hotel private automatic branch exchange hotel billing information center (PABX) to a local central office, or HOBIC. From the HOBIC, calls are switched to a DMS-200 TOPS office. Initial trunk seizure and the collection of called and calling numbers are handled as a typical call process. Refer to Figures 5-5 and 5-6 for an illustration of TOPS call processing.

After TOPS call processing occurs, the call is routed to a TOPS operator for collection of the guest room number. When a position becomes available, a 3-port conference circuit is selected and connections are established between the originating trunk and the TOPS position voice terminal via the conference circuit.

The message 1+ HOTEL displays in the upper-left corner of the operator position screen. The operator collects the room number of the guest and enters it into the TOPS system. From the TOPS position the number is sent

to the CC where it is written to the TRU. An outgoing trunk is selected and a network connection is established between the originating and terminating trunks via the conference circuit. When all the necessary data for the HOBIC call is collected, the operator presses POS REL. The TOPS position is freed and an attempt is made to establish a direct connection between the incoming and outgoing TMs.

When either party goes on hook, a second time stamp is taken and written to the TRU and charges are computed and written into the TRU. When this occurs, the TRU is placed on the AMA queue for processing. The AMA process selects the appropriate information from the TRU, formats it, and copies it into a buffer for output to AMA tape.

The HOBIC calls the TRU for availability to the next device in line. If the hotel/motel that is charged has an in-service autoquote (AQ) teletypewriter (TTY), the TRU is placed on the device queue and a process associated with the device, if one is not defined, is identified. When the device becomes available, the TRU is removed from the queue and call processing data for the call is formatted and copied into the process call data block input buffer. The data is then copied into the call data block output buffer, 29 characters at a time, and sent to the AQ TTY. Once the data is copied into the call data block, the next available device is identified and the TRU is placed in the device queue. In this example, the next device is a record TTY.

*Note*: There is one record teletypewriter per TOPS office, with a maximum queue length of 48 devices.

When the device becomes available, the TRU is removed from the queue and the call data is formatted and copied into the call process data block input buffer. The data is then copied into the call data block output buffer, 29 characters at a time, and sent to the record TTY. If the hotel/motel receiving the information does not have an AQ TTY, or if the AQ TTY queue length is exceeded, the TRU passes from the AMA system to a voicequote (VQ) system and a record TTY.

*Note*: There is one VQ TTY queue per TOPS office with a maximum queue length of 24 devices.

If any queue length exceeds specified threshold values, the TRU passes to the next device in line. If a device is down for more than ten minutes, the entire queue of TRUs passes to the next device. The TRU is freed after it passes to all necessary devices.

## Automated Alternate Billing Service

Automated alternate billing service (AABS) is a DMS-100 Family enhancement which provides automated handling for the following 0+ examples. These call types replace the operator function of most 0+ calls.

- collect
- calling card
- third party

Some types of 0+ calls, such as person to person-to-person, are handled by an operator. Other 0- calls are initially handled by operators and transfered to the TOPS voice service node (VSN).

When a subscriber dials 0+ NPA the subscriber will hear a tone. The subscriber can now enter a calling card number and a personal identification number (PIN) to charge the call.

With the AABS feature, the subscriber may select collect or third number billing, or speak with an operator. Should time out expire after the tone, an annoucement is played explaining the caller's options. This can be done with dial tone multifrequency (DTMF) digits or by voice.The AABS feature is divided between TOPS and the TOPS VSN. The DMS/TOPS VSN interface includes both data and voice links. Refer to TOPS voice service node index of publications, 450-1301-001, for additional information on VSN.

The TOPS VSN was first based on the Northern Telecom data voice system (DVS). The DVS has continued to adapt to the VSN application through additional hardware and software development. AABS is curently a cabinetized system which satisfies central office operating environments. The cabinetized system holds all required TOPS hardware.

# Administration

This section describes administrative and operational functions for the TOPS MP and TOPS 04 systems. Administrative functions are described in terms of force management and traffic office responsibilities. Hotel billing information for single and multi-traffic offices also are described. Operational functions are described in terms of operator feedback, call transfer, call transfer to a service assistant, position status checks, and calling queues.

## Administrative functions

Administrative functions for the TOPS systems include force management administration and traffic office administration (FADS/TADS). These two functions are described in the following paragraphs.

### Force management administration

Force management administration occurs at the force management center under the direction of the force manager (FM). TOPS position administration, which is supported by the TOPS MP, also is described here. In a TOPS MP system configuration, force management administration occurs at the FM position for traffic and operator administration, and a VT220-compatible terminal for maintenance and administration duties. Under the FM, one or more force administrators also are responsible for the training of other operators.

Force-level management and the force administration data system (FADS) enables the FM to track administrative data for the entire TOPS work force. Information from the FADS TTY, which can be generated in 15 or 30-minute intervals, includes traffic office performance, 6 hour and 24-hour reports. The FM screen constantly displays loop-accessed positions where either party is attached and off hook, and the number of positions. The following status data display at an FM CRT.

- occupied
- unoccupied, with a call attached or disconnected
- made-busy by operator
- in controlled traffic mode
- out of service

The summary reports from a FADS TTY detail average work time (AWT), average occupied positions (AOP), initial position seizures (IPS), answer time (ANS), calls waiting (CW) in queue, work volume (WV), and the percentage of occupancy for all TOPS positions. The reports are calculated every 15 minutes for the previous 15 minute period, if requested, or every 30 minutes automatically. Additional summary reports are available every 6 or 24 hours.

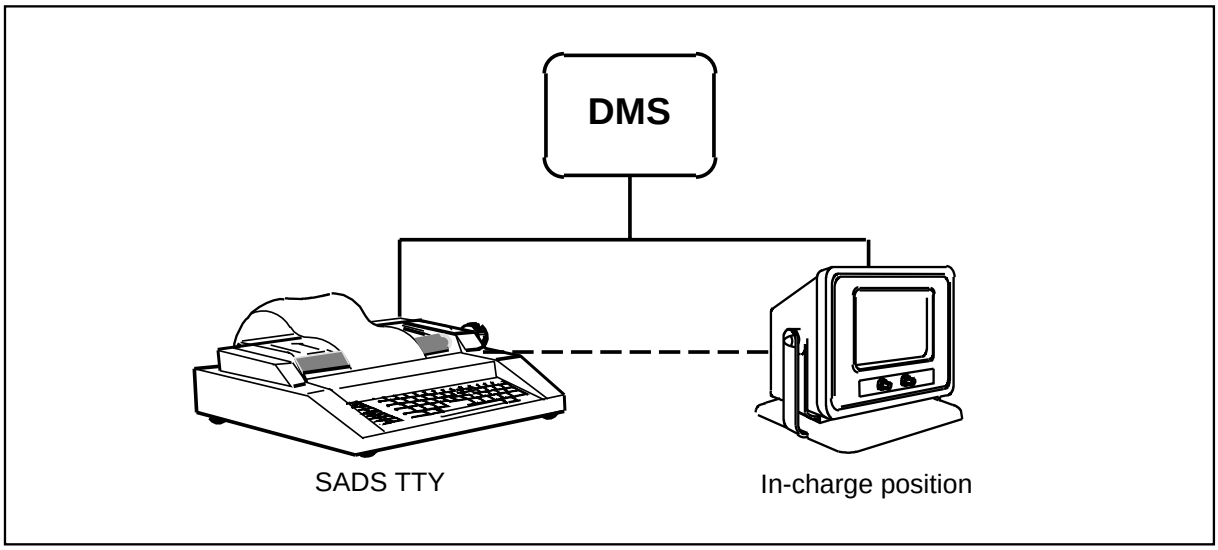
### Force management center

The force management center (FMC), which is supervised by the force manager, has four primary responsibilities.

- control number of calls to one operator group
- receive data relative to short and long-term traffic requirements
- receive statistical data to evaluate traffic office performance
- receive statistical data to evaluate entire work force

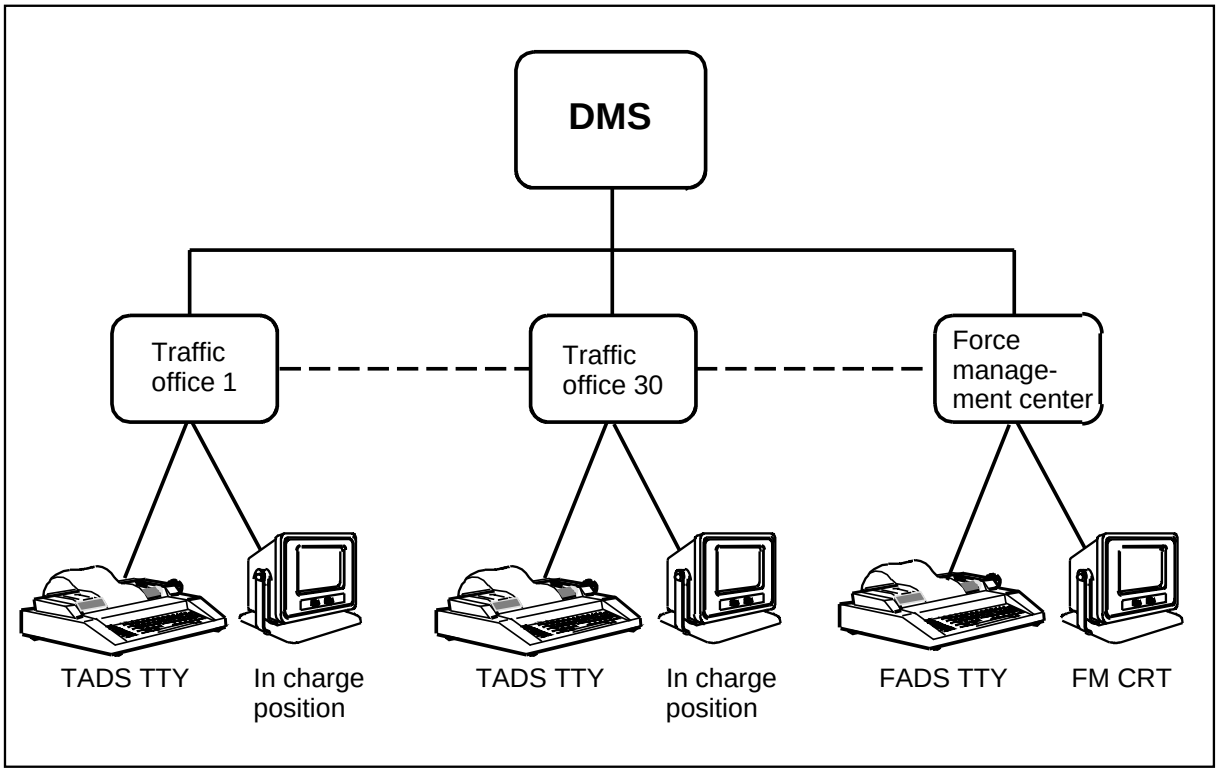
In a single-traffic office, force management and traffic functions are combined. A TOPS single-office configuration is illustrated in Figure 6-1.

**Figure 6-1** TOPS Single-Traffic Office Configuration



In a multi-traffic office, the force management center consolidates all FM functions. A TOPS multi-traffic configuration is illustrated in Figure 6-2.

**Figure 6-2** TOPS Multi-traffic Configuration




## TOPS Position Administration

TOPS position administration includes initial TOPS software installation and subsequent software upgrades from floppy disks. TOPS position administration also includes the entering of data table translations. For a TOPS MP configuration, this data is entered from a TOPS administration and maintenance interface (TAMI) position via the TOPS position controller (TPC).

The TPC communicates via the TAMI when maintenance and administrative tasks are performed. The TPC provides inter-circuitry communication supported by a common bus. To initiate the TAMI, a TOPS MP workstation may connect to a VT220-compatible terminal followed by a carriage return. After the carriage return, a main menu appears at the TAMI position with the selection of administrative tasks. A TTY can be connected to the TAMI position for hardcopy output. Pressing the PF4 key generates a hardcopy of the current TAMI screen.

The operator position and control option verifies the presence of the high-speed data interface (HSLI) card in the shelf. High-speed data access

(HSDA) status and control indicates the card and link status of the HSDA to external data bases for offices with DA or ORDB. Sonalert audibly informs force-level management when traffic loads exceed threshold on a per terminal basis.

## Traffic office administration

Management functions affecting the work force or individual operators are dependent upon the traffic office configuration type. One traffic office consists of one or more operator teams grouped together for statistical or managerial purposes. These operator teams comprise one work force. Each work force can include from 1 to 30 traffic offices. Operator positions within a traffic office can be grouped together or scattered randomly throughout the office. The four office administration data systems which may support a TOPS system include SADS, FADS, TADS and HADS.

Traffic office administration can be performed by force management, the in-charge manager, or an assistance position. The in-charge manager is directly responsible for operator supervision. In this capacity, the in-charge manager tracks administrative data for a traffic office. This position assists a maximum of six assistance positions. The assistance position has five functions.

- handles assistance requests
- monitors operators
- pages operators
- place outgoing calls
- perform an administrative search

### Force management center

The force management center (FMC) enables the force manager to enter, transmit, and erase broadcast messages to the FM FADS teletypewriter (TTY). Broadcast messages for the TOPS MP cannot exceed 60 characters. Broadcast messages for the TOPS 04 cannot exceed 64 characters. For either TOPS system, force-level management receives hardcopy summary reports which detail the following.

- IPS
- Answer time (ANS) and average work time (AWT) per call
- average occupied positions
- Call Waiting (CW) centum call seconds
- percentage of occupancy
- total operator work volume centum call seconds

Both the TOPS MP and the TOPS 04 configurations provide summary reports which can be received via a mechanized FADS (MFADS) minicomputer system. This system extracts data from a pollable port in the TOPS MP system. For traffic offices equipped with the call transfer feature, a TOPS MP system can also accumulate and send individual transfer queue measurements which include the following.

- CW in each transfer queue
- ANS and AWT per call
- WV by call transfer type
- number of operator IPS by call transfer type
- average occupied positions for each transfer queue
- percentage of occupancy
- XFR calls/percentage of XFR calls

Work volume which is generated by operators assigned by call transfer type is the ratio of WV to CCS.

### Traffic office administration data system

The traffic office administration data system (TADS) for a multi-traffic office provides an in-charge manager with traffic data information. In a TOPS MP configuration, TADS includes a keyboard-send-receive (KSR) TTY and printer where the in-charge manager input commands the DMS-200 switch. This specialized system allows a TOPS MP or TOPS 04 in-charge manager to accept any call type requiring additional assistance from any operator position. The in-charge manager uses the standard TOPS position, and a specialized keyboard, in addition to the TADS TTY. A TADS enables the in-charge manager control the following:

- allow operators to receive transferred calls
- request hardcopy data on specific operator
- place operator in/out of controlled traffic mode
- place in-charge or assistance positions in/out of service
- generate 15 or 30-minute, 6-hour, and 24-hour traffic data summaries for the individual traffic office
- operator feedback system and TTY registers
- broadcast messages
- password administration

The in-charge manager has the same functionality as the service assistance positions, in addition to displaying office statistics and the query system.

### System administration data system

A system administration data system (SADS) can only be used by a single-traffic office. The SADS enables the in-charge position, which provides force management for this office configuration, to track administrative data for that office and assist a maximum of six assistance positions using a SADS TTY. In this capacity, the SADS TTY has the combined capabilities of the FADS and TADS TTYs.

### Hotel administration data system

The hotel administration data system (HADS) is a SADS TTY located in a HOBIC which sends time and charge details to a remote printer. These call details were recorded on a voice quote (VQ) TTY when the audio quote (AQ) TTY was out of service. The HADS TTY also receives printouts of alarm messages from remote printers and collects status information from other TTYs. There must be one HADS TTY provisioned for each DMS-200 switch. In a single-traffic office, this TTY can be a SADS/HADS combination.

## Hotel billing information administration

The hotel billing information center (HOBIC) is an operator location within the operating company, or a centralized off-site location. A HOBIC can be part of a single-traffic or a multi-traffic office configuration. When located on operating company premises, the HOBIC can be a separate work area or the TOPS operator work area. The HOBIC provides three services.

- centralized billing for call inquiries and charge adjustments
- quotation of time and charges data requested by hotel quests
- quotation of call details to hotels for guest-dialed long distance calls

The TOPS system can support either autoquote (AQ) or voicequote (VQ) quotation service for hotel billing information. The AQ automatically transmits guest billing information to a receive-only (REC) TTY located in the hotel. The VQC system automatically transmits guest billing information to an REC TTY located at the operating company, where a VQ clerk then relays the information to the hotel staff or to the hotel guest. The hotel administration data system (HADS) is a TTY which resides in the HOBIC.

In a single-traffic office HOBIC, force management and traffic functions may be combined. All traffic office administration duties are performed by the in-charge manager.

A HOBIC single-traffic configuration is illustrated in Figure 6-3. A HOBIC multi-traffic configuration is illustrated in Figure 6-4. Refer to *System Configurations*, Section 2, of this manual for additional information on single and multi-traffic offices.

**Figure 6-3** HOBIC Single-Traffic Configuration

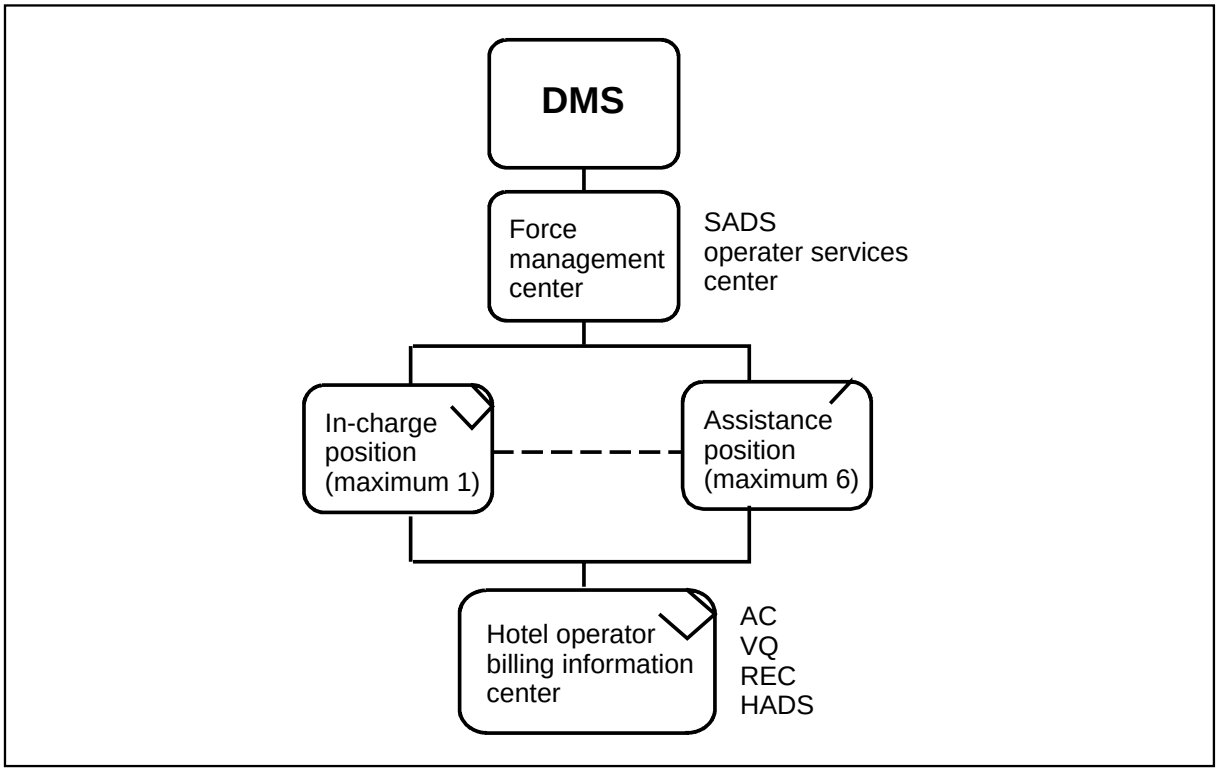
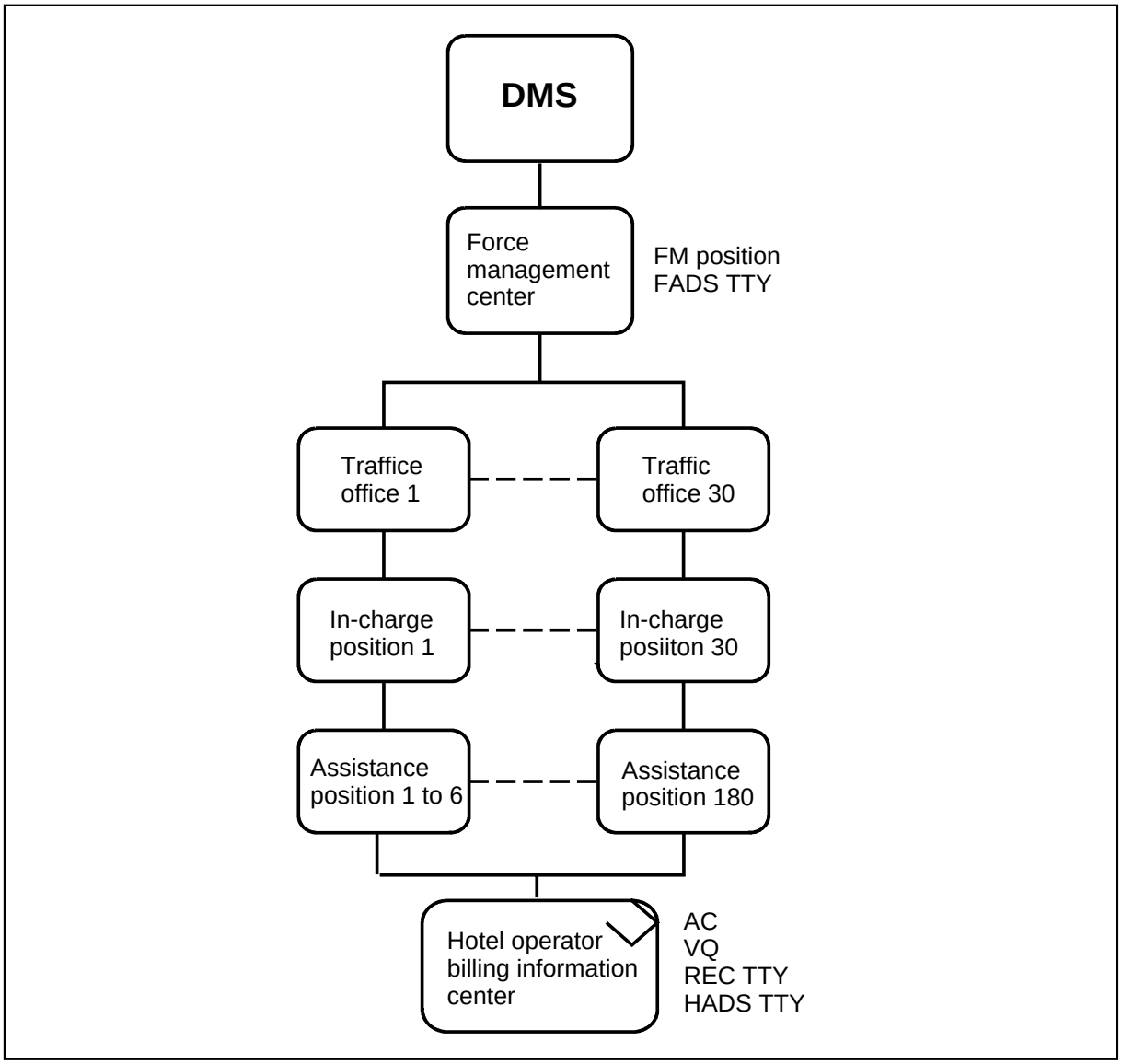


**Figure 6-4** HOBIC Multi-Traffic Office Configuration



## Operational functions

Operational functions for the TOPS systems include:

- operator feedback
- call transfer
- call transfer to a service assistant
- CAMA preferred
- position status checks
- calling queues

### Operator feedback

Each TOPS system has an online, individual operator feedback system. This system accumulates data for individual operator activities for the day. This data can be displayed, upon request, at the operator position or sent by a print command from the SADS or TADS to the TTY. Each operator has an operator number, which is associated with paired software registers, in DMS-200 memory. This logon operator number identifies the operator to the TOPS system. When the number is entered during logon, DMS-200 associates the appropriate pair of feedback registers to that operator position. One register accumulates initial position seizures for that position. The second register accumulates work volume usage.

When one operator relieves another operator, or when an operator returns to a position after an absence, the logon process should be repeated. This ensures proper statistics are accumulated for each operator. The accumulation of operator statistics is based on the correlation of numbered registers where that operator worked during one working day.

At at the start of each business day, the DMS system automatically initializes the individual operator feedback system.

### Call transfer

The TOPS system call transfer feature enables the operator to transfer calls to a specially designated operator. With this feature, operators and their positions can be classified as transfer 0, transfer 1, transfer 2. Special problems occurring in a traffic office are defined by an office-specified parameter for transfer by transfer operators. Should a call require special handling, the operator can route the call to the appropriate transfer queue.

TOPS system calls can be transferred directly by the operator, or indirectly by call type or trunk group, to operators providing specific transfer services. Using recall and non-recall queues, these operators may be assigned to handle calls in a second language or another service, such as mobile or directory assistance.

The controlled traffic mode feature allows specific operators to be excluded from handling certain call types. This feature is typically used for operator training when operators are excluded from handling calls which require more experience.

### Call transfer to service assistant

When an operator cannot handle a call, a service assistant can answer the operator's call or speaking directly to the caller. The TOPS system also enables the operator to direct a call to any available service assistant, or to a specific service assistant or in-charge position.

### CAMA Preferred

Centralized automatic message accounting (CAMA) preferred feature allows CAMA and remote CAMA calls to be moved forward in the queue, to the first available operator, before general calls which reside in the non-recall queue.

The CAMA preferred feature allows CAMA and remote CAMA calls to receive preferential treatment in reaching an operator, before calls residing in the non-recall queue are handled.

### Position status checks

Position status checks enable force-level management to meet efficiency and speed-of-answer objectives, and analyze time periods when objectives have not been met. It also performs administrative data for that office on an ongoing basis. An in-charge position continuously displays the following information when query keys are used.

- current position numbers for each operator
- position numbers for operators in preceding states
- state of positions providing operator assistance
- number of positions made-busy by the operator
- number of positions in controlled traffic mode
- number of positions out of service
- loop-accessed positions where neither called/calling party is attached and off hook
- UCP/UCD

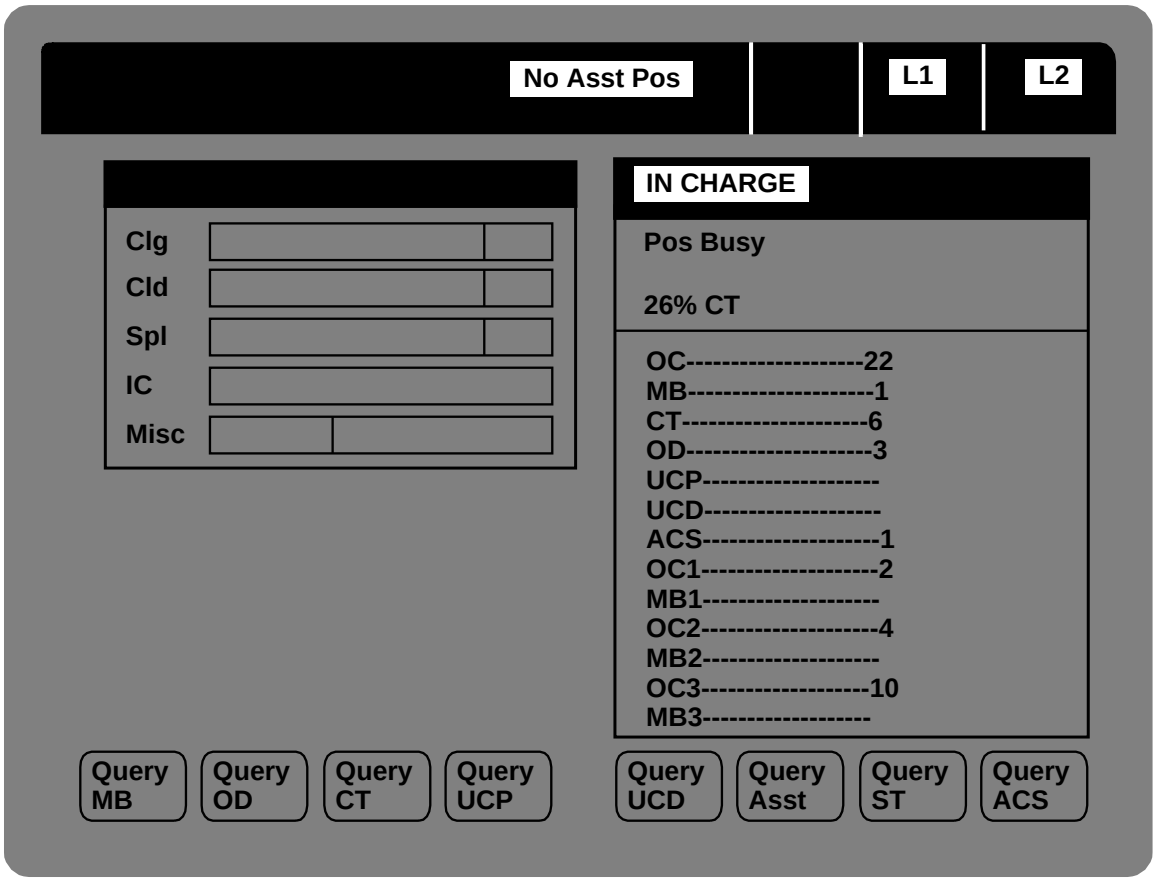
Status information is obtained by pressing query softkeys for this menu. This status information includes operator number and position, and the following data.

- operator made-busy positions
- positions out-of-service

- positions associated with operators in controlled traffic mode
- positions unoccupied with a call in progress
- positions unoccupied with a call that has terminated
- assistance requests
- study registers
- occupied positions with loop accessed when no calling party off-hook or called party

Figure 6-5 illustrates the in-charge position screen in which query softkeys are displayed and transfer queues are activated.

**Figure 6-5** In-Charge Manager Screen




## Calling queues

Each TOPS position and each operator have an established profile which specifies the type or types of calls handled at that position. The first available operator that handles that call type will be selected. If an appropriate position is not available, the call is placed in one of the four CW queues. Any new calls are placed on the bottom of the CW queue, on a

first-in/first-out (FIFO) basis. System-returned calls, which also are handled on a FIFO basis, are placed into a recall queue. Returned calls and recall calls receive priority over new, incoming calls. For an available position, all calls except CAMA search a fully-idle queue, then a partially idle queue. CAMA calls will always search a partly idle queue first.

### Calling queue thresholds

Calling queues thresholds for the DMS-200 support the calling queues described here. There are six resident tables, resident in the DMS-200 switch, which specify the call queue length threshold for each TOPS calling queue. When a call is queued, the queue threshold is checked to determine call treatment for CW and CD. When an operator presses POS RLS, a queue threshold table is checked to verify whether the calls waiting indicator for that operator position should be OFF or ON. Calling queue threshold tables include the following data.

Queueing thresholds for subscribers waiting for operator service and call distribution within call queues are two major factors which influence the volume of office traffic. The TOPS system software maintains calling queues for idle positions and for CW for TOPS operator assistance. Incoming calls are placed in one of these call queue types upon arrival to the TOPS system. Operators can be assigned to handle calls for any of these queues. Based on control data fill, operators may handle selected subsets of one queue, or more than one queue. Whenever a call that requires operator assistance is received, an attempt is made to select an idle position.

Force management calculates actual work time (AWT) based on a 15-minute time period. The AWT value determines queue threshold table values for the next fifteen minute period. Each TOPS system has a total of six queue threshold tables, representing a range of AWT thresholds. Every 10 seconds the force management process selects the appropriate tuple, within queue thresholds tables, based on the number of occupied operator positions. These tuples specify the call queue length threshold required for a specific traffic activity type. By controlling queueing thresholds, force management regulates the volume of office traffic to the operator. Thresholds are based on the number of calls in the queue, the number of occupied positions available to service calls, and AWT.

### Calls waiting and call deflect indicators

Each administrative position is updated every 10 seconds when CW, CW1, CW2, and CW3 screen messages are updated. These CW messages also appear at operator positions during screen updates when a CW queue is in the service profile for that position or operator. These messages also generate an alarm on administrative position screens.

A CW message displays when the predefined threshold has been reached. Should the number of CWs exceed the threshold, and 0+, 0-, and 1+ call

types cannot be answered before a second preset threshold is met, all new calls are deflected to a recorded announcement. The CD screen message displays when any CDs have occurred during this 10-second period at administrative positions.

# Provisioning

Provisioning requirements for the TOPS system described in this section include procedures for determining hardware and software provisioning requirements, which are based on expected operator traffic for a traffic office. Most provisioning requires an estimate of the number and types of calls to be handled by operators. This ensures the accuracy of the calculation of work force size and the equipment required.

The goal of provisioning is to balance service quality with the cost of providing service. This is accomplished by provisioning enough TOPS equipment to handle the work load for all but the customer-dependent 20 busiest half-hours of the year. Several calculations are required to determine average busy season work loads, based on current conditions, as well as reasonable average busy season work loads expected in the future.

The intent of this section is to describe the centum call seconds (CCS) engineering method, TOPS hardware and software, and operator centralization provisioning. Refer to the *Force Management Guide*, 297-2271-310, for additional information on TOPS 04 provisioning.

## CCS engineering

One method of calculating the required work force size is the CCS engineering method. This method enables the operating company to calculate the amount of equipment required for a traffic office. Five factors are considered.

- incoming traffic
- expected growth
- expected change in call processing time
- administrative requirements
- spare equipment required

Incoming traffic includes the number of incoming calls, type of incoming calls, and the length of time required to process each call type.

After CCS values have been calculated, capacity tables are used to determine the required number of operator positions. Special CCS values

must be calculated for optional equipment, such as automated coin toll service (ACTS) and mechanized credit card service (MCCS). The same capacity tables are used to determine the amount of equipment to provision optional features.

To use the CCS method, calculate an engineering base from the current work load using average business days (ABDs). An ABD call should be calculated for each busy season to detect important changes in load level over the course of a year, or other characteristics that may influence growth. The recommended number of ABDs for a calculation should be a 3-month busy season, or 63 business days. For each business day, select half-hours which have higher-than-average loads.

All other calculations are built from this base. Several hundred of the busiest half-hours, except the 20 busiest, must be averaged together to achieve an acceptable approximation of a busy season work load. This average becomes a measurable percentage of a year.

## Hardware provisioning

Hardware provisioning typically depends on the estimated average work time (AWT) and projected work volume centum call seconds (WVCCS). Some TOPS hardware can be provisioned without regard to the estimated number of operators. Other hardware components are restricted to a specific range.

### TOPS positions

A TOPS system supports four position configurations.

- operator positions
- in-charge positions
- assistance positions
- force management positions

Refer to *Equipment*, Chapter 3, of this manual for a physical description of these TOPS system position types.

#### Operator positions

As many as 1000 TOPS operator positions can be provisioned per traffic office. When the number of required TOPS MP or TOPS 04 operator positions is not known, the AWT is used to determine the requirement.

For administrative purposes, these operator positions and supporting hardware components, are clustered into teams. Teams may be numbered consecutively or according to the application or location. An operator work force can be divided into a maximum of 30 teams, with one or more teams per site.

### In-charge positions

An in-charge position has the capability of displaying team administrative data, as well as providing verbal assistance to operators. One in-charge position is required in a single-traffic office. Up to 30 in-charge positions, or 1 per traffic office, can be provisioned in a multi-traffic office.

### Assistance positions

There can be up to six assistance positions provisioned within a single-traffic office for handling operator assistance calls, in addition to monitoring other positions. In this configuration, operators can access in-charge and assistance positions by pressing the ASSISTANCE key. Force Manager position features are provided to this position type when only one operator group exists.

There can be up to 180 assistance positions can be provisioned in a multi-traffic office, with a maximum of 6 positions per traffic office.

### Force management positions

There is only one force management position in a single-traffic office. Force manager positions are required at only one location in a multi-traffic office. Recommended provisioning is one force manager position per DMS to handle all host and remote TOPS systems. Maintenance and administrative tasks for the TOPS MP system will also require a TOPS administrative and maintenance interface (TAMI) position. One TAMI position supports a maximum of four TOPS MP workstations from a VT220-compatible terminal.

### TOPS position controller

One TOPS position controller (TPC) can support from one to four TOPS MP workstations. Each TPC requires one communications port for administration and maintenance functions from the TAMI position. Typically, the TAMI is not hardwired. The TPC can have a nailed-up hard connection in the back on the component.

A high-speed link interface (HSLI) card supports a maximum of four Operator positions per TPC. A high-speed data access (HSDA) card links directly from the TPC to external data bases, as required by the operating company.

Refer to *TOPS System Configurations*, Chapter 2, of this manual for additional information on the TPC.

## Circuit and data link provisioning

Circuit and data link provisioning for the TOPS systems is described in the following paragraphs.

### Port conference circuits

There are two independent 3-port conference circuits on a TOPS 6-port conference circuit. One 6-port conference circuit should be provisioned for every two positions, with a spare allotment of five percent. The 6-port conference circuit, which is required for both TOPS MP and TOPS 04 operator centralization configurations, connects the voice channel used for any call routed to an operator position. To determine the number of 3-port conference circuits, including the 5 percent spare. Divide the total number of operator positions by 2 and multiply the total by 1.05. If 6-port conference circuits are used, adjust the outcome accordingly.

### Trunk circuits

A maximum of 2000 trunk circuits can be provisioned in any traffic office for interface between TOPS positions and the DMS-200 switch. There must be two trunk circuits per position, allowing one for voice and one for data.

Up to 160 remote operator number identification (RONI) trunk circuits, based on the RONI CCS, can be provisioned in any traffic office. Loop-around trunk provisioning, from the 100 side to the 200 side of the DMS-100/200, is based on the CCS from the 100 side of the switch. For verification purposes, two trunk circuits can be provisioned for each scrambler and tone circuit. For MFADS, one trunk circuit can be provisioned.

### Scrambler and tone circuits

The number of scrambler and tone circuits used for verification in any traffic office is based on traffic which has been determined statistically for that office by the operating company.

### Voice links

There can be as many as 2250 voice links provisioned for a host office. A remote traffic office can be provisioned for up to 150 voice links. The actual number of voice links required is based on the amount of traffic from the remote office.

### Data links

The host office can have from 2 to 60 data links. Recommended provisioning is 1 data link for 50 voice links per remote, although between 2 and 4 data links is a typical configuration. One additional link is required for backbup.

### Span lines

From 2 to 97 span links can be provisioned in a host traffic office. Recommended provisioning is always equal to the number of voice links, plus the data links, divided by 24. The recommended provisioning of span lines for a remote traffic office is always equal to the number of voice links,

plus the total number of data links, divided by 24. The range of span lines for a remote traffic office is typically between 2 and 7.

### Digital modem cards

Digital modem cards provide the necessary directory assistance (D/A) or analog-to-digital conversion for processing data signals. Data channels for the TOPS system can be connected through the switching network, via the TPC, to TTY modems or operator position modems.

**TTY modems** There can be up to 526 TTY modems in a single-traffic office. From 2 to 526 modems can be provisioned in a multi-traffic office. Recommended provisioning is one TTY modem for each SADS, HADS, VQ, AQ, REC, network operator trouble information system( NOTIS), and MFADS TTY for both single and multi-traffic offices, with a spare allotment of five percent.

**Operator position modems** One modem should be provisioned for each operator, in-charge, and assistance position in any traffic office, with a spare allotment of five percent. One TAMI position is required for every four operator positions in one traffic office.

### Digital tone detectors

A maximum of two digital tone detectors (DTDs) can be provisioned for any traffic office using a maximum of two remote operator number identification (RONI) trunk circuits.

## Teletypewriters

Each traffic office has a keyboard-send-receive (KSR) teletypewriter TTY type which is used by the in-charge manager, service assistant, or force manager to enter input commands or to query the DMS-200 switch. The four primary TTY types are dependent upon the office configuration.

### Force administration data system TTY

The force administration data system (FADS) TTY resides in the force management center and allows the force manager to enter, transmit, and erase broadcast messages to all operator positions. This TTY also provides the force manager with operator position data for each traffic office and the total system. The data provided has seven components.

- initial position seizures
- total operator work volume
- average work time per call
- call waiting CCS
- average speed of answer
- average occupied positions

- percent occupancy

This information is available in 15 or 30-minute intervals using MFADS. MFADS is a minicomputer system which extracts force manager statistics from any TOPS port connected to a TOPS digital modem. Additional summary reports also are provided in 6 and 24-hour intervals. A maximum of one FADS TTY should be provisioned per work force.

### System administration data system TTY

The SADS TTY supports a single-traffic office where force manager and traffic office manager functions are combined. All input commands can be used at the SADS TTY, which has the capabilities of a TADS TTY and a FADS TTY. One SADS TTY is required per work force.

### Traffic office administration system TTY

The TADS TTY supports a multi-traffic office. In this configuration, a force management center is required to consolidate the force manager functions. There can be up to 30 TADS TTYs provisioned in a TOPS system, with a maximum of one per traffic office. The TADS TTY allows the in-charge manager to perform three tasks.

- enter controlled traffic mode command for operator numbers
- collect operator feedback information hard copy
- assign study registers

### HOBIC TTY

In a hotel billing information center (HOBIC), there are four HOBIC TTY types.

- autoquote
- voicequote
- record
- hotel administration data system

**Autoquote TTY** The autoquote (AQ) TTY is a receive-only hotel TTY which automatically prints call details and time and charge (T&C) information. The TOPS system can be provisioned with up to 512 AQ TTYs, or 1 per hotel. The AQ also is available on a dial-up basis.

**Voicequote TTY** The voicequote (VQ) TTY assumes the role of the AQ TTY should that TTY type fail, or if the hotel does not have an AQ TTY. When call details and T&C information is received at the VQ TTY, a HOBIC operator contacts the hotel or caller requesting this information and quotes the charge for the call. A TOPS system can be provisioned with two to five VQ TTYs. Recommended provisioning is one primary, plus one backup per traffic office. This TTY type can be located in the HOBIC or the TOPS operator area.

**Receive TTY** The receive (REC) TTY serves as a backup teletypewriter should either a AQ or VQ TTY fail. The REC TTY is a receive only TTY which prints duplicate information sent to an AQ or VQ device. This TTY also duplicates messages reported by the Automatic Coin Toll Service (ACTS). Like the VQ TTY, REC TTYs there can be from two to five TTYs per traffic office, plus one TTY for backup. This TTY type can be located in the HOBIC or the TOPS operator area.

**Hotel administration** The HADS TTY is a SADS TTY located in a HOBIC which sends T&C details to a remote printer. These call details were recorded on a VQ TTY when the AQ TTY was out of service. Unlike other TTYs, HADS is a KSR keyboard-send-receive TTY which is always located in the HOBIC The HADS TTY also receives printouts of alarm messages from remote printers and collects status information from other TTYs. There must be one HADS TTY provisioned for each DMS-200 switch.

### Operator headset

The operator headset enables operator communication with the subscriber, or with other persons within the traffic office. The traffic office should be provisioned with at least one operator headset per operator, plus an appropriate number of spares. Headsets meet the generic requirements in

the *Bellcore Proposed Generic Requirements for Telephone Headsets* by *Bell Operating Company Operating Consoles*, Issue 1, August 1986 (TA-EOP-000314).

### Furniture

The TOPS furniture can be ordered in a modular or workstation configuration. The workstation includes desk furniture. Modular configurations consist of free-standing terminals, keyboards, and position controller units for use with operating company-supplied furniture.

The operating company is required to supply chairs for TOPS MP systems only. However, matching chairs can be ordered for TOPS MP furniture through Herman Miller, Inc. For TOPS 04 systems, operator position chairs may be supplied by the operating company or Northern Telecom Inc.

### Training equipment

TOPS MP computer-assisted training (CAI) is developed and manufactured by WICAT Systems for Northern Telecom Inc. One CAI training unit will support up to 16 operator positions. A cartridge tape loads the training software into the unit hard drive. A WICAT CBT terminal is used for administration of the CBT units. These units, which are optional to the customer, must be located within 100 feet of all position controller equipment.

The TUTOR-3B computer-assisted instruction (CAI), which supports the TOPS 04 system, requires a TUTOR-3B training adapter. One traffic office should be provisioned with at least two TUTOR-3B training adapters for every 25 operators requiring instruction. Additional TUTOR-3B training adapters can be obtained for cutover training. The number of additional TUTOR-3B training adapters is based on the number of operators to be trained during the cutover period.

Refer to *Training*, Chapter 11, for additional information on TOPS CBT and CAI.

## Software provisioning

Software provisioning for any TOPS system is based on operating company requirements. Primary software configurations are listed here.

### TOPS recording units

TOPS recording units (TRUs) are software storage areas designed to hold TOPS call data and centralized automatic message accounting (CAMA) which is used by central control (CC) for handling these call types. TOPS TRUs, TOPS CTRUs, and BELLCORE AMA RUs are used by TOPS call processing to provide software storage.

The maximum number of TOPS RUs is equal to the number of TOPS trunk group members. Provision as many TOPS RUs as the number of calls expected for a TOPS positions at one time.

### TOPS CAMA recording units

The maximum number of TOPS CTRUs is equal to the number of TOPS trunk group members. There is a recommended formula to calculate required TOPS CAMA RUs:

(0.25 x [number of TOPS trunk group members])

+ (percentage of CAMA calls x [number of TOPS trunk group members])

+ (percentage of InterLATA calls x [number of TOPS trunk group members])

### Bellcore CAMA recording units

There is a recommended formula to calculate required Bellcore CAMA RUs:

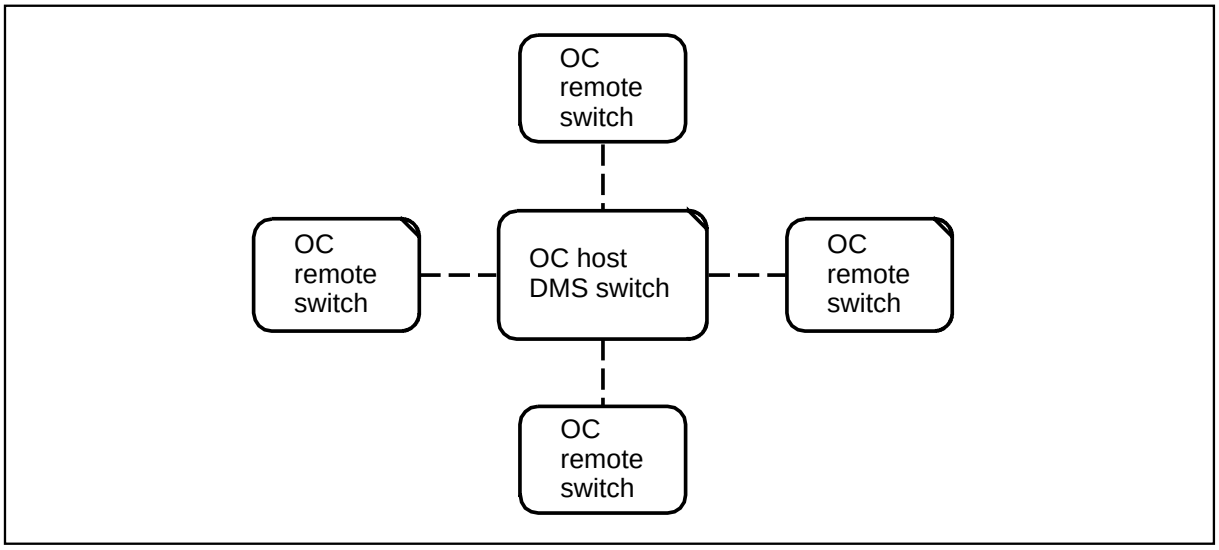
(10 x [number of SuperCAMA trunks + 999] )

1000 + (number of TOPS RUs) + (number of TOPS CAMA RUs)

## Provisioning for operator centralization

Figure 7-1 illustrates the OC network configuration. Provisioning requirements for operator centralization are based on traffic patterns and requirements as determined by the operating company. Once traffic has been analyzed statistically by the operating company, the total number of operators required at the host can be determined. The total number of trunks between the host and remote will always equal the total number of operators.

**Figure 7-1** Operator Centralization Network Configuration

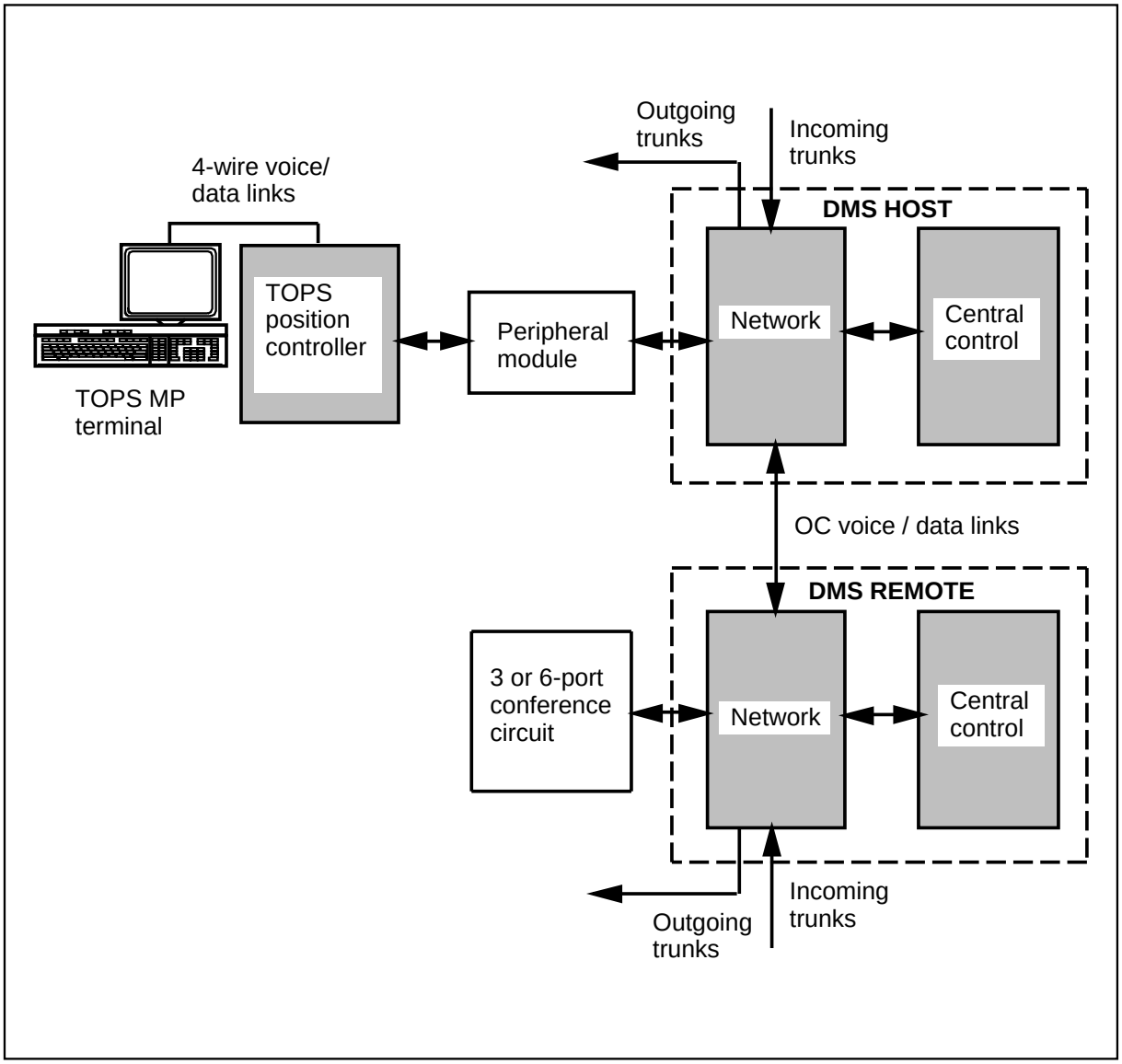



The number of peripheral modules for either TOPS system are dependent on operating company requirements. The remote configuration for either TOPS system always requires a 3-port conference circuit. Refer to *TOPS System Configurations*, Chapter 2, of this manual for additional information on TOPS MP and TOPS 04 system configurations.

### TOPS MP operator centralization

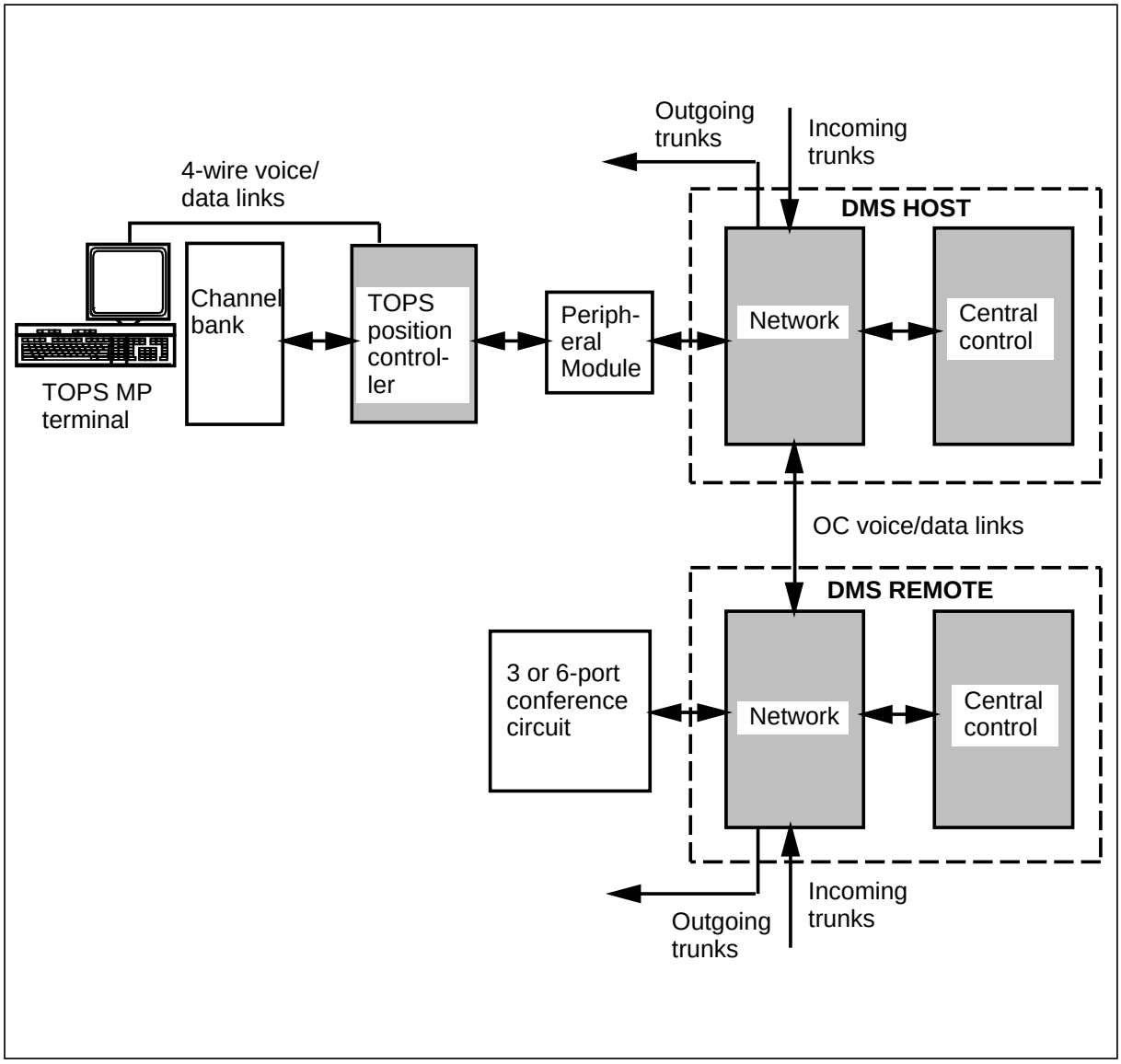
A TOPS MP analog host/remote configuration is illustrated in Figure 7-2.

**Figure 7-2** TOPS MP Analog Host/Remote Configuration



A TOPS MP digital host/remote configuration is illustrated in Figure 7-3.

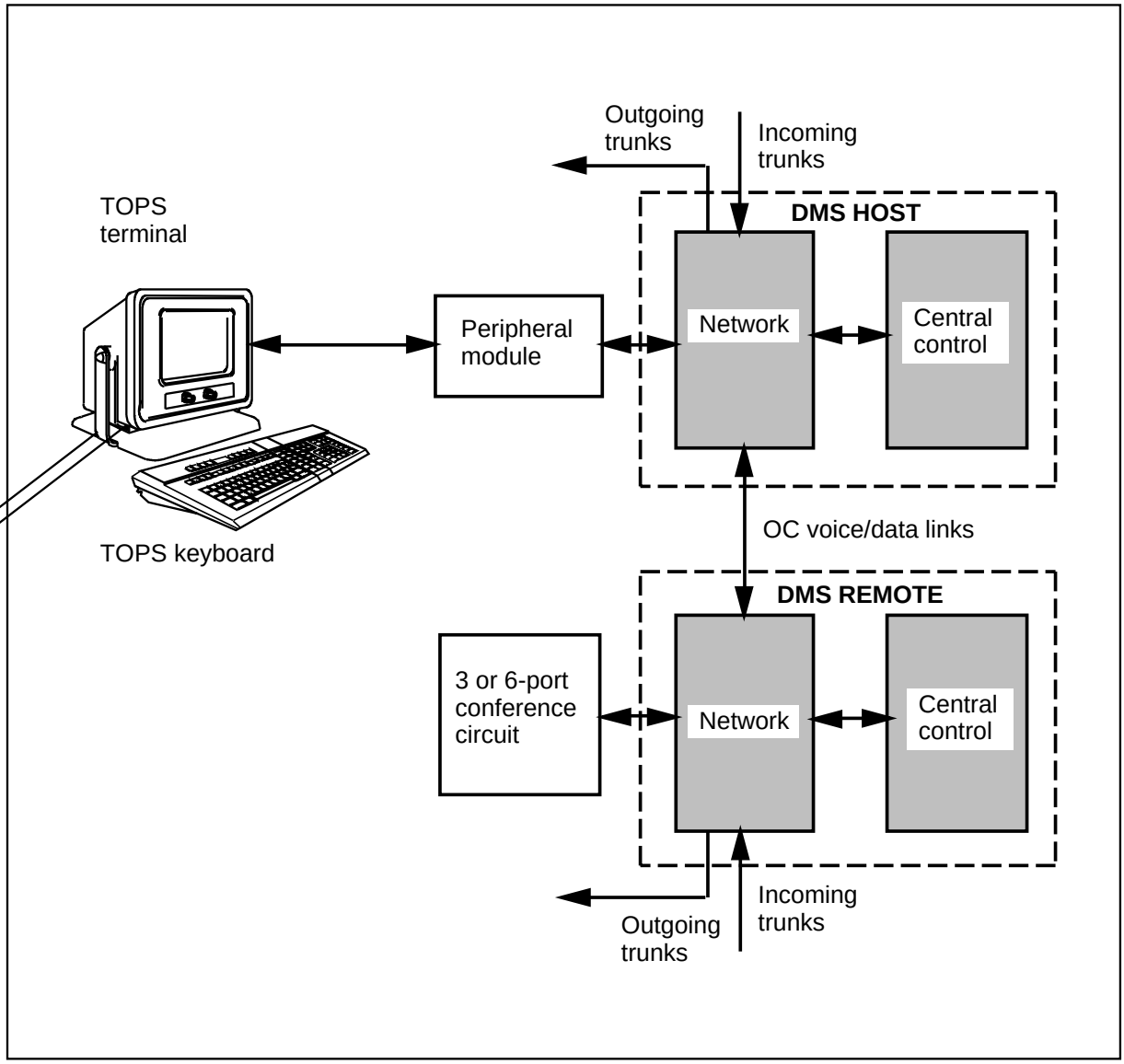
**Figure 7-3** TOPS MP Digital Host/Remote Configuration



### TOPS 04 operator centralization

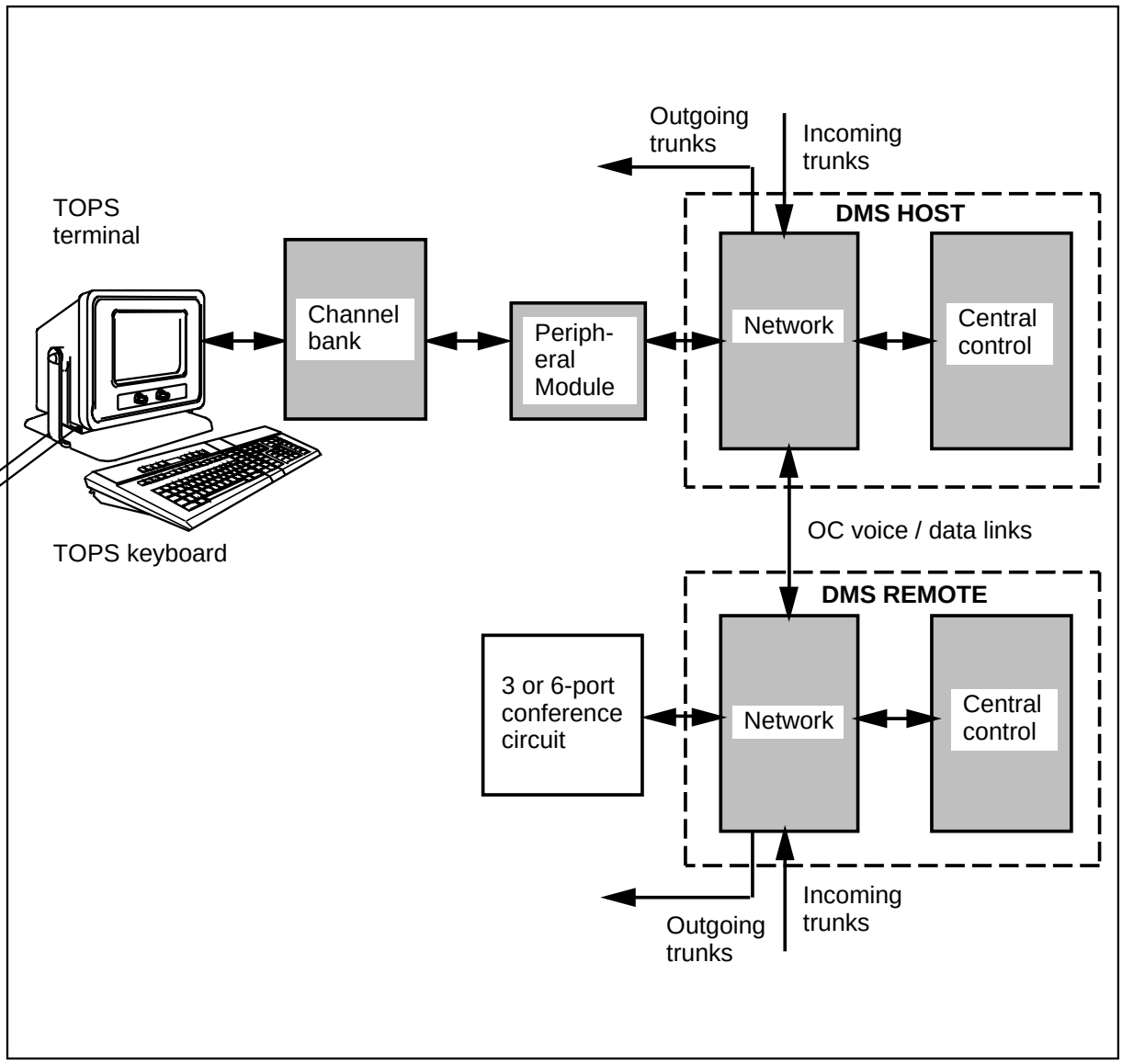
A TOPS 04 analog host/remote configuration is illustrated in Figure 7-4.

**Figure 7-4** TOPS 04 Analog Host/Remote Configuration



A TOPS 04 digital host/remote configuration is illustrated in Figure 7-5.

**Figure 7-5** TOPS 04 Digital Host/Remote Configuration



# Maintenance

The remote location of the TOPS systems dictate that maintenance procedures be performed at the TOPS system and the host site. Maintenance of TOPS hardware, such as the channel bank, terminal, and keyboard, occurs at the operator position. Maintenance for the 3-port conference circuit, digital modem, and voice and data trunks is performed from the MAP.

## TOPS MP maintenance

Using the MAP and TOPS position controller (TPC) administration and maintenance interface (TAMI), maintenance personnel perform three basic maintenance procedures for the TOPS MP.

- routine maintenance
- acceptance testing
- troubleshooting

Routine maintenance refers to the testing of equipment currently in operation. Acceptance procedures test additional equipment which is not in use. Troubleshooting recognizes hardware and software faults in the TOPS MP system and isolates the problem. When troubleshooting, the craft references a list of trouble indicators from the MAP to determine the appropriate trouble procedure.

### Routine maintenance

The routine testing of equipment ensures the reliable operation of the TOPS MP system. Routine maintenance involves the testing of TOPS MP terminals and associated equipment, and DMS components associated the TOPS MP workstation. For routine testing, the TOPS MP workstation must be busied from both the MAP and the TAMI. Testing on the TOPS position, its cabling, and associated high-speed line interface (HSLI) card can then occur.

After testing, the TOPS MP workstation is returned to service from the TAMI and the MAP. After testing from the MAP, TOPS MP terminal trunks are tested. If these tests are successful, the DMS receives a digital modem idle queue, connects the modem to the TOPS MP data trunk, and tests TOPS MP position sanity. For routine testing of DMS components associated with

an MP position, TOPS MP trunk circuits, digital modem, and 6-port conference circuit must be tested periodically.

The TOPS MP workstation trunks can be manually tested at the trunk test position (TTP) MAP level or automatically tested in automatic trunk test (ATT) mode. For manual testing at the TTP level, trunk circuits are posted, tested, and returned to service. Any failures must be cleared manually at the MAP.

The digital modem and 6-port conference circuits can be tested automatically using the ATT mode. At an assigned time, card diagnostic procedures run functional tests on the circuit. If equipment testing is not successful, the hardware is placed out of service and a log message is generated. With the exception of digital modem cards, any failed card must be replaced per operating company procedures.

A digital modem card has four circuits which can be used by four TOPS MP positions. To remove a set of digital modem cards from the switch, the four circuits must be removed from service prior to card replacement. A digital modem card diagnostic procedure is used to evaluate functions implemented in the digital modem. After replacing the card, all four circuits are returned to service. When the affected TOPS MP workstations are returned to service from the MAP, the DMS tests the trunks for each TOPS MP position using an available digital modem circuit.

## Acceptance procedures

Acceptance procedures replace correctly functioning components with a spare. After running specific tests, or waiting a prescribed length of time, maintenance personnel return the original component and places the spare component in the spare closet should fault isolation occur. Should testing fail, the component is considered unacceptable for use, removed from the test position, and returned to the supplier for repair or replacement.

New equipment tests must be performed on all new spare components for a TOPS MP system to ensure all spare components are good. These new equipment tests determine whether a new component is or is not acceptable for use as a spare in the TOPS MP system.

## Trouble shooting

A malfunctioning component of the TOPS MP system must be immediately recognized and repaired. Troubleshooting involves identifying the possible cause of a hardware fault and testing to isolate the component. Although the TOPS MP system provides visible indications for serious system malfunctions, such as data trunk failures, there are no system indicators for less serious problems. For these problems, such as malfunctioning TAMI position keyboards or TOPS MP workstation hardware, the operator should follow local trouble reporting procedures.

Isolating a fault is performed at both the MAP and the TAMI. For serious faults, system diagnostics may pinpoint the problem. For less serious faults, extensive functional testing, visual inspections, or replacement of a component may be required. Trouble indicators are grouped according to three situations.

- a call is being processed
- the TPC is being powered on or reset
- the TAMI is connected to the TPC

System-detected and operator-detected fault indicators appear when trouble occurs during call processing. Depending on the severity of the problem, the DMS-200 or TPC software generate system-detected faults. These faults, such as data trunk failure, are reported immediately to maintenance personnel for isolation, recovery, and return to service. Less severe faults, such as framing or parity errors, are reported only after repeated occurrences generate a log. Operator-detected faults, such as malfunctioning keys, or call dropping, are reported to maintenance personnel for manual maintenance to clear the trouble and return the position to service.

A TAMI terminal, if connected to the TPC, displays a series of TPC status messages. When no errors are present, the position status/control menu displays. Should any other activity occur, trouble procedures isolate the problem. When the TAMI is unable to automatically perform certain administrative or maintenance tasks, trouble procedures can isolate the problem.

## TOPS 04 maintenance

Maintenance for the TOPS 04 system includes hardware maintenance, software maintenance, and maintenance tools which are used at the MAP and the TOPS 04 position to isolate hardware and software faults. Hardware maintenance occurs at the MAP and the TOPS 04 position. From the TOPS 04 position routine maintenance, acceptance testing, and troubleshooting occur. Maintenance tools for the TOPS 04 system include commands available at the DMS-200 MAP and at the TOPS 04 position.

### Hardware maintenance

The TOPS 04 system hardware maintenance includes physical equipment for the TOPS 04 and its associated components. Diagnostic tests can be run from the MAP on a 6-port conference circuit, digital modem, and voice and data trunks. Diagnostic tests also can be run using the TOPS 04 position controller from the TOPS 04 position. In addition to maintenance from the MAP and the TOPS 04 position, maintenance procedures for the TOPS 04 system include routine maintenance, acceptance testing and troubleshooting.

### Maintenance from the MAP

The DMS-100 MAP maintains TOPS 04 hardware and assigns a master TOPS 04 position for position testing purposes. The RTEST facility may be used to assign a master TOPS 04 position from the MAP. This master TOPS 04 position is used to test other TOPS 04 positions.

Diagnostic tests for the 6-port conference circuits, digital modems, and trunk circuits, can be invoked manually from the MAP. Diagnostic tests also are automatically generated by the system when a fault is detected, or when the system is in ATT mode. The DMS hardware associated with TOPS 04 is maintained from the TTP level of the MAP. From the TTP, the hardware can be posted, manually busied, tested, and returned to service by using TTP-level commands.

When a TOPS 04 position is busied manually by the maintenance personnel, or automatically by the system, the digital modem connected to the position is disconnected and marked idle. When a TOPS 04 position is returned to service, either through the MAP or after a restart, a digital modem from the digital modem idle queue is connected to the TOPS 04 data trunk. If either or both actions fail to return a TOPS 04 position to service, a fault detection procedure is called to isolate the trouble. Isolation by the system attempts to mark the connection of the position state to be idle and marked, or attempts are made to mark other states according to user software requirements. This procedure cannot be used under warm start conditions.

If a posted digital modem is not connected to any TOPS 04 position, maintenance personnel can change the digital modem state and test the digital modem. If the posted digital modem is marked call processing busy, it is possible to force release the digital modem or voice trunk of the position. If a digital modem in the call processing busy state is force released while a call is attached to its associated TOPS 04 position, the call will be lost. When the digital modem is force released from a TOPS 04 position, a new digital modem is automatically allocated to the position and the force-released digital modem state is changed to man-busy.

### Maintenance from the TOPS 04 position

Maintenance at the TOPS 04 positions include TOPS 04 position hardware only. Position maintenance involves operating self tests on a single position or remote tests from a master position. Specific hardware includes the position controller, terminal, and keyboard.

**Routine maintenance** The routine testing of equipment ensures the reliable operation of the TOPS 04 system. Routine maintenance involves simple cleaning of the position and testing of position hardware. For routine maintenance of TOPS 04 position hardware, trunk circuits, digital modem, and 6-port conference circuit the TOPS 04 position hardware must be tested periodically.

The TOPS 04 position trunk circuits can be manually tested at the TTP level of the MAP or automatically tested in ATT mode when the position is out of service. For manual testing a the TTP level, trunk circuits are posted, tested, and returned to service. Any detected failures are cleared manually at the DMS-100 switch. When the TOPS 04 position successfully passes trunk tests, the test process receives a digital modem from the idle digital modem queue. The digital modem is connected to the TOPS 04 data trunk. The sanity of the position is then checked.

The digital modem and 6-port conference circuits can be scheduled for testing automatically using the ATT feature. At a fixed schedule, card diagnostic procedures are called respectively to run functional tests on a circuit. If equipment testing fails, hardware is placed out of service and a log message is generated. With the exception of the digital modem cards, the failed card must be replaced using operating company procedures.

A digital modem card has four circuits which can be used by four TOPS 04 positions. To remove a set of digital modem cards from the switch, the four circuits must be removed from service prior to card replacement. A digital modem card diagnostic procedure is used to evaluate functions implemented in the digital modem. After replacing the card, all four circuits are returned to service. When the affected TOPS 04 positions are returned to service from the MAP, the DMS tests the trunks for each TOPS 04 position using an available digital modem circuit.

The TOPS 04 position hardware tests include functional tests for the position controller and keyboard. The controller tests, which are run from the master position, verify the controller is functioning properly. TOPS 04 position keyboard function tests verify that keyboard functions, such as shift, page clear, line feed, and carriage return, operate correctly. These tests occur when the TOPS 04 position placed in the manual busy state and in the local mode. Upon successful completion of TOPS 04 position tests, the position is returned to service.

Acceptance procedures replace correctly functioning components with a spare. After running specific tests, or waiting a prescribed length of time, maintenance personnel return the original component and places the spare component in the spare closet should fault isolation occur. Should testing fail, the component is considered unacceptable for use, removed from the test position, and returned to the supplier for repair or replacement.

New equipment tests must be performed on all new spare components for a TOPS 04 position to ensure all spare components are good. These new equipment tests determine whether a new component is or is not acceptable for use as a spare in the TOPS 04 system.

**Trouble shooting** Trouble shooting provides fault isolation when hardware or software malfunctioning is suspected. Fault isolation involves identifying the possible cause, based on the indication of a fault, and performing tests in an attempt to isolate a fault. The TOPS 04 positions provide visible indications of serious system malfunctions, such as the central processing unit (CPU), position, or modem failures. However, no indications are provided for less serious problems such as a malfunctioning keyboard, the visual display unit (VDU), or headset. In these instances, functional testing, visual inspections, or simple replacement of components may correct the problem.

## Software maintenance

There are two fault detection methods during processing of a call system-detected and operator-detected. For system-detected faults, the CPU responds to software problems based on their severity. Faults such as failure at the data trunk are reported to the trouble handler immediately and scheduled for test. Other faults, such as framing or parity error, are only reported after repeated occurrences cause a peg count to exceed a threshold value
of 3. When digital modem, 6-port conference circuit, or TOPS 04 terminal trunk troubles occur, a flashing POS BUSY displays at the TOPS position to signal the operator the position is under test.

For operator-detected faults, such as malfunctioning keys or no screen display, trouble is reported to maintenance personnel. Operator fault types require manual maintenance procedures to correct the problem and return the position to service.

## Maintenance tools

Maintenance tools for the TOPS 04 system are commands entered at the DMS-100 MAP and the TOPS 04 position. Trunk test position maintenance and the remote test facility occur at the MAP. The local test facility occurs at the operator position.

**Trunk test position maitenance** For TTP-level maintenance, maintenance personnel enter commands at the MAP for maintaining TOPS 04 system trunk circuits, 6-port conference circuits, and digital modems. These TTP commands allow maintenance personnel to perform three functions.

- remove circuit from service
- test circuit
- return the circuit to service

**Remote facility testing** The DMS-200 command interpreter (CI) enables maintenance personnel to assign one master position, or a maximum of four, at one or more remote locations. The master position is assigned from the MAP using the RTEST feature, which is generated by the DMS-200 CI. Once assigned, the master position is used by on-site personnel to select a position for testing and enter commands required to perform diagnostic tests on selected positions without assistance from central office (CO) personnel. The RTEST system supports only a single user, but allows as many as four test processes to run simultaneously.

### Local facility testing

Diagnostic tests selectively performed on any TOPS 04 position from the local site. Each of these diagnostic test commands are entered at the master position. Should all diagnostic tests be necessary, the tests must be executed in the sequence in which they appear here.

**Controller test** Controller tests perform diagnostics for positions under test. Test results appear on the master position screen. If a fault is not found, proceed to the loopback test. If the fault is found, set the position under test modem switch to the loopback position and run the controller test again. If no fault is found again, the problem exists within the position electronics. This fault type indicates a problem in any of three areas.

- remote modem
- carrier facilities
- local modem

**Pattern generator test** The pattern generator (PTN) test executes the program which tests the pattern generator in tested position. During this test, the tested position screen is erased, the pattern generator is started, and the test pattern slowly builds.

The generator uses cursor position commands to send characters in a sequence to selected locations on the screen. Flashing and protection formats are included. All numeric characters appear on the screen to marking coordinates along the top two lines and two left-hand columns. All alphanumeric characters appear in the center of the bottom line except XYZ, which appear in the extreme right-hand columns. After completion of the pattern test, the number of position cursor errors detected displays on the master position screen.

**Line clear test** The line clear (LCV) test clears all unprotected characters from the bottom line of the test pattern.

**Page erase test** The page erase (PTX) test erases all unprotected characters, such as cent (¢) and pound (#) signs, from the screen. Failure to erase all unprotected characters indicates a malfunction of this command in the position under test. If the PTX command is input after completion of the MAZ diagnostic test, all characters are treated as unprotected and the screen erases.

**Line erase test** The line erase (LCL) test erases all characters from the current cursor position to the end of the line when input after executing the test PTN command. The current cursor position should be at Line 1 prior to this test. If any other line is erased, a position failure has occurred and the line is malfunctioning.

**Bell test** The bell (BEL) test verifies position bell tone is activated and deactivated after a predetermined period of time. This test sends a command which generates bell ringing, followed by a command which stops bell ringing. If the bell fails to ring during the interval between commands, bell electronics have failed. If the bell does not stop ringing, bell electronics have failed or the microprocessor will not turn off the command.

**Maze routing test** The maze routing (MAZ) test is another pattern generator test which ensures every row and column can be filled with ASCII characters. The MAZ test outputs four identical motifs on the screen. This allows the operator to examine positioning under high-speed transmission. The MAZ command sends cursor position commands at a constant rate to exercise the microprocessor at a constant load. The resulting screen indicates errors by overwritten characters or blank areas on the screen.

**Echo test** The echo (EKO) test command echoes characters from the keyboard and test screen of the TOPS 04 position under test to the master position screen. The position under test should be in the normal mode. Any discrepancies between the tested position and the master position screens may indicate a faulty transmission path, faulty position firmware, or faulty position electronics.

**Microprocessor test** The microprocessor (XMT) test command manually verifies the position under test microprocessor is operating properly. The routine is similar to that performed by the EKO test input. For this test, keyed entries from the master position keyboard are echoed to the position under test (PUT) and master position screens. The PUT should be in the normal mode.

**Loop-around test** The loop-around (RLP) test verifies operation of the relay loop. The character to operate the loop-around relay in the PUT is activated from the master position by the RLP command. No other tests are performed. Maintenance personnel must visually verify operation of this relay. The relay does not operate unless the position headset is unseated and the position is equipped with firmware electronics required for the test mode.

**Query headset test** The query (QRY) headset test command causes the query headset status character to be sent to the PUT. The command is used only on TOPS 04 positions equipped with the firmware electronics required for headset scanning.

**Loop-around release test** The relay unloop (RUL) command verifies loop-around relay in the PUT can be released. Maintenance personnel must visually verify release of this relay.

**Display phase a header test** The display phase a header (DMA) test exercises the control character DSM1 and displays headings implemented in the microprocessor for the PUT. The DMA command erases the PUT screen to display 64 static headers on the screen. Failure of proper header display indicates malfunction of the DSM1 control character received by the PUT or a faulty message table load in the PUT microprocessor.

**Display a flashing header test** The display a flashing header (FMA) test command exercises control character FSM1 and displays heading implemented in the PUT microprocessor. The FMA command erases the PUT screen to display 64 flashing headers on the screen. Failure of proper header display indicates the malfunction of FSM1 control character received by the PUT and a faulty message table load in the PUT microprocessor.

**Erase phase a static or flashing header test** The erase static or flashing header (EMA) test command exercises control character ESM1 and erases the 64 flashing headers displayed on the PUT screen following the FMA command. The EMA command also can be used to erase the 64 static headers displayed during the DMA test. If the EMA command successfully erases the 64 flashing headers, the DMA test is not required. Failure to erase headers properly indicates malfunction of control character ESM1 received by the PUT and a faulty message table load in the PUT microprocessor.

**Display phase b header test** The display phase b header (DMB) test command exercises control character DSM1 and displays headings not displayed in the Phase A header test. When these headers are implemented in the PUT microprocessor, the DMB command erases the PUT screen and outputs 58 static headers to the screen. Failure to properly display the headers indicates the malfunction of control character DSM1 received by the PUT and a faulty message table load in the PUT microprocessor.

**Display b flashing header test** The display phase b flashing header (FMB) test command exercises control character FSM1 and displays the remaining headings, in flashing mode, not displayed during the Phase A header test. The FMB command erases the PUT screen and outputs 58 flashing headers on the screen. Failure to properly display the headers indicates malfunction of control character FSM1, which is received by the PUT, and a faulty message table load in the PUT microprocessor.

**Interactive test** The interactive (IAT) test command exercises control characters DSM, FSM, and ESM and verifies selected headings for display or erasure at assigned locations programmed in the microprocessor. The IAT command input at the master position results in the PUT displaying a flashed underscore of TEST on the screen. Failure to properly display the headers indicates the malfunction of control character DSM and a faulty loading of the message location in the PUT microprocessor.

# Transmission

This section of the *DMS-100 TOPS MP/04 technical specification* describes transmission characteristics for both the TOPS MP and TOPS 04 systems. Also included in this section are guidelines for measuring and adjusting specific analog transmission parameters. These guidelines ensure that levels for data transmission are correct and voice quality for subscriber-operator calls is equal to subscriber-subscriber calls.

## TOPS transmission configurations

The TOPS MP and TOPS 04 systems transmission configurations can be connected with either digital or analog facilities. The TOPS MP and TOPS 04 controller is connected to the host DMS with any of three peripherals.

- 8-wire trunk module
- digital carrier module
- digital trunk controller

The TOPS controller terminates using two sets of 4-wire, voice grade analog trunk facilities. One 4-wire trunk carries analog voice signals. The other carries data signals encoded in a 202 modem format with frequency shift keying.

### TMS configuration

The 8-wire trunk module (TM8) peripheral can terminate up to 30 analog trunks using NT1X54AA or NT2X72AA trunk circuit cards. Both trunk circuit cards can provide 600 ohms termination of 4-wire analog trunks. These cards differ in the type of padding or means of attenuating transmission levels. The NT1X54AA provides both software-controllable pads and preset pads. The NT2X72AA provides preset pads only. Because voice and data trunks are paired on a per-position basis, they should be terminated with trunk circuit cards of the same type and provisioned consecutively with even numbered voice trunks and odd numbered data trunks.

A typical TM8 configuration is illustrated in Figure 9-1. The TM8 connects directly to the TOPS controller by means of 4-wire analog trunks. These

trunks are the facilities for bidirectional transmission of voice and data between the TM8 and the TOPS system.

**Figure 9-1** TM8 Direct to TOPS Configuration

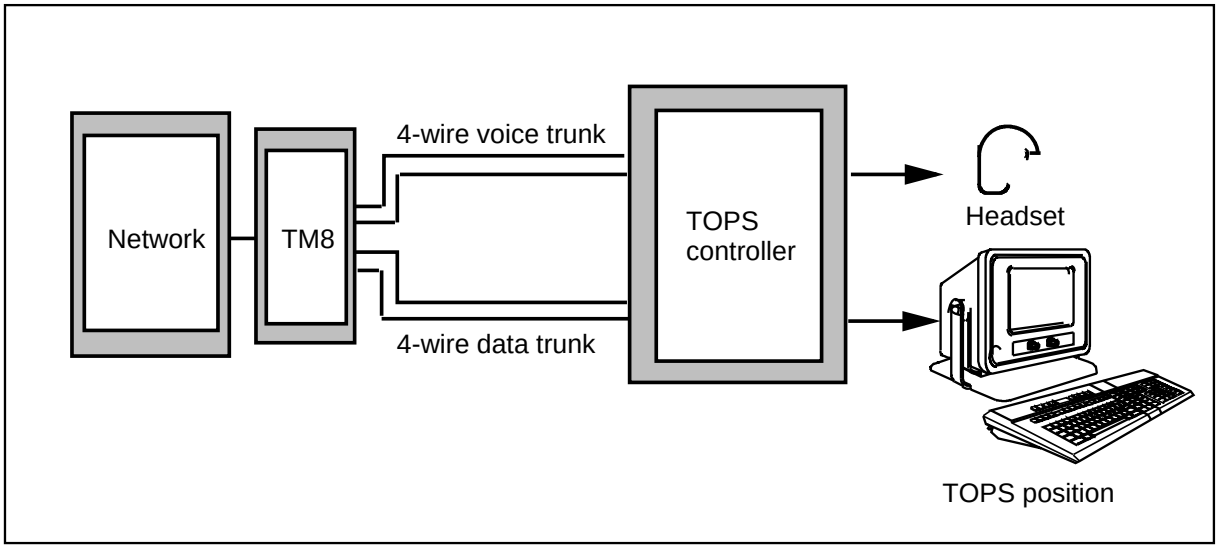
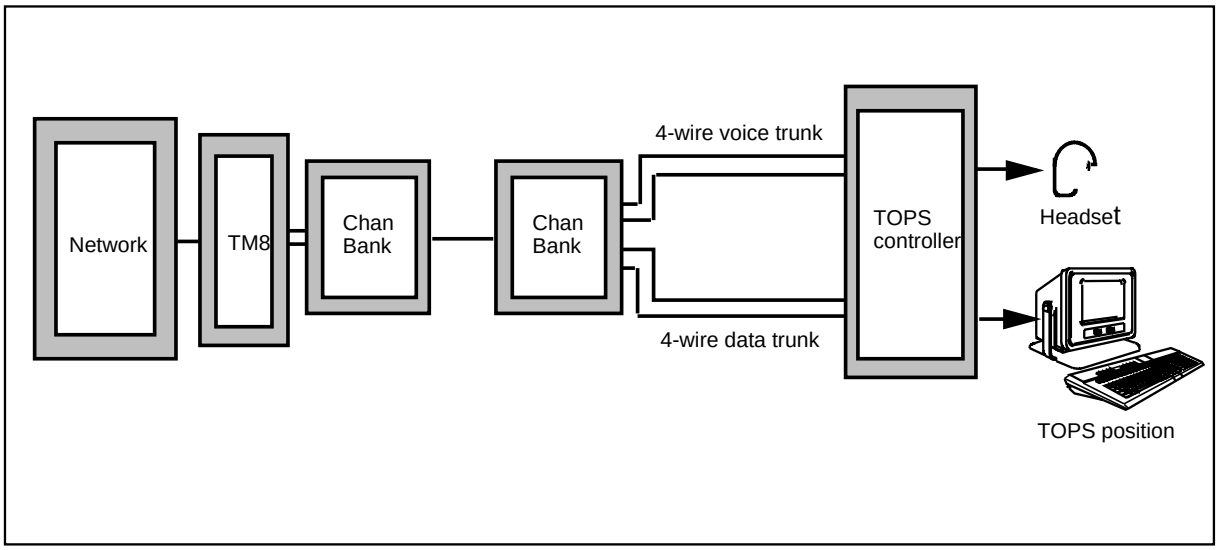



Figure 9-2 illustrates a pair of channel banks linked by DS-1 digital facilities. Compatible channel banks for the TOPS system are Northern Telecom DE-3, DE-4, or equivalent. At the channel banks, voice and data trunks terminate on QPP357 channel units. The QPP357 channel unit provides 600 ohms termination of 4-wire analog trunks. One DS-1 facility can support up to 12 TOPS positions. Of the 24 channels available, 12 are used for voice and 12 are used for data.

**Figure 9-2** TM8 to TOPS Configuration with Channel Banks




## DTC/DCM configuration

When a TOPS system is connected to a host DMS using a DCM or DTC, DS-1 digital facilities provide the transmission path for voice and data signals. The two digital trunk circuits for each position are assigned with four circuit separation. The channel bank provides the interface between the digital facilities and the analog trunks to the TOPS controller. The analog interface to the TOPS controller is the same for a DMS trunking peripheral or existing transmission facilities. The DCM peripheral terminates up to five DS-1 facilities or 120 digital trunks. The DTC terminates up to 20 DS-1 facilities or 480 trunks.

The use of digital facilities in place of analog trunks is dictated by a combination of factors, to include cost and transmission quality considerations, and the distance between the host switch and the operator bureau. Either TOPS can be a maximum of 1000 miles from the host switch.

## TOPS MP trunk transmission levels

Trunking and transmission for the TOPS MP system includes transmission between the DMS and the TOPS position controller (TPC), and transmission between the TPC and TOPS MP workstation. This transmission enables the TPC and TOPS MP workstation to transmit and receive signals at the proper levels only if signals between the DMS and the TPC are set at the proper levels.

When testing transmission levels from the DMS to the TPC, a tone generator connects through the network to the test trunk position (TTP) via the MAP. When measuring the transmission levels from the TPC to the DMS, a test tone is sent from a test measurement set (TMS) and measured from the TTP. Transmission parameters listed here apply when testing DMS to TPC transmission levels.

- Voice path test levels downstream, from DMS to TPC, has a 1004 transmit level at TTP (0 dBm0) and an expected receive level at TMS (-3 dBm0).
- Voice path test levels upstream, from TMS to DMS, has a 1004 transmit level at TMS (-3 dBm0) and an expected receive level at TTP (-6d Bm0).
- Data path test levels downstream, from DMS to TMS, has a 1004 transmit level at TTP (-13 dBm0) and an expected receive level at TMS (-16 dBm0).
- Data path test levels downstream, from TMS to DMS, has a 1004 transmit level at TTP (-16 dBm0) and an expected receive level at TTP (-19 dBm0).

Digital/analog (D/A) converters of the NT1X54AA or NT2X72AA in the TM8 provide 9 dB of gain for transmit voice and data signals. For both voice and data, pads for these cards provide the required signal loss between the test access trunk and the TPC. This required signal loss, the sum of pad and transmission loss, is 3 dB.

The analog/digital (A/D) converters of the NT1X54AA or NT2X72AA in the TM8 provide a 12 dB of gain for the received voice and data signals. For both voice and data, pads for these cards provide the required signal loss between the test access trunk and the TPC. This required signal loss, the sum of pad and transmission loss, is 3 dB.

Figure 9-3 illustrates a DTC/DCM to TOPS Configuration. Figure 9-4 illustrates DMS to TPC voice trunk transmission levels. Figure 9-5 illustrates DMS to TPC data trunk transmission levels. Figure 9-6 illustrates DMS to TPC voice trunk transmission levels with channel banks. Figure 9-7 illustrates DMS to TPC data trunk transmission levels with channel banks.

**Figure 9-3** DTC/DCM to TOPS Configuration

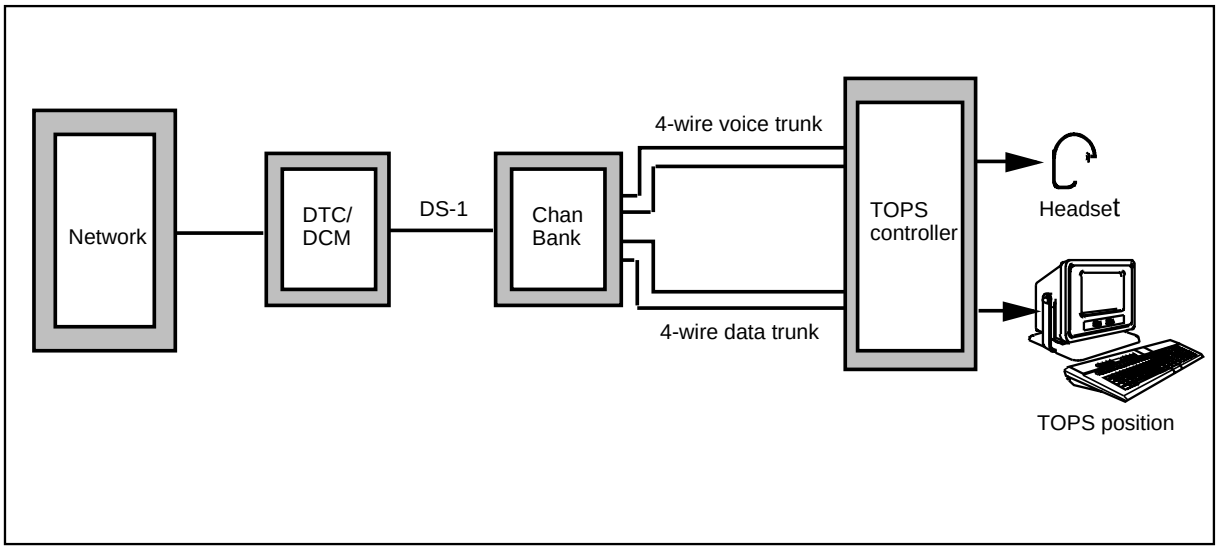


**Figure 9-4** DMS to TPC Voice Trunk Transmission Levels

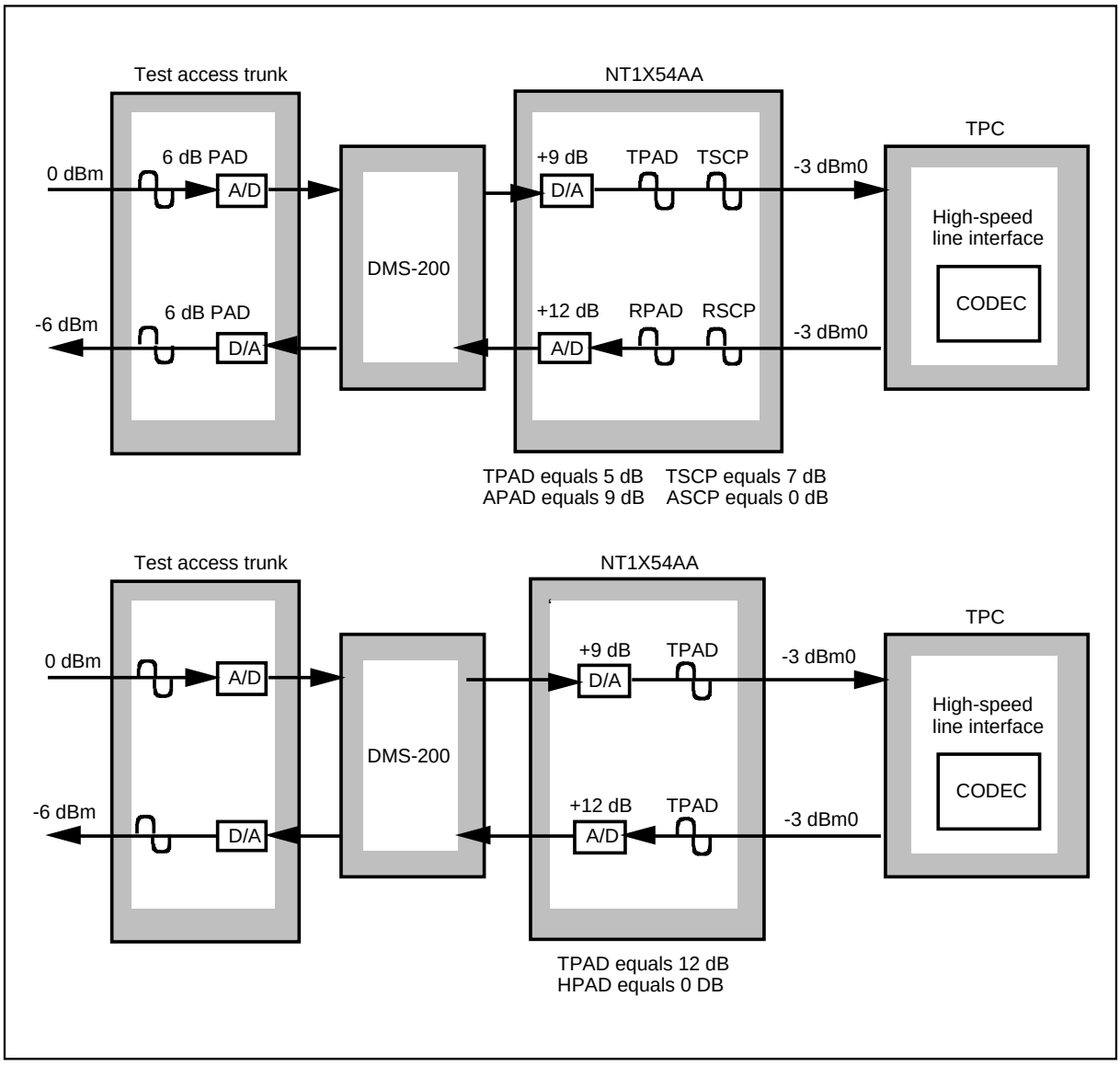


**Figure 9-5** DMS to TPC Data Trunk Transmission Levels

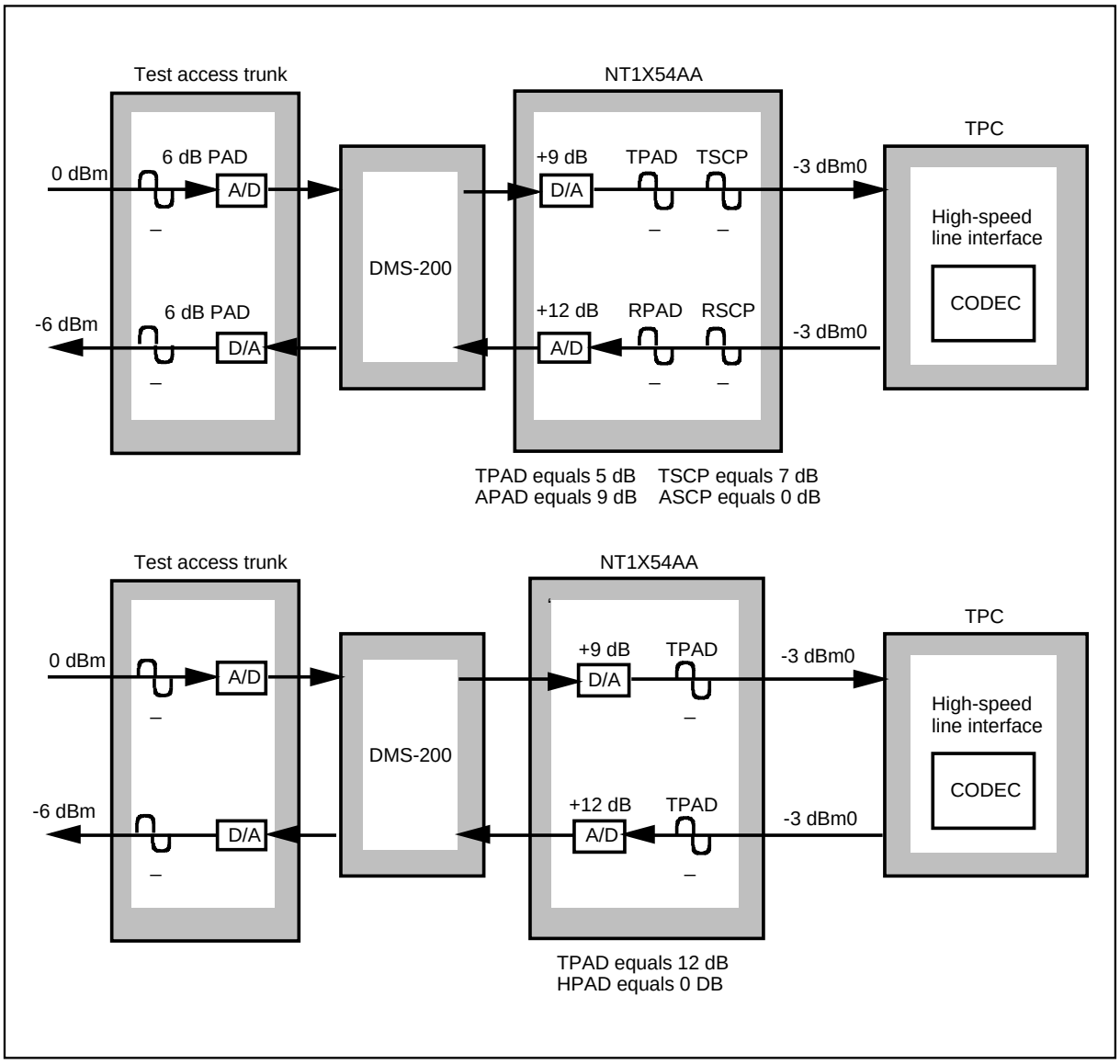


**Figure 9-6** DMS to TPC Voice Trunk Transmission Levels with Channel Banks

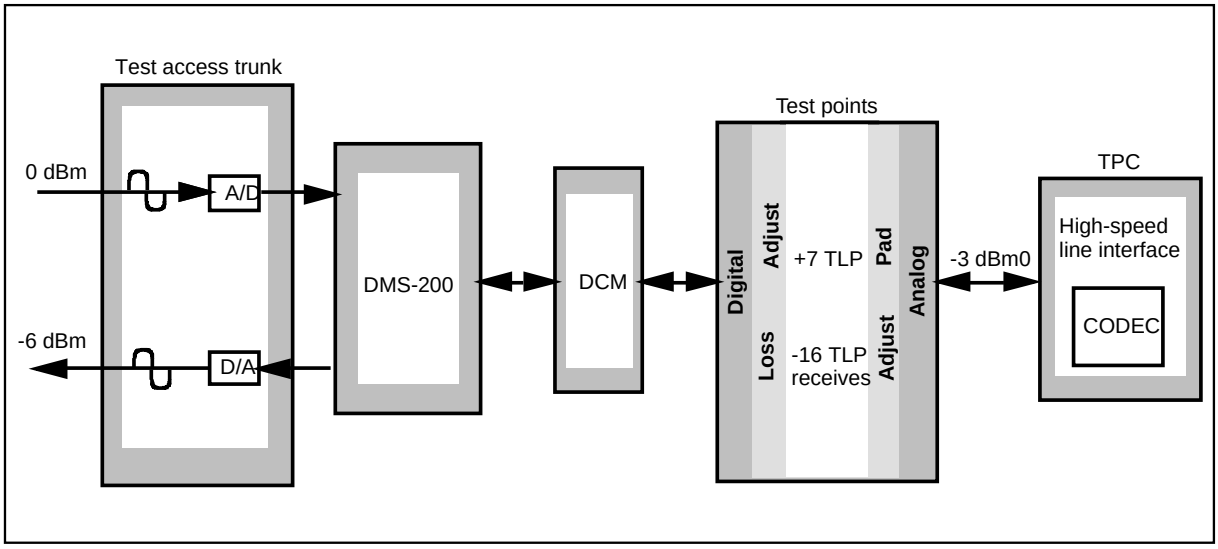
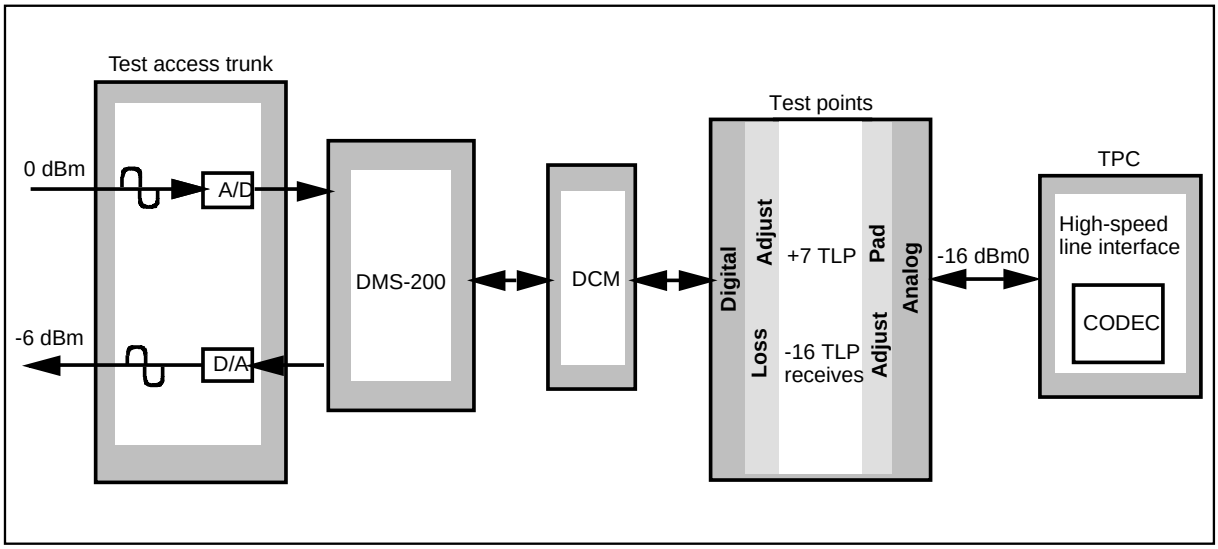



**Figure 9-7** DMS to TPC Data Trunk Transmission Levels with Channel Banks




## TOPS MP transmission paths

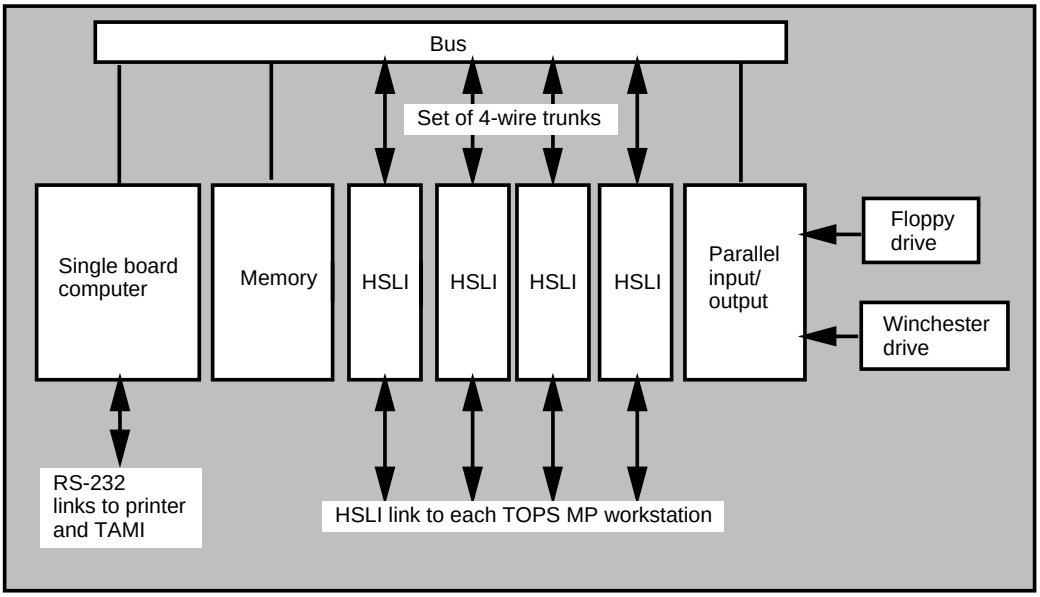
TOPS MP transmission paths are described in the following paragraphs.

### TOPS MP TPC

The TOPS TPC is a microcomputer system which processes voice and data signals between the TOPS MP workstation and the DMS switch. The TPC also communicates via a TOPS administration and maintenance interface

(TAMI) when maintenance or administration tasks are performed. The TPC and the telephony card located in the monitor controller, provides the circuitry for any TOPS MP Operator for DMS switch communication. Figure 9-8 illustrates a block diagram of the TPC.

**Figure 9-8** Block Diagram of TOPS Position Controller




The high-speed line interface (HSLI) data stream is decoded and demultiplexed into voice and data signals by the HSLI card. Pulse-code modulated (PCM) voice is converted back to the analog format and sent to the DMS switch over a standard 4-wire telephone line. The TPC performs no further processing on the voice signal. The data path routes to the single-board computer (SBC) processes operator input. The SBC generates a message to central control (CC) and sends the data back to the HSLI for transmission upstream. The HSLI encodes the data into an analog signal using an on-card modem, and transmits it to the DMS switch.

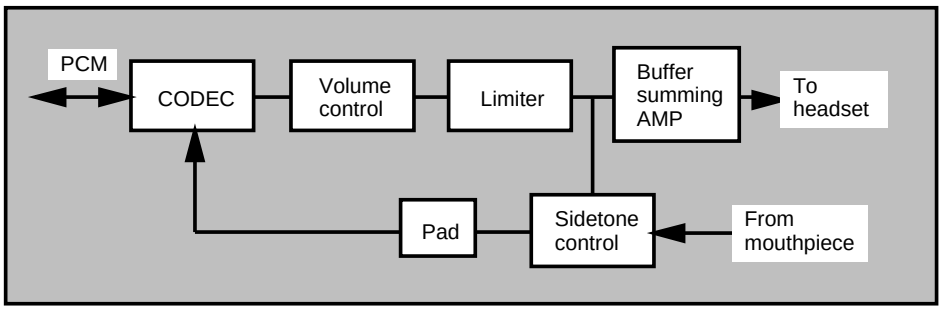
### TOPS MP telephony card

After conversion to an analog signal at the code decoder (CODEC), the received PCM voice signal travels through volume control, a limiting circuit, an amplifier, and the operator headset. Volume control adjusts at the keyboard and can vary the gain +/-5 dB. The limiting circuit, when set to ON, ensures power for the received audio signal does not exceed a preset

threshold of 91 dBspl. Control of this circuit is accessible from the TOPS MP monitor controller.

The transmit voice signal routes through a sidetone circuit and a pad to the CODEC and converts the signal to PCM. The sidetone circuitry routes some of the signal, or 12 dB less than the operators speech level, from the transmit path to the receive path. This allows the operator voice to be heard in the headset. The sidetone level is controlled by using a dual online package (DIP) switch on the telephony card. The sidetone control pad adjusts during installation to accommodate different electrical characteristics of headsets. Figure 9-9 illustrates a block diagram of the telephony card.

**Figure 9-9** Block Diagram of TOPS MP Telephony Card

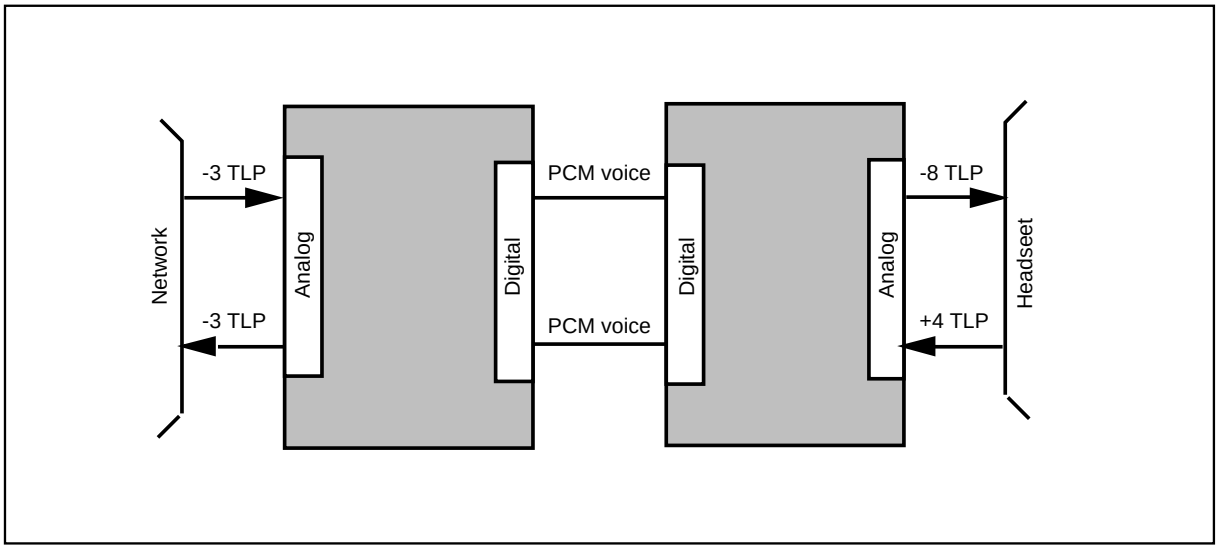



PCM Pulse-code modulated speech

## TOPS MP headset interface

The TOPS MP headset interface is designed for headsets with an output impedance of 300 ohms nominal, and an input impedance of 50 ohms nominal. For the downstream voice path, a -3 dBm0 1004 Hz test signal at the trunk interface produces an output level of -8 dBm0 into 300 ohms at the trunk interface. For the upstream voice path, a 1004 Hz test signal at +4 dBm0 into 50 ohms yields a -3 dBm0 into 600 ohms at the trunk interface. Figure 9-10 illustrates TPC to TOPS MP terminal voice transmission Levels.

**Figure 9-10** TPC to TOPS MP Terminal Voice Transmission Levels




## TOPS MP audio characteristics

Transmission characteristics for TOPS MP audio apply to both the transmit and receive direction, except for sidetone and amplitude limiting. These characteristics apply only to the receive direction. The operator is the point of reference for these transmit and receive directions.

### Nominal level

The average talker level is the nominal level. It is is specified as -21 dBm0 (0TLP).

### Idle channel noise

The idle channel noise level for the transmit direction in the TOPS MP is 18 dBrnC0. For the receive direction, it is 17.5 dBrnC0.

### Frequency response

The frequency response for both the transmit and receive directions of the TOPS MP is listed in Table A.

| Frequency Response (Hz) | Transmit | Receive |
|---|---|---|
| 200 | 3.13 | -7.09 |
| 300 | 2.73 | -3.07 |
| 3000 | 0.68 | -1.35 |
| 3400 | -0.11 | -2.76 |

**Table A** Frequency Response

### Level tracking

The TOPS MP level tracking characteristics are listed in Table B.

| Level Tracking | Transmit | Receive |
|---|---|---|
| 3 to -37 dBm0 | 4.28 | -0.21 |
| -37 to -50 dBm0 | 0.20 | 0.55 |

**Table B** Level Tracking

### Signal-to-noise ratio

Signal-to-noise ratios for the TOPS MP are listed in Table C.

| Signal-Noise Ratio dB Input | Transmit | Receive |
|---|---|---|
| 0 to -30 dBm0 | 20.0 | 33.0 |
| -340 dBm0 | 30.0 | 26.0 |
| -45 dBm0 | 26.0 | 23.0 |

**Table C** Signal -to-Noise Ratio

### Harmonic distortion

Harmonic distortion characteristics of the TOPS MP system are listed in Table D.

| Harmonic Distortion (dB below fundmental) | Transmit | Receive |
|---|---|---|
| 2 nd | 50.0 | 50.0 |
| 3 rd | 55.0 | 55.0 |

**Table D** Harmonic Distortion

### Sidetone

Sidetone, provided by an electrical circuit outside of the operator headset, feeds part of the operator speech from the transmit path to the receive path. For the TOPS MP system, the level of this signal is 13.7 dB below the level of the transmit path.

### Voice control

Volume control for the TOPS MP system controls room noise for low-level calls. This volume control is variable within a 5-dB range.

### Amplitude limiting

To prevent annoying high-level acoustic signals from reaching the operator, automatic gain control (AGC) limits the level of high-amplitude signals. The amplitude ceiling for the steady signal is -19 dBm0. The amplitude limiting attack time is the interval between the onset of high-level tone burst input and the instant AGC output reaches a value between the initial level and -26 dBm0. Amplitude limiting release time is the interval between the end of a high-level tone burst signal and the instant the amplitude limiter loss inserts in the receiver path when it reaches the midway point between the limiting level and the final level. For the TOPS MP, the range for the amplitude limiting release time is 26 to 80 ms.

## TOPS 04 trunk transmission levels

To test DMS-200 to TOPS 04 voice or data downstream paths at the DMS, a tone generator connects through the network to the trunk to be tested. This connection is accomplished using the DMS-200 test trunk position TTP. At the TOPS 04 controller site, the controller is disconnected from the trunk to be tested. The trunk connects to a test measurement set (TMS) for a 600 ohms termination mode. The TMS measures the signal level at the point of interface to the TOPS 04 controller. To test voice or data upstream paths for a TOPS 04 to DMS-200 configuration, a signal transmitted from the TMS measures the transmission level at the DMS from the TTP.

Refer to *TOPS 04 Trunking and Transmission Guidelines*, 297-2271-140, for additional information on testing TOPS 04 trunk transmission levels. Trunk transmission levels apply when testing the TOPS 04 transmission levels.

| TRUNK TRANSMISSION LEVELS | |
|---|---|
| Voice path levels downstream DMS to TMS | 1004 Hz transmit level at TTP 0 dBm<br>Expected receive level at TMS -3 dBm |
| Voice path levels upstream TMS to DMS | 1004 Hz trasmit level at TMS -3 dBm<br>Expected receive level at TTP -6 dBm |
| Data path levels downstream DMS to TMS | 1004 Hz transmit level at TTP -13 dBm<br>Expected receive level at TMS -16 dBm |
| Data path test levels upstream TMS to DMS | 1004 Hz transmit level at TMS -16 dBm<br>Expected receive level at TTP -19 dBm |

**Table E** Trunk Transmission Levels

The NT1X54AA or NT2X72AA D/A converters in the TM8 provide +9 dB gain for transmit voice and data signals. For both voice and data, the pads on these cards provide the required pad loss + transmission loss equals 3 dB loss signal required between the test access trunk and the TOPS 04 controller.

The NT1X54AA or NT2X72AA A/D converters in the TM8 provide +12 dB gain for the received voice and data signals. For both voice and data, the pads on these cards provide the required pad loss + transmission loss equals 3 dB loss signal required between the test access trunk and the TOPS 04 controller. Figure 9-11 illustrates TOPS 04 voice trunk transmission levels. Figure 9-12 illustrates TOPS 04 data trunk transmission levels.

**Figure 9-11** TOPS 04 Voice Trunk Transmission Levels

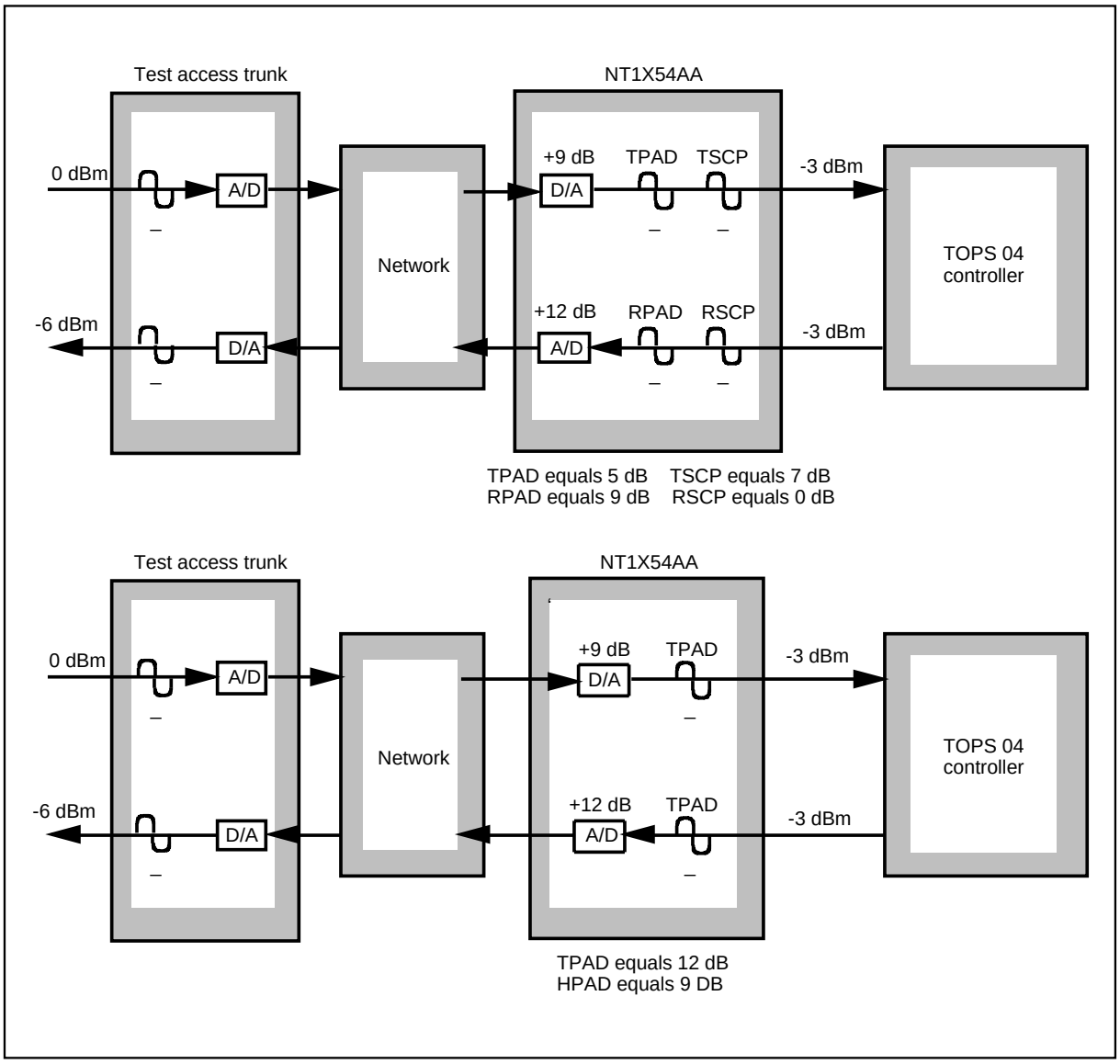
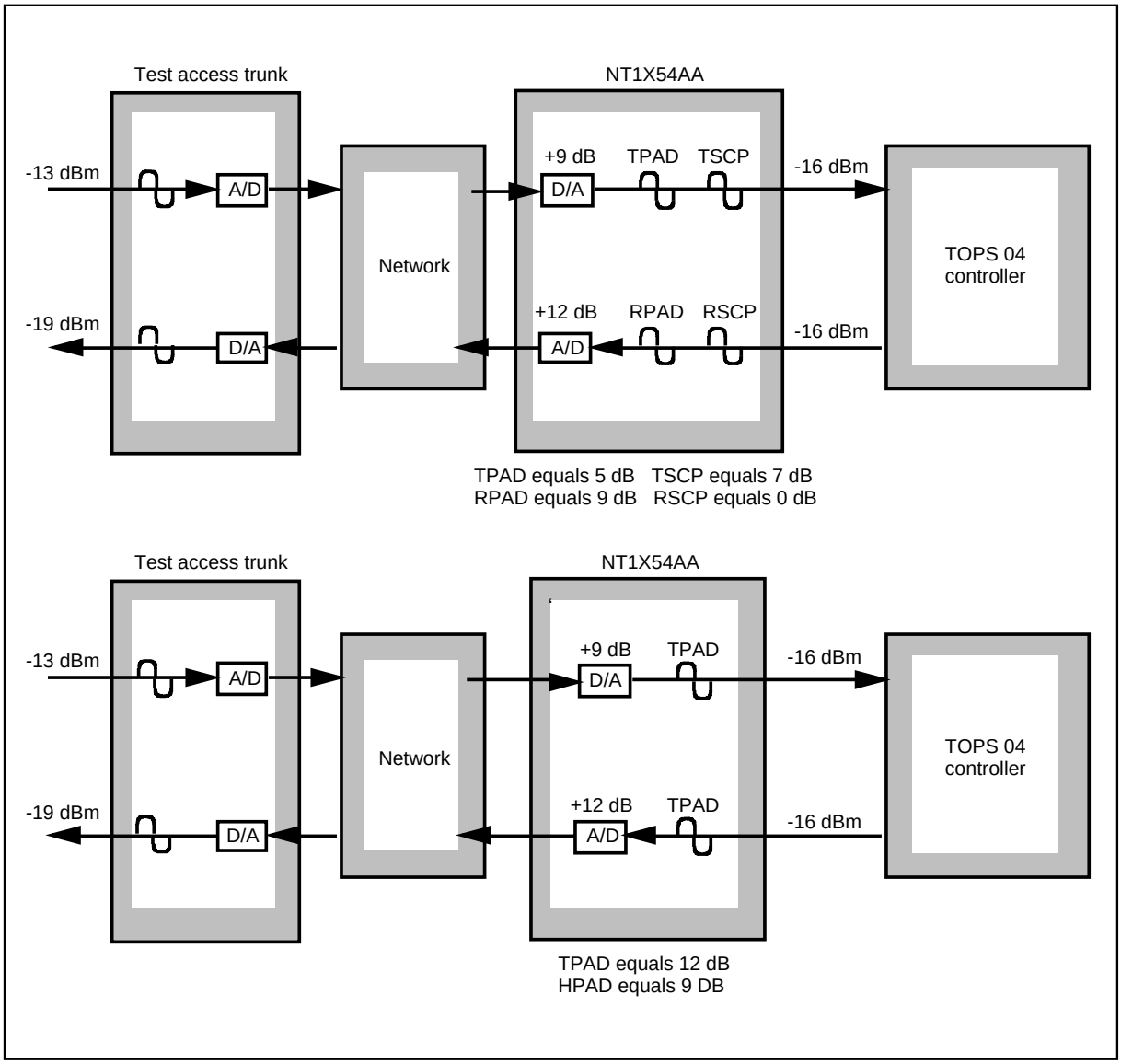


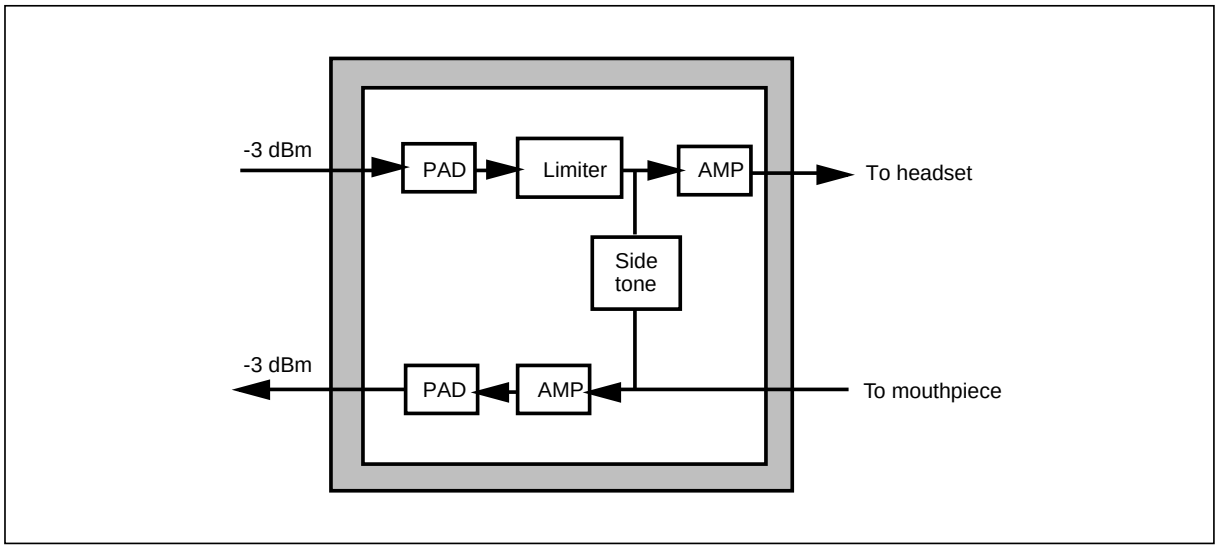
**Figure 9-12** TOPS 04 Data Trunk Transmission Levels




## TOPS 04 controller

The TOPS 04 controller enables the operator to communicate with the DMS-200 switch. Within the controller are circuits required for this communication. These circuits include voice and data signal paths, sidetone and limiting threshold options, pads, and amplifiers. Figure 9-13 illustrates voice signal levels at a TOPS 04 controller.

**Figure 9-13** TOPS 04 Voice Signal Levels at TOPS 04 Controller




Headset receive levels depend on the limiting threshold, VREC pad values, and headset efficiency. Voice signal transmit levels depend on the efficiency of the mouthpiece microphone and VMST pad values. Sidetone levels depend on the DIP switch setting.

### Voice signal path

A received voice signal follows the 4-wire voice trunk path through a pad, limiting circuit, and amplifier to the operator headset. The limiting circuit ensures power for the received audio signal does not exceed a preset threshold. The limiting threshold is set by using the DIP switch on the audio/modem card located in the TOPS 04 controller.

A transmitted voice signal follows the path from the mouthpiece of the operator headset, through an amplifier and a pad to the 4-wire voice trunk. The pad in the transmit path compensates for the varying electrical efficiency of different headsets. The transmitted voice signal also is routed through sidetone circuitry. This circuit passes some of the voice signal from the transmit path to the receive path which allows the operator to monitor their own voice in the headset. Sidetone level is controlled by a DIP switch on the audio/modem card in the TOPS 04 controller.

**Voice path pads** The TOPS 04 controller, which includes receive voice, transmit voice, and four transmit data pads. Transmit data pads, which are located on a mounting bracket in the TOPS 04 controller, are plug-in pads available in three values.

- 0 dB
- 0.1 dB through 0.9 dB
- 1.0 dB through 16.0 dB

The four pads are required by the TOPS 04 controller, two pads receive the voice path and two pads receive the voice path. Padding of 0 dB to 32 dB can be provisioned, with a range of 0 dB to 16.9 dB provisionable in 0.1 dB increments, and a range 17 dB to 32 dB provisionable in 1 dB increments. The voice path pads are designed to compensate for electrical efficiency of the headset. The pads do not compensate for facility loss on voice trunks. Transmission levels at the interface of the voice trunk and the TOPS 04 controller are designed for -3 dBm for both transmit and receive paths.

When a Northern Telecom Venture I headset is used, VREC pads are provisioned at 7 dB nominal and the VXMT pads are provisioned at 10 dB nominal.

**Limiting threshold selection** The received voice signal limiting threshold is selected using the S3 DIP switch, located on the audio/modem card. The settings for this switch are listed in Table F. These measurements refer to a 100mV, 1004 Hz input signal and are accurate to within $\pm$ 1.0 dBm. Other switch settings are not supported.

| LIMITING LEVEL 600 Ω Probe dBm | LIMITING LEVEL 300 W Probe dBm | S3-1 | S3-2 | S3-3 |
|---|---|---|---|---|
| No Limit | No Limit | OFF | OFF | OFF |
| -25.0 | -22.0 | OFF | OFF | ON |
| -28.0 | -25.0 | OFF | ON | OFF |
| -34.0 | -31.0 | ON | OFF | OFF |
| -38.0 | -35.0 | ON | ON | OFF |

**Table F** Limiting Threshold Selection

**Headset interface** Output impedance at the headset interface is 300 ohms nominal. The headset impedance is 75 ohms nominal. For the downstream voice path, with 0 dB VREC padding and no limiting, a -3 dBm, 1004 Hz test signal at the trunk interface yields, at the headset interface, an output level of -6 dBm into 300 ohms. For the upstream voice path, with 10 dB VXMT padding, a 1004 Hz test signal at 2 dBm into 75 ohms yields, at the trunk interface, an output level of -3 dBm into 600 ohms.

The pads and level limiting circuitry allow electrical efficiency of various headsets. Input and output levels of the Northern Telecom Venture I headset are listed here. For headsets manufactured by other sources, consult the manufacturer literature.

| RECEIVE | |
|---|---|
| **Headset Input (dBm into 300 ohms)** | **Headset Output (Sound Pressure Level)** |
| -22 | 99 |
| -25 | 95 |
| -31 | 88 |
| -43 | 85 |

**Table G** Receive Headset Input/Output

| TRANSMIT | |
|---|---|
| **Mouthpiece Input (Sound Pressure Level)** | **Mouthpiece Output (dBm into 75 ohms)** |
| 84 | -24 |
| 89 | -19 |
| 94 | -14 |

**Table H** Transmit Mouthpiece Input/Output

**Sidetone level** Sidetone level can be adjusted by two switches on the S2 DIP switch on the audio/modem card. This card is located in the hinged card cage inside the TOPS 04 controller. These sidetone levels are $\pm$ 1.0 dBm, taken with a 0 dBm test tone at 1004 Hz and 600 ohms input impedance with TMS set on the termination mode. Due to impedance mismatch, the 0 dBm tone at 600 ohms input impedance corresponds to a +4 dBm tone at 75 ohms.

The level settings for the receive voice path are listed in Table I.

| SIDETONE LEVEL 600 OHM Probe dBm | SIDETONE LEVEL 300 OHM Probe dBm | S2-1 | S2-2 |
|---|---|---|---|
| No Sidetone | No Sidetone | OFF | OFF |
| -29.0 | -26.0 | ON | OFF |
| -25.0 | -22.0 | OFF | ON |
| -21.0 | -18.0 | ON | ON |

**Table I** Sidetone Level

### Data signal path

The data signals received on the 4-wire data trunk are converted from frequency shift keying (FSK) encoding to transistor-transistor logic (TTL) signals by the modem circuit for the audio/modem card. Transmit data path is provisioned to support only one pad. This pad is placed in the uppermost DXMT pad socket.

Transmit data signals are converted from TTL signals to FSK, passed through a pad, and transmitted on the 4-wire data trunk. Transmit and receive levels for data at the interface between the TOPS 04 controller and the trunk are specified at -16 dBm nominal. The DXMT pad is adjusted to compensate for transmission loss and the output level of the modem. The pad value is 10 dBm nominal.

## TOPS 04 audio characteristics

Audio transmission characteristics for the TOPS 04 system apply to both transmit and receive direction except for sidetone and amplitude limiting in the receive direction. These transmit and receive directions are referenced to the operator.

## Nominal level

The average talker level is the nominal level. This level is specified to -21 dBm0.

### Idle channel noise

The idle channel noise level for the transmit direction in the TOPS 04 is less than or equal to 11 dBrnC0. In the receive direction, the is 10 dBrnC0.

### Frequency response

The frequency response for both transmit and receive directions for the TOPS 04 is listed in Table J.

| Frequency (Hz) | Minimum Loss (dB) | Maximum Loss (dB) |
|---|---|---|
| 60 | 20. | - |
| 200 | 0. | 4.0 |
| 300 | -0.5 | 1.0 |
| 3000 | -0.5 | 1.0 |
| 3200 | -0.5 | 1.5 |
| 3400 | 0. | 3.0 |

**Table J** TOPS 04 Frequency Response

### Level tracking

The TOPS 04 level tracking characteristics are listed in Table K.

| Level Tracking Input dB | Maximum Deviation from Insertion Loss at 0Bm at Input Signal Level |
|---|---|
| 3 to -37 dBm0 | +/- 0.5 dB |
| -37 to -50 dBm0 | +/- 1.0 dB |

**Table K** TOPS 04 Level Tracking Characteristics

### Signal-to-noise ratio

Signal-to-noise ratios for the TOPS 04 system are listed in Table L.

| Signal-to-Noise Ratio dB Input | Transmit | Receive |
|---|---|---|
| 0 to -30 dBm0 | 56.8 | 14.4 |
| -40 dBm0 | 47.1 | 44.7 |
| -45 dBm0 | 41.9 | 39.7 |

**Table L** TOPS 04 Signal-to-Noise Ratios

### Harmonic distortion

Harmonic distortion characteristics of the TOPS 04 system are shown in Table M.

| Harmonic Distortion (dB below fundamental) | Transmit | Receive |
|---|---|---|
| 2 nd | 76 | 79 |
| 3 rd | 74 | 79 |

**Table M** Harmonic Distortion Characteristics

### Sidetone

Sidetone, which is provided by an electrical circuit outside of the operator headset, feeds part of the operator speech from the transmit path into the

operator receive path. For the TOPS 04 system, the level of this signal is 12 dB below the level of the transmit path.

### Voice control

Volume control is provided to overcome room noise on low-level calls. This volume control is variable over a 5 dB range.

### Amplitude limiting

To prevent annoying high-level acoustic signals from reaching the operator, automatic gain control (AGC) is used to limit the level of high-amplitude signals that may occur at the operator position. The amplitude ceiling for the steady signal is -20 dBm0.

# Power and Grounding

Power distribution for the TOPS systems provide controlled and protected distribution of ac and dc power to dc-powered operator positions. The grounding system must provide immunity, within industry accepted standards, from operational and transient voltages which could be hazardous to operating company personnel and TOPS equipment.

## TOPS MP power and grounding

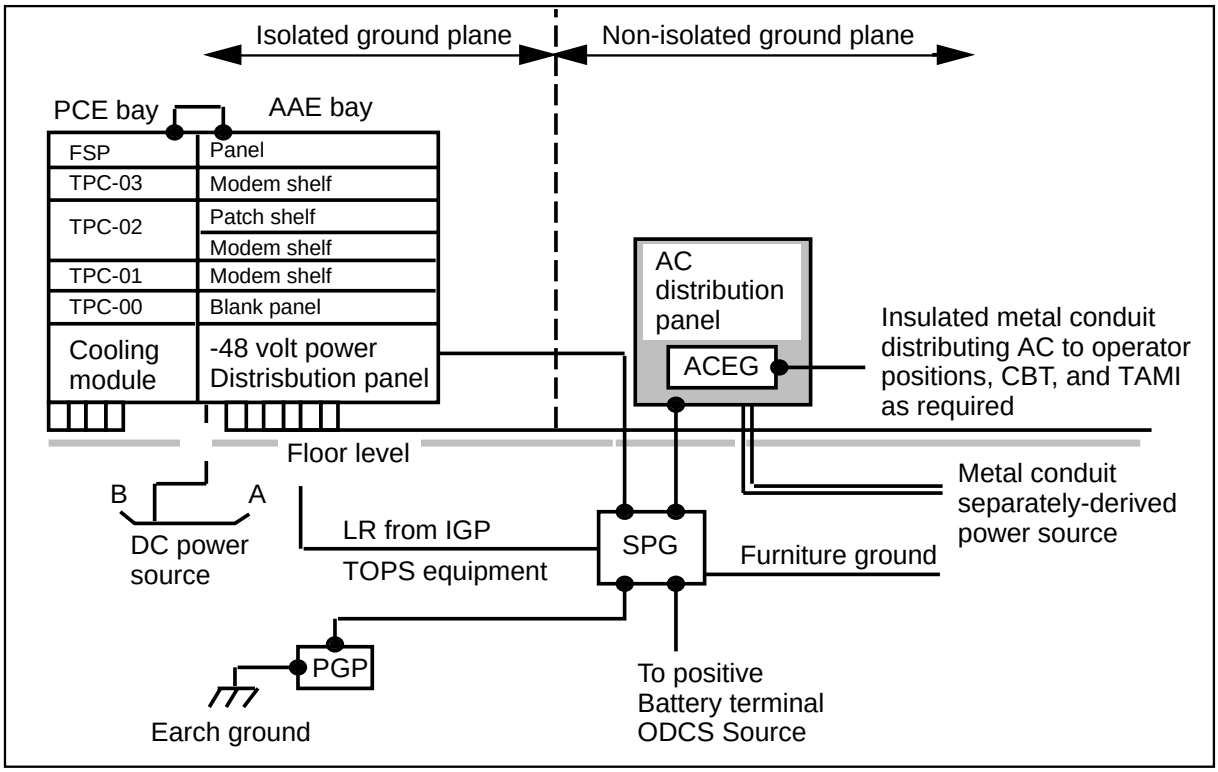
The TOPS MP system includes one or more position controller equipment (PCE) bays, one or more auxiliary access equipment (AAE) bays, and the required number of MP operator positions. Each operator position consists of a keyboard and a terminal. All signaling between the AAE and the PCE bays, and either the DMS host or the MP operator positions, is ac coupled and dc isolated. The PCE and AAE bays are powered from a -48 Vdc power plant and arranged in an isolated ground plane (IGP) configuration. The bays must be located within one floor of the point where dc power source is grounded.

The MP Operator position equipment is powered only from a dedicated ac power source. This equipment cannot be farther than 1000 cable feet from the PCE and the AAE bays. The equipment can be located with other equipment which is part of the building integrated ground plane. All TOPS MP positions must be located within one floor of the point at which their ac source is grounded. TOPS MP positions are designed to ensure no possibility of personnel hazard by following this specification.

The TOPS MP support equipment is ac powered, to include a computer-based training (CBT) system and the TPC administration and maintenance interface (TAMI) terminal. The CBT system is located within the same area as the PCE and AAE bays, and must be powered from an ac source referenced to the same single point ground (SPG) as the PCE bays. The TAMI can be locally or remotely located from the PCE and AAE bays. If the TAMI is within 7 feet of the PCE and AAE bays, it must be powered from an ac source referenced to the PCE equipment SPG. If the TAMI is located more than 7 feet from the PCE bays, commercial ac can be used for the TAMI power source.

A SPG philosophy ensures that all power sources, signal planes, and metallic enclosures and supports, either within or close to the TOPS MP equipment, are referenced to the same ground. Figure 10-1 illustrates a typical TOPS MP system grounding arrangement.

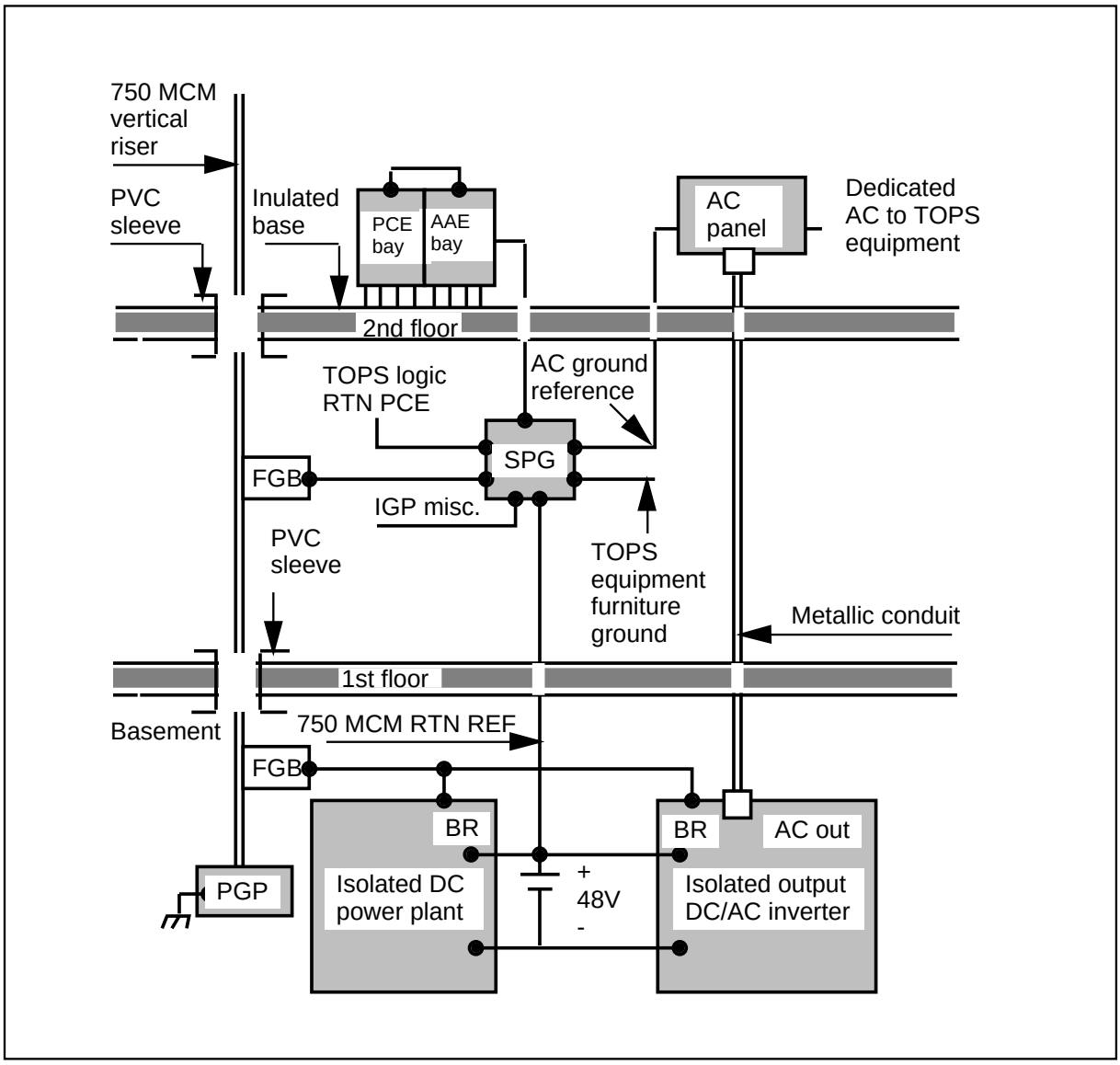
**Figure 10-1** Typical TOPS MP System Grounding Arrangement




## Position controller equipment bay requirement

The PCE bay is a steel EMI/RFI cabinet enclosure which is powered by -48 Vdc and grounded in accordance with IGP requirements. The bay is insulated from the floor and any contact with conduit, cable racks, or other incidental grounds. It is grounded intentionally to the SPG serving the TOPS MP system. Battery return and logic return are insulated from the PCE bay. Logic return is connected to the SPG. Battery return is connected to the main dc power plant. This multi-story TOPS MP installation configuration with an isolated ac inverter is illustrated in Figure 10-2.

**Figure 10-2** Multi-Story TOPS MP Installation with Isolated AC Inverter




## Modem interface requirements

Each TPC is connected to a dc-powered modem in the AAE bay. TPC maintenance is performed using a TAMI position that, if located remotely from the PCE/AAE bay, can be powered from commercial ac not referenced to the PCE bay SPG. To ensure isolation between TAMI power and DMS power references, the modem used for the TAMI must isolate logic ground from chassis ground. When a printer is used with the TAMI position, it must be powered from the same source as the TAMI.

### Auxiliary access equipment bay requirements

The AAE bay is powered by -48 Vdc and can be mounted in the same or separate line-up with the PCE bays. In either case, grounding must be in accordance with IPG requirements and similar to that of the PCE bay.

### Power distribution panel

The power distribution panel (PDP) serves as a local -48 Vdc power distribution and protection facility.

### DC-powered equipment in bays

All dc-powered equipment in the AAE must be protected by adequate fuses, as specified by the manufacturer. The equipment must derive its power from the -48 Vdc source assigned to the TOPS MP system. All dc-powered equipment must have the battery return insulated from the equipment chassis or frame. When an equipment manufacturer straps the battery return internally to the equipment chassis, the ground strap must be removed.

### TOPS MP operator position

Equipment at operator positions are ac powered from a separately derived source. All equipment is plastic encased, isolated from the integrated ground plane, and grounded internally by green-wire grounding to the dedicated ac distribution panel. This panel is grounded to the SPG.

Twist-lock receptacles for the display terminal equipment use a common straight-blade configuration, which are color coded to distinguish them from commercial power. Additional receptacles can be provided at administrative positions to facilitate connection of equipment from the original manufacturer, which may not be available with twist-lock plug terminations. Caution labels also are provided with these receptacles to indicate restricted use.

Additional ac-powered equipment for a TOPS MP operator position should meet four requirements.

- Only ac power provided by the twist-lock receptacles should be used. This mandatory standard for operator positions also is recommended at Administrative positions, although color coded, straight-blade receptacles can be used.
- The equipment must be plastic-encased to isolate it for electrostatic discharge (ESD) and to protect personnel from electrical hazard.
- The equipment should have insulated feet to isolate it from the surface on which it rests. This surface can be part of the integrated ground plane.
- No personal lights, fans, heaters, or other ac-powered equipment should be within 7 feet of any 0perator position.

### Modular workstation

The modular TOPS MP workstation includes a monitor controller mounted on the controller base of the terminal. This design is appropriate when the work surface or furniture is customer supplied. Customer-supplied furniture should conform to the grounding requirements specified in this document.

### Integrated workstation

An integrated TOPS MP workstation includes a controller base which is separate from the monitor controller. For this workstation type, the controller base is installed vertically in NT-supplied furniture. The NT furniture, which is designed specifically for the TOPS MP system, incorporates ESD and grounding requirements described in this document.

The NT furniture work surface is an ESD conductive surface which is not insulated. All conductive furniture associated with a TOPS MP position must have metal work grounded to the SPG.

### Computer-based training equipment

The computer-based training (CBT) equipment is ac powered and mounted in its self-contained framework. There are four steps to follow when installing and powering the CBT equipment.

1 Only ac-power referenced to the PCE bay SPG and accessed via a straight blade, which is color coded with a CAUTION label to restrict use, should be used with a flexible cord.

2 The equipment frame is isolated from its base mounting and from any incidental ground contact.

3 The equipment frame is intentionally grounded with a 1/0 AWG insulated cable from the ground stud on the equipment to the SPG for the TOPS MP system.

4 The equipment frame should not be grounded to the PCE or to the AAE frames when contained in the same frame.

### Channel bank equipment

Channel bank equipment required to link the TOPS MP system to a remote host is customer provided and external to TOPS MP equipment. One channel bank is required for every 12 operator positions. Signaling between channel banks and the AAE is ac coupled and dc isolated. Channel bank equipment is typically dc powered. If the equipment is powered from the AAE bay (PDP) it must meet three requirements.

- Each channel bank circuit must be fused separately on its input -48 Vdc feed by adequate fuses, as specified by the manufacturer.
- Battery return must be insulated from the channel bank chassis.
- The channel bank relay rack or frame must be insulated from the floor and any incidental ground contact, and intentionally grounded with a 1/0 AWG insulated cable to the SPG.

## TOPS MP power requirements

The TOPS MP requires continuous dc power with a nominal -48 Vdc and continuous, protected 120 Vac at 60 Hz ac power.

### DC power requirements

Figure 10-3 illustrates a typical dc power plant and power distribution. This dc power is provided from a -48 Vdc power plant with storage battery plant backup. The storage battery provides a minimum of three hours of reserve power, if an emergency source such as a diesel generator is available on site. This source must provide a maximum of eight hours of reserve power if an emergency source is not available.

The dc power plant should be isolated power, with a positive discharge bus insulated from incidental ground and connected intentionally to the SPG. Any ground strap between the battery charger positive output terminal and its frame must be removed to meet this isolation requirement.

Separate A and B feeds should be provided for PCE and AAE equipment. The dc source voltage range should not exceed -42.75 Vdc to -55 Vdc, measured at bulkhead EMI filter input terminals on each PCE bay. The dc-powered equipment has three load current requirements.

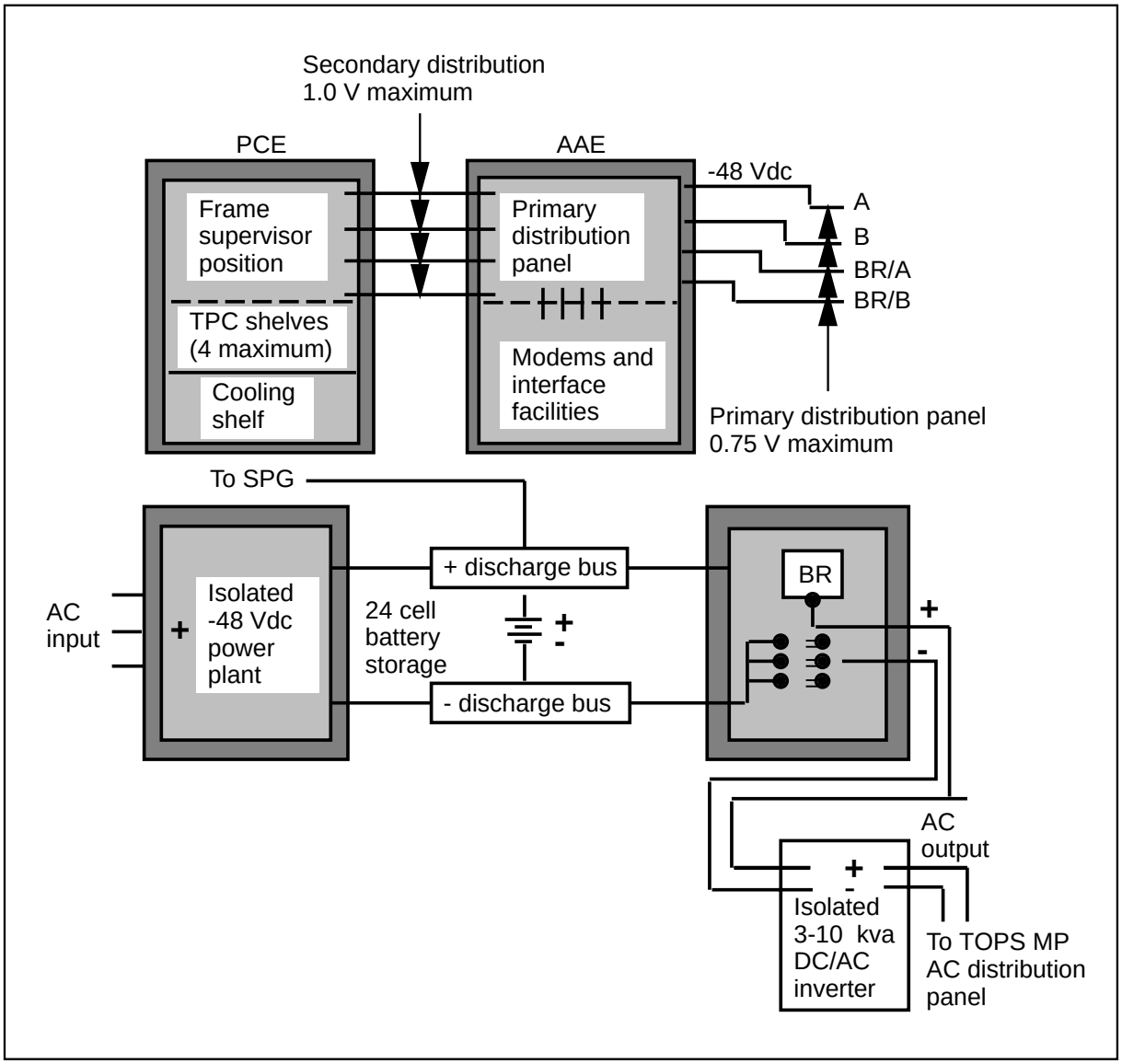
| | |
|---|---|
| TPC Shelf | 4 Amp at -52 Vdc, 5 Amp at -42 Vdc |
| PCE Bay | 17 Amp at -52 Vdc, 21 Amp at -42 Vdc |
| AAE Bay | 5 Amp at -52 Vdc, 6 Amp at -42 Vdc |

The PCE and AAE bay loads are designed for a fully equipped configuration. The dc power for these bays is distributed evenly between A and B feeds. The primary and secondary dc distribution feeders have recommended loop voltage drops.

| | |
|---|---|
| Primary | 0.75 Vdc maximum between dc power plant distribution put terminals and the AAE PDP input busbars. |
| Secondary | 1.0 Vdc maximum between PDP output and PCE Distribution frame input terminals. |

A typical TOPS MP dc power plant distribution is illustrated in Figure 10-3.

**Figure 10-3** Typical TOPS MP DC Power Plant and Distribution



## AC power requirements

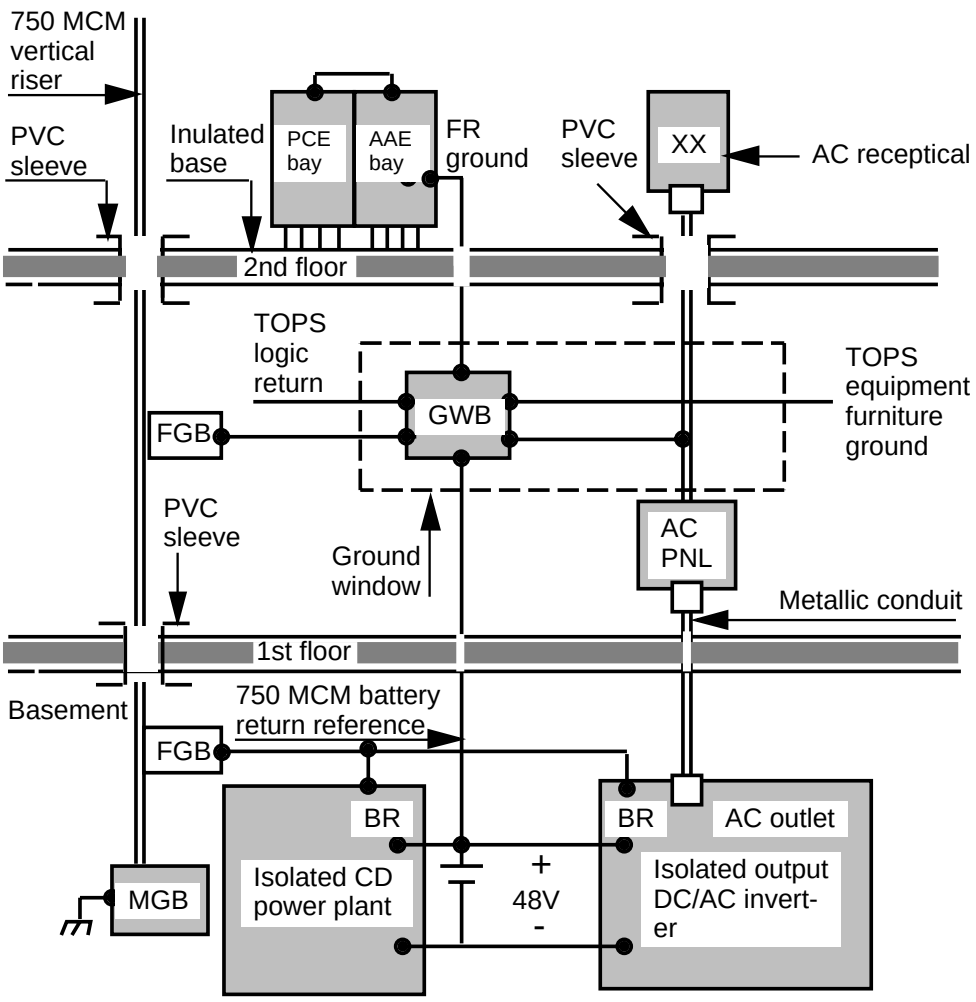
The ac power required for the TOPS MP equipment is a separately derived dedicated system in the form of an isolation transformer or dc/ac power inverter. With either configuration, the TOPS ac power is isolated from commercial ac power and referenced to the SPG for its grounding requirement. The transformer or inverter must be within one floor of the SPG. Printers are optional equipment.

The TOPS MP equipment has specific ac power requirements.

| | |
|---|---|
| WICAT CBT system | 12.00 Amp at 120 Vac, 60 Hz |
| TOPS MP display terminal | 0.75 Amp at 120 Vac, 60 Hz |
| Texas Instruments Omni-800 printer | 1.30 Amp at 120 Vac, 60 Hz |
| Digital Equipment Corporation DECWriter IV printer | 1.30 Amp at 120 Vac, 60 Hz |

The separately derived ac power source is fed to a dedicated ac distribution panel for TOPS MP equipment, as illustrated in Figure 10-4. For operator areas with raised floors, the ac distribution panel must be on the same floor as TOPS MP equipment and next to the principal exit door, as required by *NEC Article 645-3*.

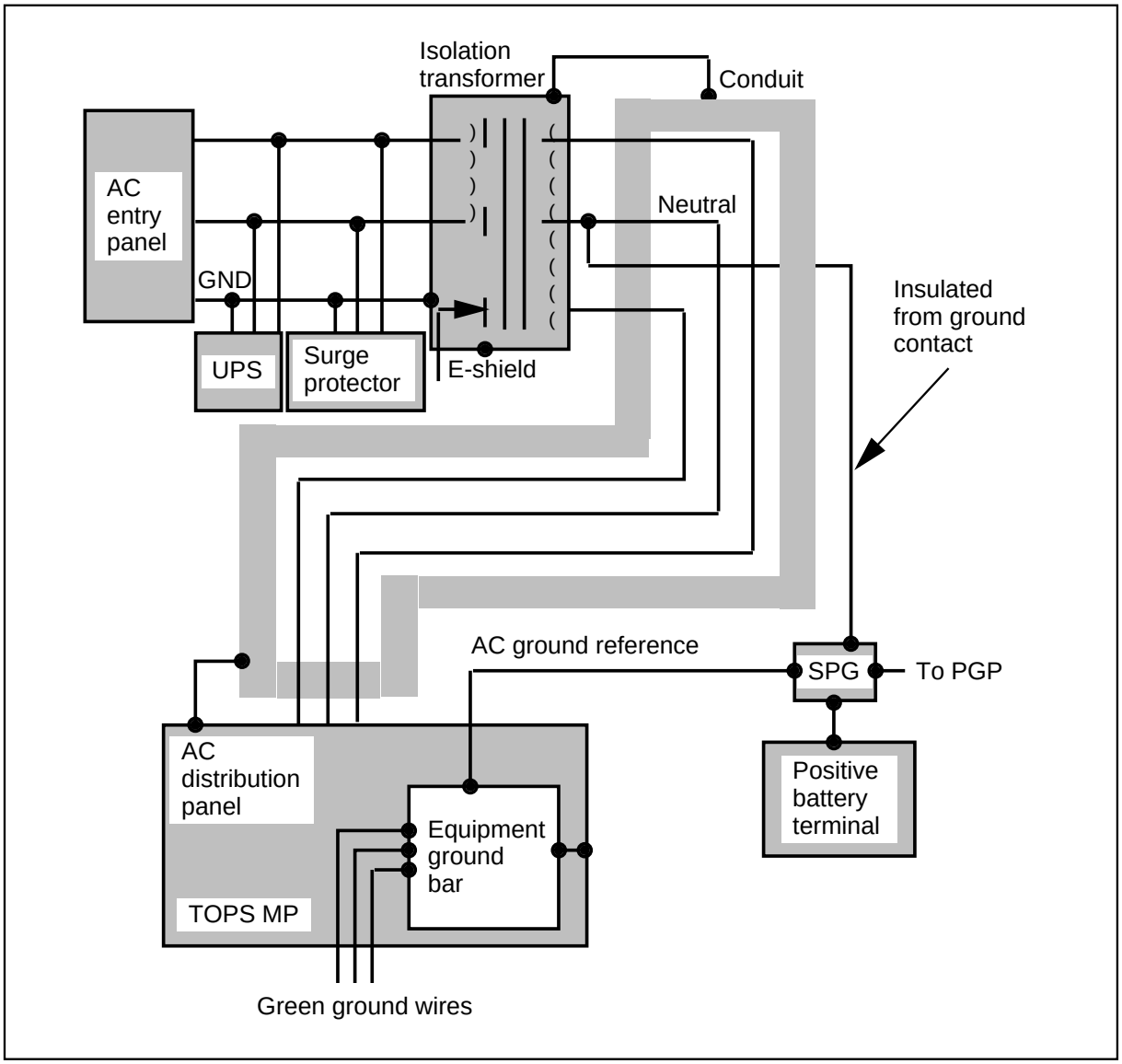
**Figure 10-4** TOPS MP Multi-Story Installation with Ground




***Note:*** All equipment referenced to the SPG must be located within one floor of SPG. Only one SPG is allowed for each isolated power source.

Figure 10-5 illustrates a TOPS MP ground window configuration. The ac load distribution conduit between the distribution panel and operator positions is isolated from incidental ground for both the multi-story installation with ground window and ac power with isolation transformer configurations.

**Figure 10-5** AC Power Arrangement with Isolation Transformer




## AC receptacles

Receptacles for TOPS MP equipment can use either non-isolated or isolated green-wire configurations. In all cases, ac safety green-wire ground is referenced back to a SPG. For a non-isolated configuration, the green-wire is in contact electrically with any enclosure surrounding the receptacle. For a isolated configuration, the green-wire does not make contact with metal work, and additional wiring is required to ensure that any metallic receptacle enclosures are connected to the SPG.

For customers requesting non-isolated green-wire receptacles, there are three configurations. Yellow straight-blade receptacles can be used on an

optional basis. This receptacle is similar to the receptacle for the administrative position.

| | |
|---|---|
| Administrative Positions | One brown duplex twist-lock re-ceptacle or two yellow duplex straight-blade receptacles. |
| Standard MP Operator Positions | One brown duplex twist-lock receptacle. |
| CBT Facility | Two yellow duplex straight-blade receptacles. |

All receptacles are in the immediate vicinity of the TOPS MP system. Receptacles are floor or wall mounted, using multi-outlet poles and/or conduits, as allowed by local codes. Metallic outlet poles and conduits must be isolated from contact with the building integrated ground plane and referenced to SPG, either via the green-wire non-isolated configuration or an additional isolated configuration.

The twist-lock and the color coded straight blade receptacles provide a distinction between commercial ac power and ac power dedicated to TOPS MP equipment on the operating company premises. These receptacles also restrict foreign loads from being powered from a dedicated ac power source, which could result in interference with the performance of the TOPS MP system.

### AC equipment ground requirements

The green-wire ground conductor for the TOPS MP dedicated ac distribution network should be insulated from contact with any incidental ground. An insulated green-wire conductor is required for each ac load distribution circuit leaving the ac distribution panel. These conductors terminate at the equipment ground bar inside the ac distribution panel. The equipment ground bar is grounded to SPG in accordance with local electrical codes.

If a ground window is used for the grounding, the equipment ground bar can originate at the junction box within the ground window and connect directly to SPG. All conduit from the ground window to the TOPS MP equipment must be isolated from incidental ground.

### Commercial ac-powered equipment

The TOPS MP equipment must not be indiscriminately powered from commercial ac power, either temporarily or permanently. Any equipment operating by commercial ac power, adjacent to the TOPS MP equipment, must be separated by a minimum space of 7 feet to avoid a possible personnel hazard because the grounding systems are different. If the 7 feet distance cannot be maintained, isolating screens may be used to prohibit personnel contact between the two grounds.

A 3-10 KVA output dc/ac inverter can be added to existing -48 Vdc storage batteries to obtain dedicated ac power required for the TOPS MP equipment. In some instances, additional capacity may be required for the storage battery, depending on the inverter load and the duration of emergency power required for the installation. To provide adequate noise, ripple, and transient suppression on the -48 Vdc power bus, the minimum acceptable battery capacity is four times the maximum load drain.

### DC and ac power inverter

The dc/ac power inverter should be a separately derived source of 120 Vac, 60 Hz, with the capacity to power a large TOPS MP system. A large capacity inverter can be installed initially to provide for expansion of the TOPS MP system. Separate inverters of smaller capacity can be added as the TOPS MP system expands.

Each inverter operates from a separately protected fuse or circuit breaker with -48 Vdc input, which is separately wired and protected ac output to a load distribution panel. Each green-wire load panel equipment ground bar is connected to the SPG.

The positive input terminal of the inverter must be isolated from the inverter chassis to retain the power plant isolation requirement. If a ground strap connects the positive input terminal to the inveter chassis, the strap must be removed. The positive discharge bus of the dc power plant is isolated and grounded to SPG. This installation references both the ac and dc source to the same SPG where the TOPS MP equipment is referenced.

For TOPS MP system in a commercial office space site, a dc/ac power inverter may not be the preferable choice for separately derived ac power. In this case, an isolation transformer powered from commercial ac power, with an uninterrupted power source backup, should be used. There are five reasons for choosing such an installation.

- A large capacity dc power plant with storage batteries does not exist at the site.
- The storage battery capacity of an existing dc power plant is not sufficient to handle the additional dc and ac load required for the TOPS MP system.
- The TOPS MP system location exceeds one floor of separation from the SPG, requiring a separate power source and SPG for the TOPS MP system.
- The isolation transformer with an uninterrupted power source is more feasible for a particular site installation.
- An uninterrupted power source already exists at the site with sufficient load capacity and duration for TOPS MP ac power requirements.

### Isolation transformer installation

The isolation transformer must be located within one floor of the SPG. The transformer should maintain complete electrical isolation between commercial ac power on the transformer primary and the transformer secondary. A single phase transformer with 120/240 Vac secondary output is sufficient for the TOPS MP system.

The secondary power conduit between the isolation transformer and dedicated ac distribution panel is grounded to the transformer case or frame. The primary power conduit is grounded to the transformer case. The transformer case is grounded back to the ac entrance panel multi-ground-neutral with an insulated grounding cable. This cable is sized in accordance with NEC Table 250-94.

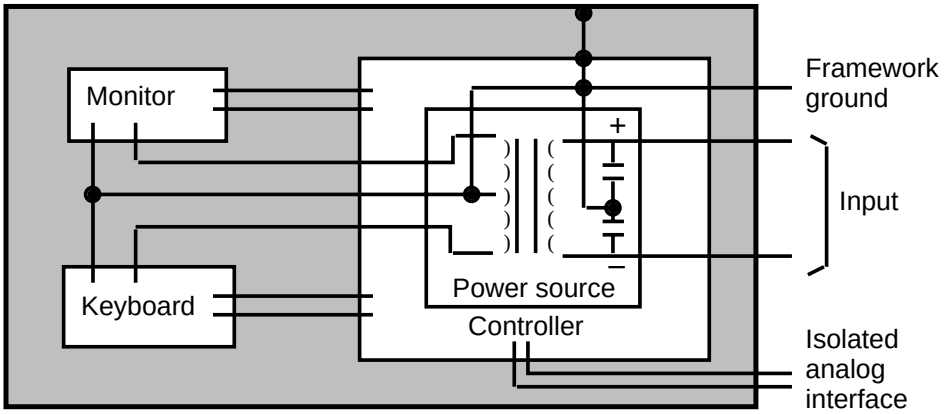
The primary conduit, isolation transformer case, secondary conduit, and distribution panel form a continuous electrical ground to the multi-ground-neutral using metallic conduit installed in accordance with *NEC Article 346*. When an electrostatic shield exists between primary and secondary power conductor for the transformer, it is grounded to the transformer case.

The secondary neutral conductor runs continuously in conduit with phase conductors to the ac distribution panel. A secondary neutral terminal at the transformer is grounded in accordance with *NEC Article 250-26* for separately derived systems using a 4/0 AWG cable connected to the SPG. The neutral grounding cable to the SPG is normally non-load carrying and should be type MC metal sheathed cable, with an insulated sleeving to prevent incidental ground contact between the transformer and the SPG for air plenum applications. This cable is in accordance with *NEC Article 300-22*. For other applications, grounding cable can be routed, where permitted, in non-metallic conduit under the following conditions.

- DC power input and dc-powered TOPS framework must be referenced to the same SPG, which must be within one floor of the dc-powered TOPS positions.
- Green-wire safety ground and any metallic conduit of the ac service, local to dc-powered positions, must be referenced through a single connection to the same SPG as the dc-powered TOPS framework.

Figure 10-6 illustrates a typical arrangement when dedicated ac power is obtained from an isolation transformer.

**Figure 10-6** Basic DC-powered TOPS 04 Position Configuration




***Note 1***: The dc power input and dc powered TOPS framework must be referenced to the same SPC, which must be within one floor of the dc powered TOPS positions.

***Note 2***: The green-wire safety ground and any metallic conduit of the ac service, local to to dc powered positions, must be referenced through a single connection to the same SPG as the dc-powered TOPS framework.

**Surge protector** A surge protector of adequate voltage rating and power dissipation is recommended. This surge protector should be connected across ac power input leads of the isolation transformer and grounded to the isolation transformer case. The surge protector suppresses both commercial power transients and switching transients caused by cutover of the uninterrupted power supply.

**Uninterrupted power supply requirements** A uninterupted power supply (UPS) is required to maintain constant ac power to operator positions during commercial power outages. The holding time for the UPS should be sufficient to maintain ac power through typical outage durations for the area.

### Grounding support

The TOPS MP equipment arrangements are configured to isolated ground plane requirements and conform to the grounding topology of the DMS-100 switch. TOPS MP equipment often dictates that some TOPS hardware be collocated with other equipment, which is arranged in a non-isolated ground plane configuration.

The equipment in two different ground zones is isolated, but intentionally grounded to SPG. Transformer coupling is used to isolate any signal lines

between equipment in the two zones. Direct coupling is avoided to ensure no metallic connection crosses isolated ground plane boundaries.

**Isolated ground plane equipment** The AAE bays are always in the isolated ground plane configuration either with the bays or with other isolated equipment. All equipment in this configuration is isolated from incidental ground contact with the floor, cable racks, metallic conduit, or other conductive surfaces. There is one intentional ground cable connection to the SPG.

**Integrated ground plane equipment** Operator workstations, to include the terminal, furniture, and divider partitions, are normally located in an integrated ground plane area. Furniture and divider partitions associated with these operator positions, which are grounded intentionally to SPG, can be in contact with the building or incidental ground. All ac-powered equipment used at any operator workstation is insulated from contact with incidental ground by a twist-lock/color-coded receptacle and equipment plastic enclosure. This enclosure insulates the equipment from the furniture and operator. The ac green-wire equipment grounds terminate at the ac distribution panel and are intentionally grounded to the SPG.

**Single point ground** The SPG for the TOPS MP is an insulated ground bar which references isolated ground plane and integrated ground plane equipment, dedicated green-wire ac power, and the positive battery dc-power plant bus to one common ground point. The SPG then connects to earth ground for the building site.

**Single floor installations** A single floor installation contains TOPS MP equipment bays, which are in the isolated ground plane, operator positions in the non-isolated ground plane, and SPG on the same floor. The SPG, power, and grounding cabling can be located below the equipment, in a raised floor area, or above the equipment in a dropped ceiling area. Isolated ground plane equipment is insulated from the floor or incidental ground contact and is intentionally grounded only to the SPG.

Dedicated ac power is provided by a separately derived power source to a dedicated ac distribution panel and distributed to TOPS MP equipment, as required. A separately derived power source, as defined by the NEC, can be an isolation transformer or a dc/ac inverter. The ac equipment ground bar in the distribution panel is connected to SPG with insulated 4/0 AWG cable.

The dc power plant providing power to the PCE and AAE bays must have a battery positive bus grounded to the same SPG servicing the TOPS MP system. The dc power plant is not grounded to the SPG.

**Single point ground connections** The SPG is an insulated ground bar which connects isolated ground plane and non-isolated ground plan equipment to a common ground reference. The SPG is connected to the principal ground point for a building site. The principal grounding point can be a series connection of driven ground rods, buried ground grid, steel well casing, or similar grounding arrangements which typically measure 5 ohms or less earth ground impedance.

Impedance cannot be allowed to exceed local electric utility limits. The only connection between isolated ground plane and non-isolated ground plane equipment should be through the SPG serving the system.

- principal ground point
- ac distribution panel ACEG bar
- main dc power plant positive battery bus
- isolated ground plane equipment logic return
- isolated ground plane equipment framework ground
- MP operator position furniture and metallic partitions
- ac isolation transformer secondary neutral when located on same or adjacent floor as SPG
- principal ground point
- ac distribution panel ACEG bar
- main dc power plant positive battery bus
- isolated ground plane equipment logic return

- isolated ground plane equipment framework ground
- MP operator position furniture and metallic partitions
- ac isolation transformer secondary neutral when located on same or adjacent floor as SPG.

Ground cable connections always connected to SPG include the following.

- principal ground point
- ac distribution panel ACEG bar
- main dc power plant positive battery bus
- isolated ground plane equipment logic return
- isolated ground plane equipment framework ground
- MP operator position furniture and metallic partitions
- ac isolation transformer secondary neutral when located on same or adjacent floor as SPG
- dedicated ac local load circuit conduit and green-wire conductor for No. 6 AWG cable or larger ground window
- miscellaneous isolated ground plane metal hardware and apparatus.

This connection replaces the ac distribution panel ACEG bar when a ground window is defined.

All grounding conductors connecting to SPG should be insulated copper conductors with 2-hole mounting lug terminals. All cables should be permanently marked or tagged to indicate opposite end terminal connection for the cable. Table N contains adequate power and grounding wire sizes for the TOPS MP system.

| GROUND CABLE | Distance to Single Point Ground | |
|---|---|---|
| | < 100 Feet | > 100 Feet |
| Misc. Bay Frame Ground | 1/0 AWG | 4/0 AWG |
| AAE/PCE Bay Frame Ground | 1/0 AWG | 4/0 AWG |
| AC Dist. Panel ACEG Bar | 4/0 AWG | 350 MCM |
| AC Isolation XFMR Sec. Grnd. | 4/0 AWG | 350 MCM |
| Furniture Cluster GND | 4/0 AWG | 350 MCM |
| Single-floor SPG to PGP | 750 MCM | 750 MCM |
| Multi-floor SPG to FGB | 750 MCM | 750 MCM |
| Positive SPG to dc Power Plant | 750 MCM | 750 MCM |
| IGP Storage Cabinet | 1/0 AWG | 4/0 AWG |

**Table N** TOPS MP Wire Sizes

**Ground window** A ground window is a spherical volume, approximately 3 feet in radius which contains a main ground bar (MGB). The MGB is a copper bar that provides SPG termination for the isolated ground system serves. There can be only one ground window associated with the main power source serving the isolated ground plane, and it must be within one floor of the IGP.

When ac power is provided for the isolated ground plane, the conduit containing the load circuit must pass through the ground window. The conduit and green-wire grounding conductors normally terminate at a junction box within the ground window. They are grounded intentionally to the MGB using No. 6 AWG cable or larger. All circuit green-wire grounds terminate at the ACE ground bar in this junction box or at the ac distribution panel. The ac neutral is not connected to the ground window.

**Multi-floor installations** The one floor rule applies in a multi-floor installation. This rule states that the SPG or ground window cannot be more than one floor from the isolated ground planet it serves. The main dc power plant can be more than one floor away from the SPG, but the positive battery discharge bus must be grounded at the SPG.

- standard configuration with SPG and vertical riser
- ground window configuration with SPG and vertical riser
- maximum separation of MP operator position and equipment

The SPG main grounding cable connects to the floor ground bar on the same floor, rather than directly to the PGP. The floor ground bar in turn is bonded to the building vertical riser originating at the PGP. The vertical riser must

be an insulated 750 MCM copper conductor. The vertical riser must be continuous, with no series mechanical taps or splices.

The MGB connects to the FGB using a standard configuration with SPG and vertical riser. However, a ground window configuration will have all conduit and green-wire ground conductors passing through the ground window before distribution to MP equipment. In this configuration, the conduit must be isolated from contact with incidental ground after leaving the window.

In some instances, the operator position can be remotely located from associated TOPS MP equipment. The maximum remote distance which is allowed for this configuration is 1000 cable feet in the same building.

When operator positions are 1000 cable feet away, in a vertical direction, the SPG one floor rule is violated. When this occurs, a second separately derived ac power source and SPG are required on an adjacent floor or on the same floor as the operator positions. This separates ac power from the ac power required by CBT equipment. It can be obtained from dedicated ac power assigned for the TOPS MP system via an isolation transformer, as described in this section. The second SPG is used specifically for MP operator positions and their ac power source.

The second SPG must be connected to the same PGP as the existing SPG. All the requirements for ac power and grounding described in this document must be observed.

When operator positions are 1000 feet away, in a horizontal direction on the same floor or on an adjacent floor, a similar arrangement can be used. For this configuration, a second SPG and a separately derived ac power source are required at the same locations or within one floor as MP operator positions.

### Electrostatic discharge and personnal hazards

The TOPS MP operator positions are susceptible to personal hazards arising from electrostatic discharge (ESD) and different ground references. Every reasonable precaution should be taken to minimize these hazards for maintenance personnel, the operator, and the equipment.

**Shielding and isolation** Three precautions should be taken at the operator positions.

- All ac power should be derived from dedicated ac power provided by the twist-lock and/or color-coded receptacles.
- No ac-powered equipment with an exposed metal chassis should be within 7 feet of the operator position.
- Equipment or metallic hardware located less that 7 feet from the operator position should be isolated from contact by an insulating screen or barrier.

**Grounding integrity** All ac-powered equipment typically provided at the Operator position is green-wire grounded back to the SPG and plastic encased.

Northern Telecom furniture has all metallic members and panels internally grounded and brought to a ground stud. This stud is grounded intentionally to SPG. The top working surface is a conductive ESD surface, which is grounded internally and should not be used as an isolated or insulating surface. This furniture also is designed for isolation pads and mounting bushings to maintain isolation from incidental grounds, in accordance with IGP requirements.

Any partition dividers or furniture with a metallic structure, or components provided by the operating company, should have provisions to connect grounding cables from these partitions and furniture to SPG.

**ESD floor coverings** Properly installed ESD vinyl or carpet floor coverings are recommended for use in the operator position area. An ESD ground mat at each operator position can be used instead of an ESD floor. Ordinary floor wax should not be used on ESD vinyl flooring. Refer to manufacturer recommendations for care of the flooring.

Only carpeting intended for ESD control which 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. Normal carpeting can cause excessive build-up of electrostatic charge. Anti-static carpet sprays are not dependable, need frequent replenishing, and can damage plastic surfaces and finishes of equipment in the operator area.

## TOPS 04 power and grounding

The ac and dc power facilities are the responsibility of the operating company, unless there is an agreement with Northern Telecom Inc. Nominal dc voltage is required to operate a dc-powered TOPS 04 is -48 Vdc. This voltage may be obtained from a dedicated TOPS power source or from a source that also serves other equipment. The TUTOR-3B training adapter

requires ac power at a nominal 115 Vac, 60 Hz. This ac power may be obtained from the commercial building power main. Copper cable is recommended for all power feeds.

Grounding for the TOPS 04 system is based on SPG applied to each cluster of operator positions. Data communication between operator positions and central office switch facilities use an isolated interface.

## DC power facility

Voltage limits, noise limits, and power distribution for the TOPS 04 system are described in the following paragraphs.

### Voltage limits

To ensure adequate system performance, dc voltage measured at the MAP must range between -42 Vdc and -56 Vdc.

### Noise limits

Noise levels measured at the dc voltage input for TOPS 04 operator positions must not exceed 55 dBrnc in the bridging position and 100 mVrms in any 3kHz band between 10 kHz and 20MHz.

Step voltage changes on dc voltage input at the TOPS 04 operator positions must not exceed 5V in magnitude, at a rate of change of 1V/ms. Faster rates of change can be tolerated if the step voltage magnitude is less than 5V. The product of magnitude and rate of change must not exceed 5 $V_2$/ms.

### Power distribution

Most clusters of TOPS 04 operator positions are powered from dc facilities which also power other equipment. Figure 10-7 illustrates a TOPS 04 operator position cluster, which should be powered from a local distribution panel. A local distribution panel provides three benefits.

- bulk distribution from the dc source to the TOPS 04 operator position area
- controlled ground referencing for all positions and power feeds
- individual feeder overcurrent protection local to the TOPS 04 operator positions.

Every battery feeder for TOPS 04 positions must be accompanied by, and in close proximity to, a return feeder with equal current-carrying capabilities. The feeder size must ensure that input voltage remains within the specified limits, even under the worst voltage drop conditions. The maximum current drain by a TOPS 04 operator position is 1.0A at -42 Vdc. Typically, No. 14 AWG cable is sufficient to power each operator position from the local distribution panel.

To determine cable sizes, voltage drops, or conductor lengths:

$$CM = \frac{11.1 \times I \times L}{\text{Allowable Voltage Drop}}$$

Where:

CM the conductor cross-sectional area in circular mils

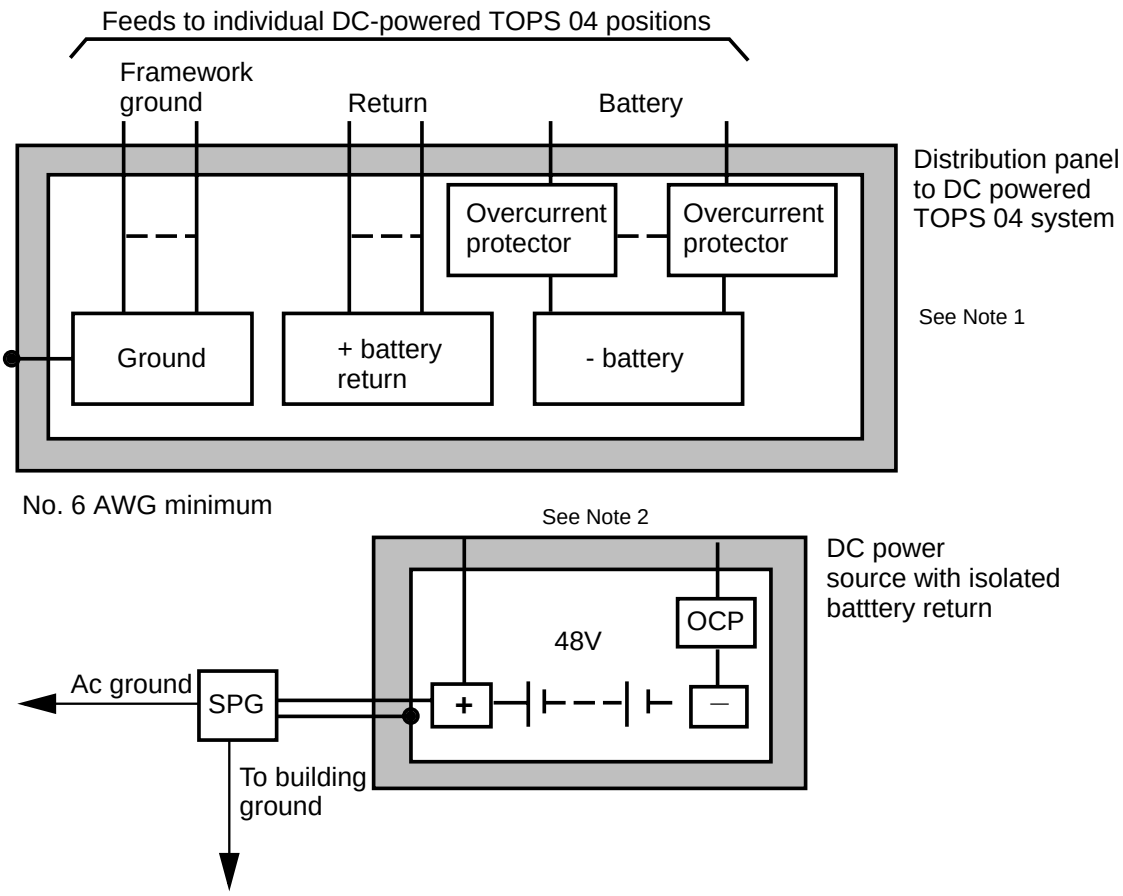
11.1 the resistivity, ohms - CM/ft, of hard-drawn copper, per ASTM Standard B173

I the maximum load current in amperes

L the conductor loop length in feet

The current rating of any fuse used for the feeds to TOPS 04 operator positions should be as close to 1.5 times the feeder full load as is practically possible and still adequately coordinate any other protective devices in the distribution. A maximum fuse size is recommended to prevent additional engineering in the event of office expansion.

**Figure 10-7** TOPS 04 Operator Position Cluster




***Note 1.*** Single feeder pair sized for voltage drop and current.

***Note 2***. Isolated from incidental ground.

## TOPS 04 ac power facility

The distribution of commercial 115 Vac, 60 Hz power for use on or near the TOPS 04 position is from customer-furnished ac distribution centers which have been installed in accordance with the applicable CSA, UL, or NEC specifications. This ac grounding is treated as part of position grounding for all TOPS positions, as described in this section.

The only requirement for ac facilities at TOPS 04 positions is the TUTOR-3B training adapter. A receptacle for this unit may be mounted in

the position, but should located where it is not readily available for general use, such as floor or vacuum cleaners.

## TOPS 04 grounding

The TOPS 04 system grounding ensures that all parts of a TOPS 04 operator position cluster, and any other equipment within reach of the cluster, are maintained at a common potential under all operational conditions. The SPG references all parts of a TOPS 04 operator position cluster, all surrounding equipment, and all power feeds to the same point on the building ground. Multiple connections to the building ground system, either deliberate or incidental, are prohibited.

Any conductive furniture that supports TOPS 04 equipment, such as metallic partitions or desks, must have all separate sections connected together and referenced to the TOPS position single point ground.

### Colocation with other equipment

If any equipment uses a different building ground than TOPS 04 operator position SPG, it must be at least 7 feet away from the TOPS position cluster. If the 7 foot distance cannot be met, strategically placed isolating screens must be provided to avoid possible contact by personnel between the TOPS positions and other equipment.

### AC ground referencing

All ac power-feeding equipment within 7 feet of the TOPS 04 area must be grounded to the TOPS 04 operator position SPG. This grounding is accomplished by referencing the green ac safety ground, as well as any metallic conduits enclosing the power feeds, to the TOPS position SPG. The ac equipment must also be isolated from any other ground.

### DC power and main ground interface

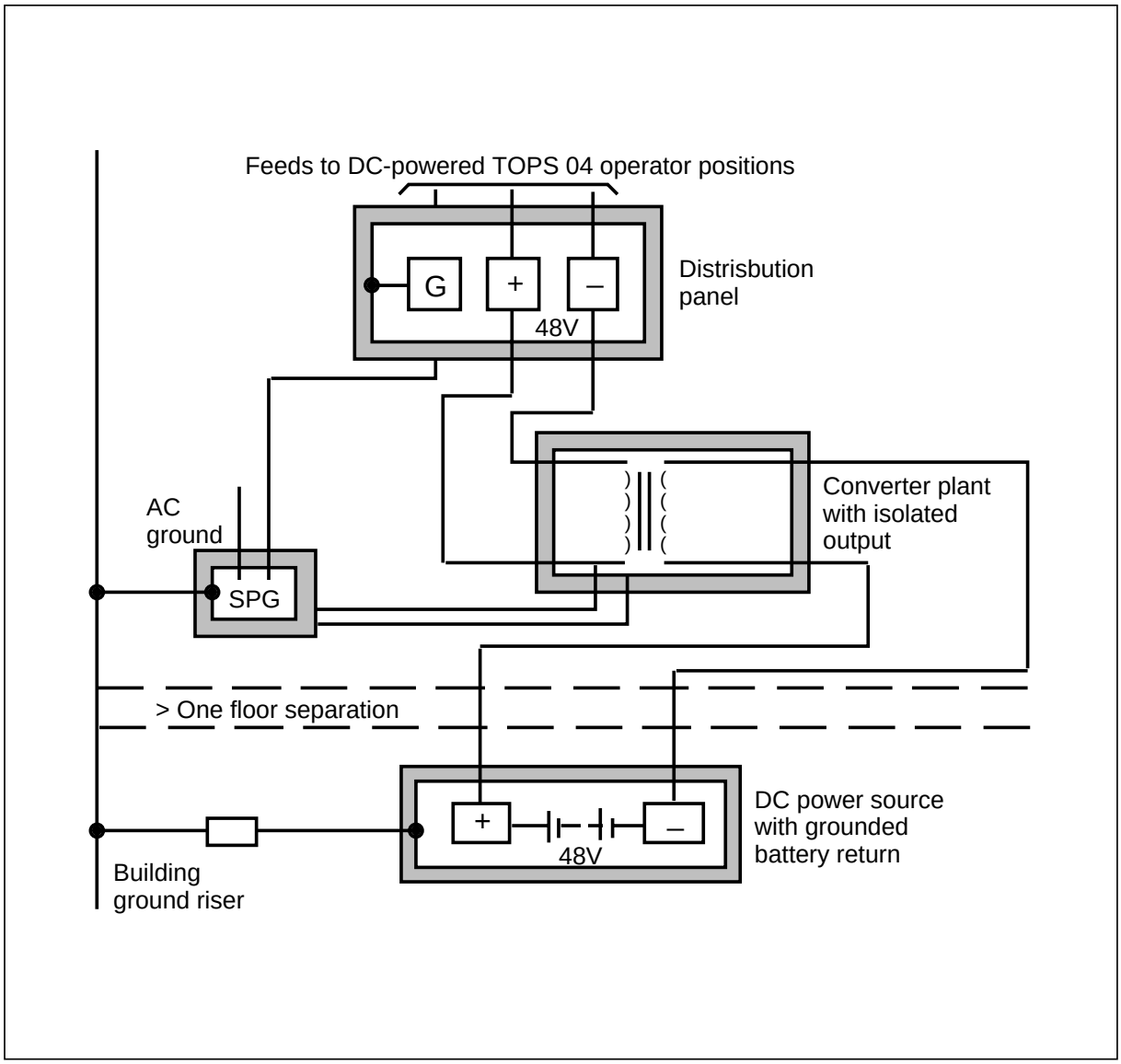
Where a dc power source is dedicated to the TOPS operator position cluster, the +48 V battery return must only be connected to the building ground system on the same floor as these positions. This connection point serves as the SPG for all ground references from the TOPS position cluster. Framework, cable racks, and battery stands associated with the dc power source must be locally grounded by one or more runs of No. 6 AWG cable, as required, at the floor where they are located. The vertical separation between the TOPS 04 operator position cluster and the power source is not limited to a specific number of floors for this configuration.

In nearly every case where existing facilities are used, the TOPS 04 operator positions are part of a tenant system fed from a power source which also feeds other systems. The power source typically has an existing connection to the building ground system, either directly or through one of the other tenants. If these positions are located within one floor of the point where the

power source is referenced to the building ground system, dc power can be obtained directly from the power source.

If the TOPS 04 operator positions are located more than one floor away from the point where the existing power source is referenced to the building ground system, dc power must not be obtained directly from the power source. A -48V dc-dc converter plant with isolated input/output is recommended for this configuration. Converter plant input is fed from the existing dc power source and must conform to any special grounding restrictions imposed by the power source. The converter plant feeds isolated dc power to the TOPS 04 operator positions, which is grounded to the same SPG as the TOPS 04 operator position cluster located within one floor of any dc-powered TOPS equipment. Figure 10-8 illustrates remote dc-powered TOPS 04 positions.

**Figure 10-8** Remote DC-powered TOPS 04 Positions



# Operator training

Operator training for the TOPS systems utilizes two types of computer-controlled call simulators to instruct operators in their work environment. Computer-assisted instruction (CAI) provides training to any operator at a TOPS MP workstation. The TUTOR-3B training adapter simulates call handling at a TOPS 04 operator position. The CAI system also tracks students' progression through each training module, while recording average work time (AWT) scores. Both training systems are described in this section.

## TOPS MP computer-assisted instruction

The TOPS MP CAI system simulates toll and assistance operator traffic by presenting calls to each operator at their workstation. This capability makes it possible for any TOPS MP workstation to function as a training position whenever training is required. An overview of the TOPS MP CAI system is illustrated in Figure 11-1.

The TOPS MP training system interfaces with the TOPS position controller (TPC) to support up to 16 operator positions at a time. Call voice and call data are stored on a hard disk where the data is processed for presentation at the workstation. TOPS MP screen updates are synchronized with the call voice to provide a realistic scenario of an operator-subscriber interface.

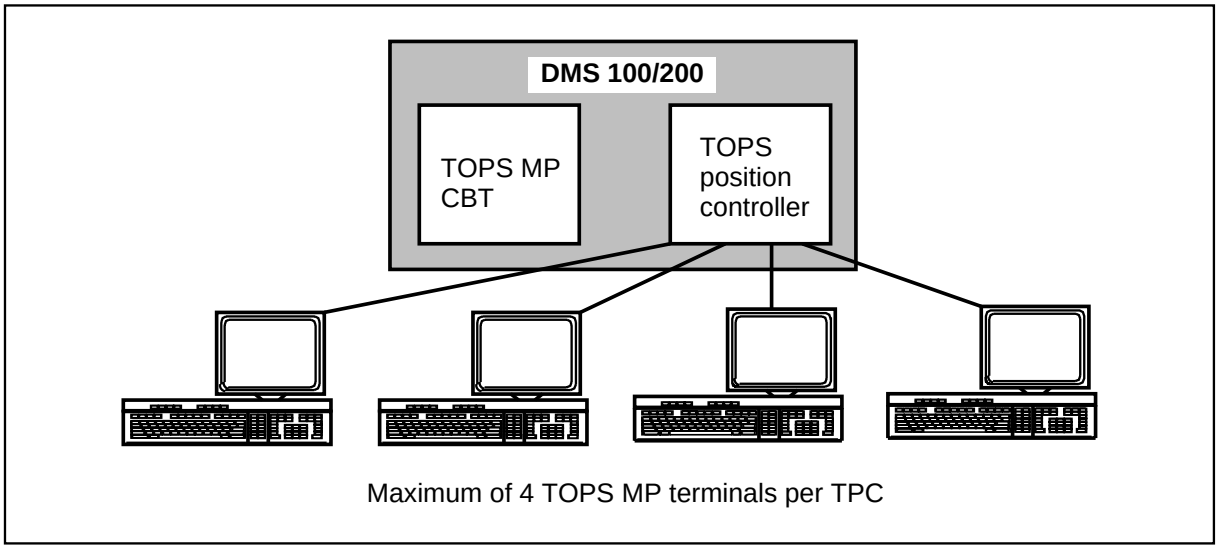
This CAI software interface integrates the function of the CAI system with TOPS MP keying sequences input from the TOPS MP keyboard. It also allows the operator to translate TOPS keystrokes which are recognized by the CAI system. Only operator positions which are datafilled in the TPC as toll and assist positions can use this training mode.

One CAI unit can serve a maximum of four TPCs. Each TPC can reside in the same or different PCE cabinets. The maximum cabling distance between the CAI and the PCE cabinet is 50 feet.

The ac-powered TOPS MP CAI equipment is mounted in a self-contained frame. To install and power-up the TOPS MP CBT system, ensure that only ac power, which is referenced to the single point ground (SPG) PCE bay with a straight-blade receptacle, is used with a flexible cord. This ac power source is color-coded with a CAUTION label to restrict use. Additionally, the

equipment frame must be isolated from its mounting and incidental group. The equipment frame is intentionally grounded with a 1/0 AWG insulated cable, from the ground stud on the equipment, to SPG.

**Figure 11-1** Computer-Assisted Instruction System Overview




## TOPS 04 TUTOR-3B

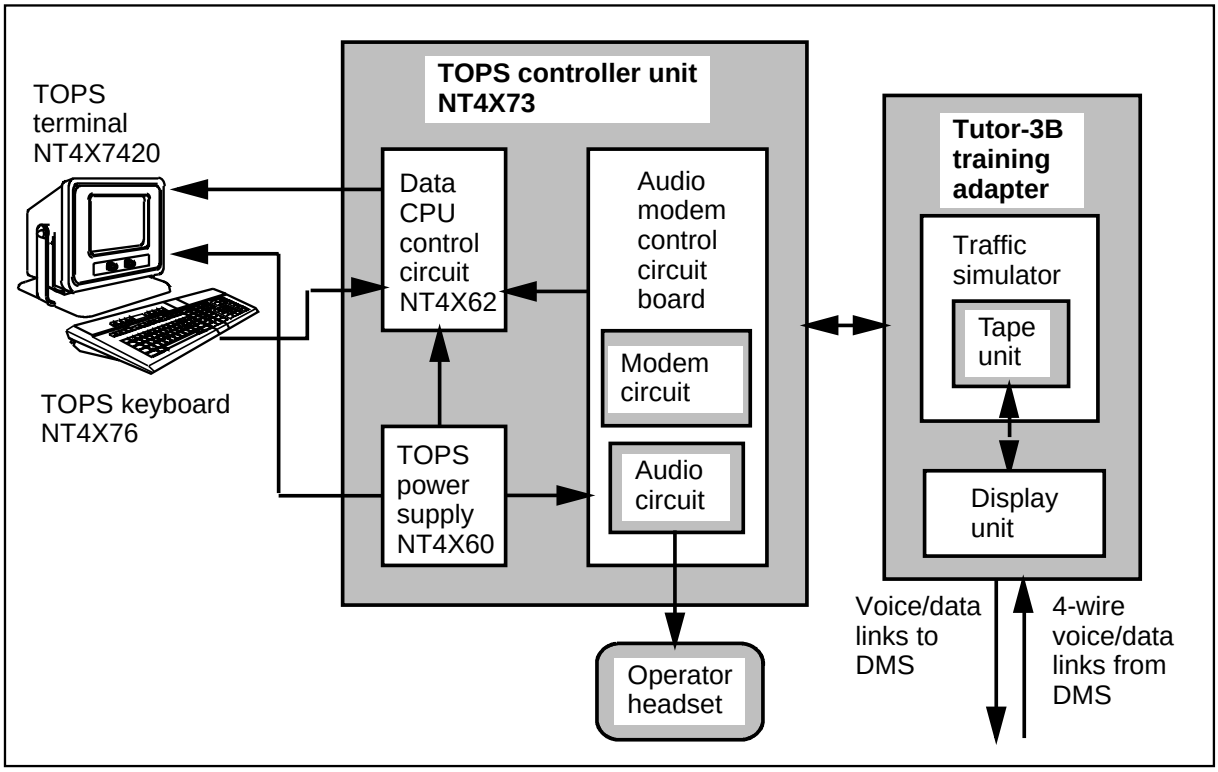
Operator training for the TOPS 04 system is delivered via a TUTOR-3B training adapter which records and totals the incidence of incorrect keystrokes entered by an operator. The training adapter is a microprocessor-controlled TOPS simulator with a built-in casette tape playback system. Prerecorded tapes provide complete simulation of call handling situations any operator may encounter. This training system includes screen displays and audible signals typically generated by a TOPS system, as well as verbal responses from the subscriber.

Any operator position can be converted to a training position by plugging in a TUTOR-3B training adapter. The operator position automatically disconnects from the TOPS system when TUTOR-3B is connected. The TUTOR-3B simulator provides traffic simulation which is independent of the DMS switch.

### TUTOR-3B adapter

The TUTOR-3B training adapter includes the TOPS 04 position, a cassette tape unit and a traffic simulator. In the TUTOR-3B mode, the TOPS 04 position operates as an input/output (IO) device which displays the progress of the trainee. The cassette tape provides audio to the headset while data from the TUTOR-3B CPU appears on the position screen. A block diagram of TUTOR-3B is illustrated in Figure 11-2.

**Figure 11-2** TUTOR-3B Adapter Interface

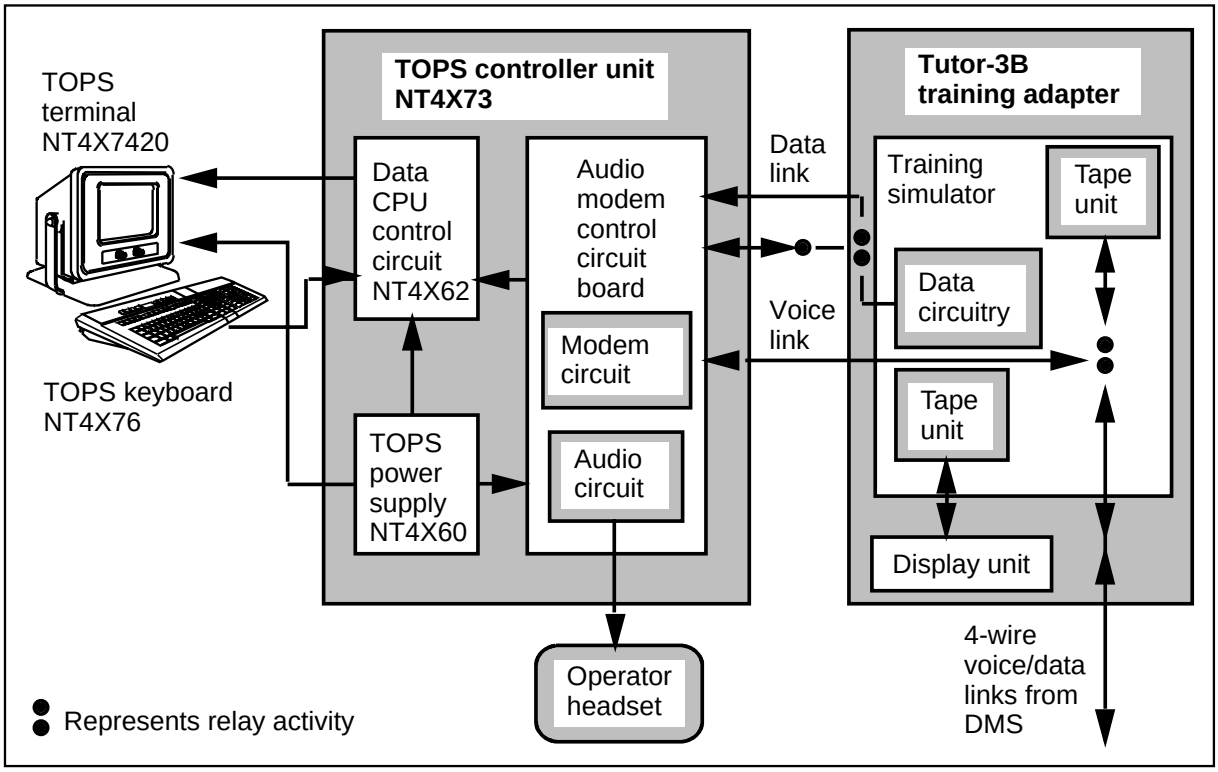



The TUTOR-3B communicates with the TOPS 04 position by one set of voice and data links. The TUTOR-3B traffic simulator also connects to 4-wire voice and datalinks from the switch. The power switch on the TUTOR-3B faceplate permits switching of the TOPS 04 between training and customer interface modes.

## Training and customer interface modes

To switch between the training and customer interface modes, TUTOR-3B opens or closes voice and data paths between the TOPS 04 position and the DMS. When TUTOR-3B is off, the TOPS 04 position is in communication with the DMS. When TUTOR-3B power is on, voice and data paths between the DMS and TOPS 04 position are open and communication between this training simulator and the TOPS 04 position is established. Voice and data paths between TUTOR-3B and the TOPS 04 position are illustrated in Figure 11-3.

**Figure 11-3** TUTOR-3B V oice and Data Paths




## Voice path

When TUTOR-3B is off, 4-wire voice signals from the switch pass uninterrupted through relays from the TUTOR-3B to the TOPS 04 console. When the TUTOR-3B is on, these relays open the voice path between TOPS 04 and the DMS switch. Voice signals are then exchanged between TUTOR-3B voice circuitry and the TOPS 04 position.

## Data path

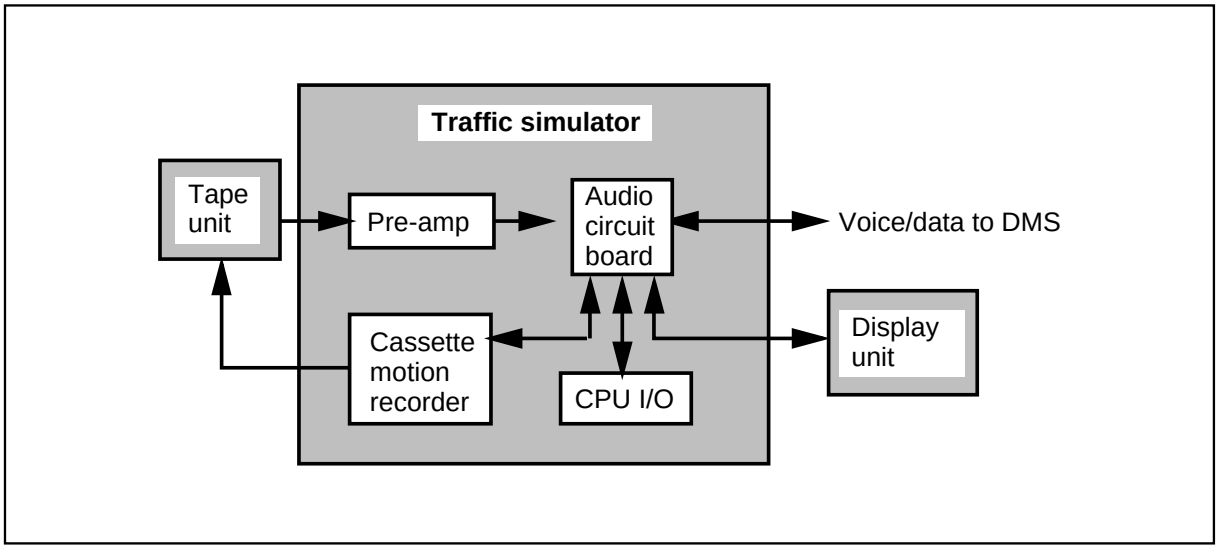
When the TUTOR-3B is off, data signals from the switch pass through TUTOR-3B to the modem in the TOPS 04 controller. After they are converted to RS232 Electronic Industry Association (EIA) signals in the modem, the signals are looped back through the relays in TUTOR-3B to the central processing unit (CPU) in the TOPS 04 console. When the TUTOR-3B is on, the relay opens the EIA data path between the modem and CPU circuitry. Data signals are then exchanged between TUTOR-3B data circuitry and TOPS 04 CPU circuitry.

## Traffic similator

The traffic simulator provides circuitry necessary for simulating call handling situations an operator is likely to encounter. The traffic simulator, which is used in conjunction with a cassette tape and a display unit, provides a realistic call handling environment for the operator trainee.

Components that reside in the traffic simulator are described in the following paragraphs. Figure 11-4 illustrates a block diagram of the traffic simulator.

**Figure 11-4** Traffic Simulator Block Diagram




**Preamplifier circuit board** Both voice and data signals are sent to a pre-amplifier (PRE-AMP) circuit board for amplification. These voice and data signals are amplified to compensate for the frequency response of the cassette tape heads. Voice signals are amplified to 70dB. Data signals are amplified to 50dB.

**Audio circuit board** The audio circuit board is the central interface and buffer for voice, data, status and control signals. The circuit board performs six additional functions.

- Passes voice signals from PRE-AMP to the TOPS 04 console headset. The circuit board also adds an error tone to the voice signal when the operator trainee response is incorrect. This error tone is added to a signal from the CPU I/O circuit board.
- Detects operator trainee speech received from the TOPS 04 console headset.
- Processes data signals from the PRE-AMP. Cassette data signals from the PRE-AMP are received as FSK signals. These FSK signals are converted to transistor-transistor-logic (TTL) signals before transmission to the CPU I/O circuit board.
- Processes data signals to the TOPS console. The audio circuit board receives TTL data signals from the CPU I/O circuit board. These signals are converted to an EIA format before being passed to the TOPS console.

- Provides tape motion control arbitration. Receives fast forward, play, rewind, and stop signals from the CPU I/O circuit board and switches on the display unit and training simulator. Tape motion control arbitration circuitry buffers voice and data signals and sends them, one at a time, to tape motion control.
- Exchange status and control signals among three circuit boards.
  - CPU I/O
  - cassette-motion controller
  - display unit

**Cassette-motion controller board** The cassette-motion controller board is responsible for six functions.

- Status of cassette-in-place and clear-leader/oxide detection to audio circuit board
- Forward and reverse tape motor drive
- Improper tape motion operating condition sensing
- Reel braking on a stop or end-of-tape signal initiation
- Boost for rewind and fast forward, which drives the rewind motor backward in fast-forward mode and forward-motor backward in rewind mode
- Forward take-up delay to ensure read head-of-tape unit is in place, the and tape pinch roller has engaged capstan drive spindle before forward take-up reel is activated

**CPU I/O circuit board** The CPU I/O circuit board is the central controller for the TOPS 04 TUTOR-3B. This board interfaces with the audio control circuit board to receive status and control signals from four sources.

- Display unit
- Cassette tape drive
- TOPS 04 keyboard
- Cassette-motion controller circuit board

The CPU uses voice and data signals to provide five functions.

- Control tape motion
- Format TOPS 04 screen
- Control output of display unit
- Insert error tone to the outgoing voice path
- Determine expected keyboard and/or voice response

### Display unit

The display unit is the primary interface between the operator trainee, or supervisor, and the TOPS 04 TUTOR-3B traffic simulator. The display unit contains a set of switches and a set of light emitting diodes (LEDs). The switches control tape motion and output of the display unit. The LEDs indicate the progress of the present training session. Switches control tape motion and output of the operator screen. The LED displays when the tape can be advanced or tape motion is in manual mode.

The display unit is driven by signals from the CPU I/O circuit board. All signals to and from the display unit pass through the audio circuit board. Because the switches on the display unit are in series with the switches on the training simulator, the TOPS 04 TUTOR-3B cannot operate unless the display unit is connected. The display unit contains three circuits.

- Seven-segment LEDs which display the elapsed time of current training session clock, total incorrect calls and the present simulation call number.
- Indicator LEDs which display calls when trainee makes an error, the call-processed-incorrectly signal and play, fast forward, reverse and stop.
- Control switches which control tape motion, the display unit output mode, and the automated and manual tape advance modes.

### Tape unit

The tape unit reads TUTOR-3B coursework data from a C-60, 2-track Phillips' cassette. One track carries voice signals. The other track carries CPU data. Because both cassette tape tracks are used, the tape unit can be played only in one direction.

The TOPS 04 TUTOR-3B tape unit is the Phi-Technologies Opto-Tach Deck Model 5-087 which operates remotely via the motion control circuit board. Remote control is accomplished by providing power to the appropriate motor when training occurs. There are five major circuits in the tape unit.

- Forward and reverse reel-drive using unregulated dc motors for fast-forward and reverse modes which operate on power supplied by the motion control board.
- A capstan drive opto-track deck using an unregulated dc motor in the play mode to regulate tape speed, via an optical sensor for feedback to circuitry on the motion control board.
- Beginning-of-tape and end-of-tape sensors generating signals by a lamp and photocell circuit, which detects the clear leader at the beginning and the end of the tape.
- Two-channel, two-track read head which reads voice and data signals on the cassette tape played in one direction.

### Cassette tape

All TOPS 04 TUTOR-3B coursework is programmed on a standard C-60 Phillips' cassette in a two-channel two-track format. There is one track for voice and one track for data. Both the beginning and end of the tape consist of a clear leader which is detected by the photocell and lamp circuit of the cassette unit. The cassette tape format is illustrated in Figure 11-5.

A 40-second reference tone is provided on each master to ensure a proper recording level on the duplicate tapes. Cassette data signals are recorded as FSK tones. Both transmitted and received data are exchanged using one of four bit protocols.

- one start bit
- one stop bit
- one parity bit
- seven data bits for each ASCII character

### Power requirements

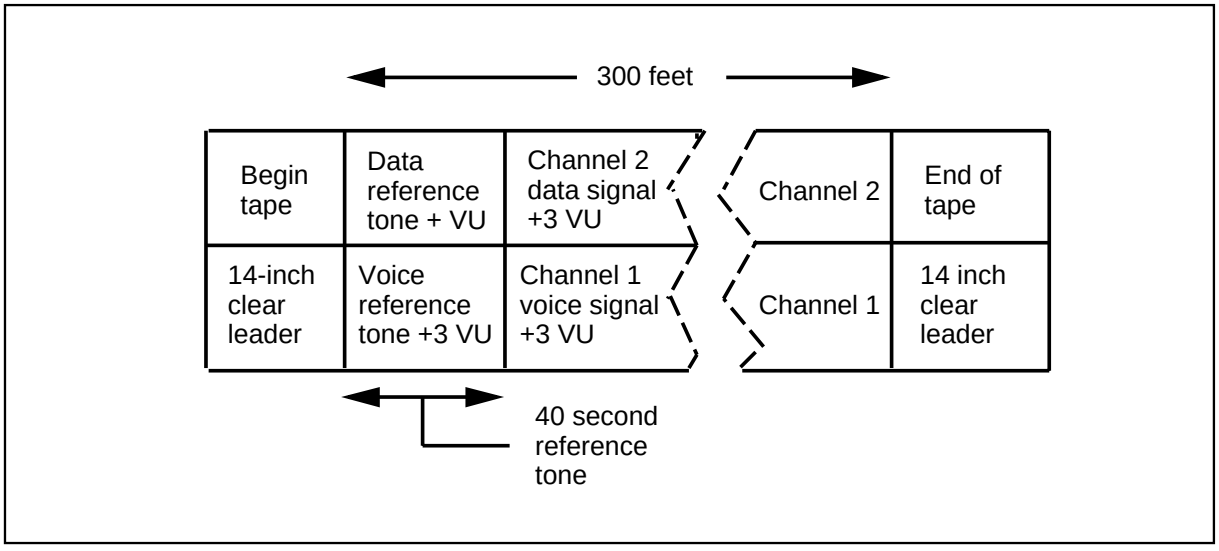
The TOPS 04 TUTOR-3B power supply produces +5, +12, and -12 Vdc for all circuit boards. The power source uses a standard 120 Vac/60 Hz electrical outlet. Power wiring is shielded and filtered to reduce transient noise. Power requirements for the TOPS 04 system are listed here.

| | | | |
|---|---|---|---|
| Voltage point | +5Vdc | +12Vdc | -12Vdc |
| Typical current | 2.5A | 550mA | 135mA |
| Input voltage | 115 Vac at 60 Hz | | |
| Typical current | 0.6A rms | | |
| Reel-drive dc motor nominal voltage | 8Vdc | | |
| Reel-drive dc motor nominal current | 500mA | | |

## Environmental considerations

The TOPS 04 TUTOR-3B is designed to operate within a temperature range of 10 to 30 degrees C and a humidity range of 20 to 50 percent. For short periods, the TUTOR-3B can operate in the range of 5 to 59 degrees C and a humidity range of 20 to 80 percent. Temperature and humidity extremes are 80 percent humidity at 21 degrees C, and 30 percent humidity at 49 degrees C.

**Figure 11-5** Cassette Tape Format



# List of terms

**A**

| | |
|---|---|
| AAE | Auxiliary Access Equipment |
| AABS | Automated Alternate Billing Service |
| AATCC | American Association of Textiles, Chemists, and Colorists |
| ABD | Average Busy Days |
| ABS | Average Busy Season |
| A/C | Attendant Console |
| ACD | Alarm Control and Display |
| | Automatic Call Distribution |
| ACTS | Automatic Coin Toll Service |
| AGC | Automatic Gain Control |
| ALT | Automatic Coin Testing |
| AMA | Automatic Message Accounting |
| AMAB | Automatic Message Accounting Billing |
| ANI | Automatic Number Identification |
| ANIF | Automatic Number Identification Fail |
| ANS | Answer Time |
| AOP | Average Occupied Positions |
| AOSS | Auxiliary Operator Service System |
| AQ | Autoquote |

| | |
|---|---|
| ASCII | American Standard Code for Information Interchange |
| ACSC | Alarm Sending and Checking System |
| AST | Activity Switch Timer |
| AT | Access Tandem |
| ATT | Automatic Trunk Testing |
| AUT COL | Automatic Collect |
| AWT | Average Work Time |
| AXU | Alarm Crosspoint Unit |

**B**

| | |
|---|---|
| BCS | Batch Change Supplement |
| BEL | Bell |
| BLV | Busy Line Verification |
| BNS | Billed Number Screening |
| BOI | Blind Operator Interface |
| BVC | Billing Validation Center |

**C**

| | |
|---|---|
| CA | Call Attempt |
| CAMA | Centralized Automatic Message Accounting |
| CBT | Computer-Based Training |
| CC | Central Control |
| CCB | Call Condense Blocks |
| CCC | Central Control |
| CCF | Custom Calling Feature |
| CCIS | Common Channel Interoffice Signaling |
| CCIS6 | Common Channel Interoffice Signaling 6 |
| CCS | Centrum Call Seconds |

| | |
|---|---|
| CCV | Calling Card Validation |
| CD | Call Deflect |
| CDC | Coin Detection Circuits |
| CDO | Community Dial Office |
| CI | Command Interpreter |
| CMC | Central Message Controller |
| CODEC | Code Decoder |
| CPS | Call Processing Software |
| CPU | Central Processing Unit |
| CRT | Cathode Ray Tub |
| CSM | Channel Supervision Message |
| CT | Call Transfer |
| | Controlled Traffic |
| CTRU | Central TOPS Recording Unit |
| CW | Call Waiting |

**D**

| | |
|---|---|
| D/A | Digital/Analog |
| DCM | Digital Carrier Module |
| DTD | Digital Tone Detectors |
| DE-3/4 | |
| DIP | Dual Online Package |
| DMA | Display A Phase Header |
| DMB | Display Phase B Header |
| DMS | Digital Multiplex System |
| DNI | Digital Network Interconnect Frame |
| DP | Dial Pulse |

| | |
|---|---|
| DPO | Dial Pulse Originating |
| DPT | Dial Pulse Terminating |
| DRAM | Digital Recording Announcement Machine |
| DS-1 | |
| DTA | Digital Trunk Array |
| DTE | Digital Trunk Equipment |
| DTC | Digital Trunk Controller |
| DTMF | Dual-Tone Multifrequency |

**E**

| | |
|---|---|
| EA | Equal Access |
| EAABS | Exchange Access Alternate Billing Service |
| EABS | Exchange Alternate Billing Service |
| EAAB | Exchange Access Alternate Billing Service |
| EAEO | Equal Access Exchange Office |
| EIA | Electronic Industry Association |
| EKO | Echo |
| EMA | Erase Static/Flashing Header |
| EMI | Electromagnetic Interface |
| ESD | Electrostatic Discharge |
| ESP | Essential Service Protection |

**F**

| | |
|---|---|
| FADS | Force Administration Data System |
| FDHP | Full Duplex Handshaking Protocol |
| FDL | Facility Data Link |
| FGB | Floor Ground Bar |
| FGC | Feature Group C |

| | |
|---|---|
| FGD | Feature Group D |
| FIFO | First In/First Out |
| FM | Force Manager |
| FMA | Display A Flashing Header |
| FMC | Force Management Center |
| FSK | Frequency Shift Keying |
| FSP | Frame Supervisory Panel |
| FXO | Foreign Exchange Office |
| FXS | Foreign Exchange Subscriber |

**G**

| | |
|---|---|
| GOS | Grade Of Service |
| GWB | Ground Window Bar |

**H**

| | |
|---|---|
| HADS | Hotel Administration Data System |
| HDBH | High Day Busy Hour |
| HOBIC | Hotel Billing Information Center |
| HSDA | High-Speed Data Access |
| HSLI | High-Speed Line Interface |

**I**

| | |
|---|---|
| IAT | Interactive |
| IC | Inter-exchange Carrier |
| | InterLATA Carriers |
| ICI | Incoming Call Identification |
| I/O | Input/Output |
| IOC | Input/Output Controller |
| IGP | Isolated Ground Plane |
| IPML | Inter-Peripheral Message Link |

| | | |
|---|---|---|
| | IPS | Initial Position Seizure |
| **K** | | |
| | KSR | Keyboard Send Receive |
| **L** | | |
| | LATA | Local Access and Transport Areas |
| | LBR | Large Business Remote |
| | LCA | Line Concentrating Array |
| | LCC | Link Control Card |
| | LCL | Line Erase |
| | LCM | Line Concentrating Module |
| | LCV | Line Clear |
| | LED | Light Emitting Diodes |
| | LGC | Line Group Controller |
| | LLC | Line Load Control |
| | LMC | Line Module Controller |
| | LMS | Local Measured Service |
| | LTC | Line Test Center |
| | | Line Trunk Controller |
| | LTP | Line Test Position |
| **M** | | |
| | MADN | Multiple Appearance Directory Number |
| | MAZ | Maze Routing |
| | MAP | Maintenance and Administration Position |
| | MCA | Multiple Call Arrangement |
| | MCCS | Mechanized Calling Card Service |
| | MDC | MERIDIAN Digital Centrex |
| | MF | Multifrequency |

| | |
|---|---|
| MFADS | Mechanized Force Administration Data System |
| MGB | Main Ground Bar |
| MLHG | Multi Line Hunt Group |
| MMI | Man-Machine Interface |
| MP | Multipurpose |
| MSB | Message Switch and Buffer |
| MSN | MERIDIAN Switched Network |
| MTM | Maintenance Trunk Module |
| MTX | Mobile Telephone Exchange |
| MUMR | Multi Unit Message Rate |

**N**

| | |
|---|---|
| NC | Network Crosspoint |
| NCOS | Network Class-of-Service |
| NM | Network Module |
| NMC | Network Message Controller |
| NOP | Network Operating Protocol |
| NOS | Network Operations System |
| NOTIS | Network Operation Trunking Information System |
| NPA | Number Plan Area |
| NRS | Network Resources Selector |
| NTP | Northern Telecom Practice |
| NUC | Nailed-Up Connection |

**O**

| | |
|---|---|
| OA | Operator Assisted |
| OASMIV | Operator-Assisted Manual Inward Validation |
| OAU | Office Alarm Unit |

| | | |
|---|---|---|
| | OC | Operator Centralization |
| | OGT | Outgoing Trunk |
| | OM | Operational Measurement |
| | ONI | Operator Number Identification |
| | OPM | Outside Plant Module |
| | OSS | Operator Services Signaling |
| **P** | | |
| | PAMS | Preselected Alternate Master/Slave |
| | PCE | Position Controller Equipment |
| | PCM | Pulse Code Modulation |
| | PDC | Power Distribution Center |
| | PDP | Power Distribution Panel |
| | PGP | Principal Ground Point |
| | PIN | Personal Identification Number |
| | PIO | Parallel Input Output |
| | PM | Peripheral Module |
| | POF | Pending Order File |
| | POP | Performance Oriented Practice |
| | POS RLS | Position Release |
| | POTS | Plain Old Telephone Service |
| | PTN | Pattern Generator |
| | PTX | Page Erase |
| **Q** | | |
| | QRY | Query |
| **R** | | |
| | RAM | Random Access Memory |
| | RCA | Remote Control Array |

| | |
|---|---|
| REC | Receive |
| RLC | Remote Line Controller |
| RLCM | Remote Line Concentrating Module |
| RLM | Remote Line Module |
| RLP | Loop Around |
| RMM | Remote Maintenance Module |
| RONI | Remote Operator Number Identification |
| RSC | Remote Switching Center |
| RSM | Remote Service Module |
| RTEST | Remote Test |
| RTS | Return to Service |
| RUL | Relay Unloop |

S

| | |
|---|---|
| SADS | Subscriber Carrier Array |
| SBC | Single-Board Computer |
| SCA | Single Call Arrangement |
| | Switching Carrier Array |
| SCC | Switching Control Center |
| SCM | Subscriber Carrier Module |
| SES | Service Evaluation System |
| SLC | Speech Link Connector |
| SDPO | Sleeve Dial Pulse Originating |
| SMDI | Station Message Desk Interface |
| SMDR | Station Message Detail Recording |
| SPG | Single Point Ground |
| SS7 | Signaling System No. 7 |

| | | |
|---|---|---|
| | ST | Start |
| | STA | Signaling Terminal Array |
| | STCM | Signaling Terminal Controller Module |
| | ST TMG | Start Timing |
| T | | |
| | TADS | Traffic Office Administration System |
| | TAMI | TPC Administration and Maintenance Interface |
| | TICS | TOPS InterLATA Carrier Service |
| | TM | Trunk Module |
| | TM8 | 8-Wire Trunk Module |
| | TME | Trunk Module Equipment |
| | TNN | Trunk Network Number |
| | TOPS | Traffic Operator Position System |
| | TPC | TOPS Position Controller |
| | TPVM | Telephony Peripheral Virtual Machine |
| | TRKGRP | Trunk Group |
| | TRU | TOPS Recording Unit |
| | TSB | Time Switch Broadcast |
| | TSPS | Traffic Separation Measurement System |
| | TTC | Trunk Test Center |
| | TTP | Trunk Test Position |
| | TTT | Transmission Test Trunk |
| | TTY | Teletypewriter |
| | TWOOT | Two-Way Operator Office Trunks |
| U | | |
| | UCD | Uniform Call Distribution |

| | | |
|---|---|---|
| | | Universal Call Distributor |
| | UL | Underwriter’s Laboratory |
| | UPS | Uninterupted Power Supply |
| | UTR | Universal Test Receiver |
| V | | |
| | VDU | Visual Display Unit |
| | VFG | Virtual Facility Group |
| | VQ | Voicequote |
| | VSN | Voice Service Node |
| W | | |
| | WV | Work Volume |
| X | | |
| | XMT | Microprocessor |

# Index

## Numbers



## A



## C

## D



## E



## F



## H



## I



## K



## M



## N



## O



## P

# R



# S



# T

# U



# V



# W

DMS-100 Family

# TOPS MP/04
# Technical Specification

Technical Specification



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