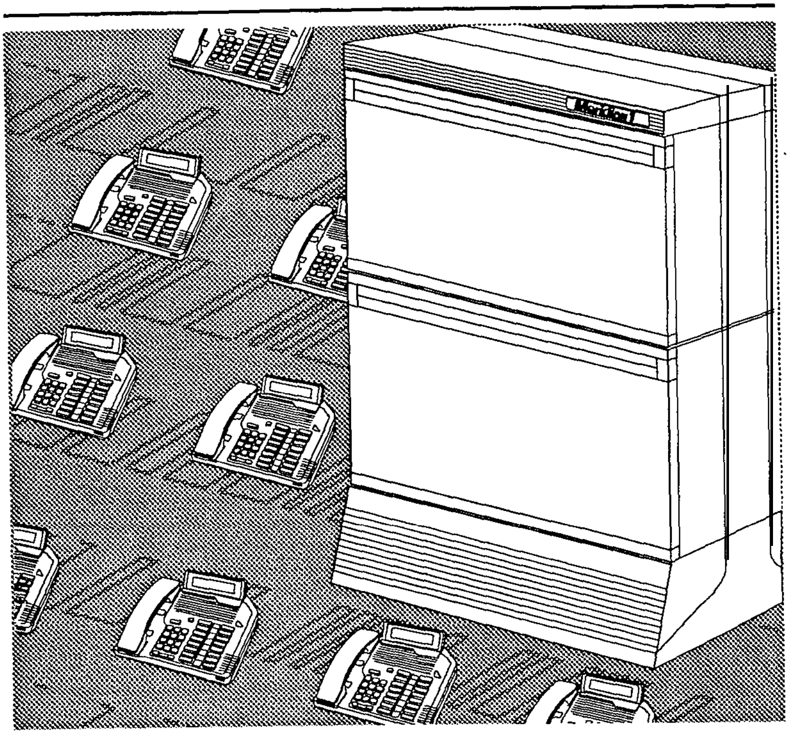
553-3001-100

SL-1

System options 21, 51, 61, 71

System overview

Standard



northern telecom

Meridian 1
Communication Systems

SL-1

System options 21, 51, 61, 71

System overview

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About this document

This document describes the features and services, hardware and software architecture, and the family of products that comprise Meridian 1.

References

See *the SL-I planning & engineering guide* for

- *Master index* (553-3001-000)
- *System overview* (553-3001-100)
- *Installation planning* (553-3001-120)
- *System engineering* (553-3001-151)
- *Power engineering* (553-3001-152)
- *Sparesplanning* (553-3001-153)
- *Equipment identification and ordering* (553-3001-154)

See the list of line and trunk circuit descriptions in *the Master index* (553-3001-000) for specific references to lines and trunks.

See the SL-1 installation and maintenance guide for

- *System installation procedures* (553-3001-210)
- *Circuit pack installation and testing* (553-3001-211)
- *Installation procedures for telephone sets and attendant consoles* (553-3001-215)
- *Extended systems installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-251)

- *General maintenance information* (553-3001-500)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

See the SL-1 XII software guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- *XII software management* (553-3001-300)
- *XII features and services* (553-3001-305)

See the SL-1 XII input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Contents

Meridian 1

Introduction

Meridian 1 Communication Systems are a family of digital multiplex voice and data switching systems built upon a foundation of state of the art digital switching equipment and advanced software program control. Meridian 1 systems provide a wide range of sophisticated voice and data services for both Private Branch Exchange (PBX) and Central Office (CO) applications ranging in size from 30 to 60,000 ports.

A Meridian 1 Communication System is a single source solution to the complex requirements of today's business communications environment. In a single, integrated system, it provides advanced voice features, local area network communications, and sophisticated information services. A comprehensive open architecture ensures continual growth in capacity and the capability to address the ongoing needs of business communications and information management.

The foundation for Meridian 1 Communication Systems is a voice and data circuit-switched digital sub-system. It is comprised of a central processing unit, memory store, and a digital switching network that uses time division multiplexing and pulse code modulation techniques. Peripheral interfaces are used to connect a wide array of telephones, trunks, and terminals.

Meridian 1 Communication Systems systems are also designed to accommodate the rapidly expanding requirements for data communications. Building upon the strength of the original SL-1 architecture, significant system enhancements have been developed for data communications, including:

Meridian Modular Telephones, a family of digital telephones that utilize standard twisted pair wiring and support a wide range of data communications options.

Meridian 1 LANSTAR, a 2.56 Mbps local area network (LAN) for Macintosh II and IBM PC compatible computers.

The Meridian 1 commitment

Northern Telecom is committed to meet the needs of our customers by providing systems which guarantee:

Continuing product compatibility

A high degree of component and system reliability

Cost effective, modular packaging

Advanced administration and maintenance capabilities

Ease of installation

Cost effective system expansion and upgrade

Product compatibility

All new products are compatible with the installed base of systems and can be installed alongside existing equipment. For network enhanced Meridian SL-1 systems, the upgrade consists of adding X11 release 15 software with a new CPU ROM pack, **Superloop** Network cards in existing network slots, and one or more Intelligent Peripheral Equipment Modules. For **non-network/CE** enhanced Meridian SL-1 systems, an upgrade package is also available. For more information about extending existing systems, see ***Extended systems installation*** (553-3001-250).

In addition, Meridian 1 systems now utilize the DS-30 signalling method used by other Northern Telecom switching products, providing a common signalling scheme throughout the Meridian 1 family and allowing for system growth beyond 10,000 ports without requiring a change in peripheral equipment.

System reliability

Meridian 1 systems are designed and built to meet the highest standards for reliability, resulting in less downtime and increased system availability. In most systems, critical system elements are duplicated to guarantee system reliability. There are two identical Central Processing Unit (CPU) and memory circuits in most system configurations, and both CPUs can access both memory circuits. If one CPU or memory circuit fails, the system automatically switches to the standby CPU or memory circuit without disrupting call processing.

Modular equipment packaging

Meridian 1 hardware is housed in modular equipment cabinets that are common to all system elements. These cabinets are called Universal Equipment Modules (UEM). Each UEM has removable front and rear covers with locking latches for easy access to its contents.

UEMs are stacked one on top of another to form a column. Each column may contain up to four UEMs. Systems are comprised of one or more columns. An Expansion Kit is provided to interconnect the columns in a multi-column system for compliance with FCC standards for EMI/RFI. At the base of each column of UEMs is the pedestal The pedestal houses cooling fans, air filters, a power distribution assembly (including the circuit breakers and power switches) and a System Monitor circuit. At the top of- each column is a Top Cap assembly which consists of two air exhaust grilles and a thermal sensor assembly.

Advanced administration & maintenance

An important feature common to all Meridian 1 systems is an advanced administration and maintenance system. Administration and maintenance functions can be performed locally or at a remote location. These functions include service change, reassignment of features, and additions or deletions of equipment. Meridian 1 systems also provide an automatic in-line conversion feature which significantly simplifies upgrades of Xl 1 software. Reconfiguration of system data structures occurs during system reload.

A System Monitor circuit card controls and monitors the status of all power-related hardware and functions, including column thermal status, power supply operation, blower operation, power fail transfer, circuit breakers, external rectifiers, batteries, and Uninterruptable Power Supply (UPS) systems. The same system monitor is used for AC and DC powered systems. A System Monitor is installed in the pedestal of each column. The System Monitor located in the column containing CPU0 acts as the master system monitor; monitors located in other columns act as slaves. The master polls the slaves and reports their status to the CPU. The master System Monitor is connected to the CPU by an RS232C port located on an SDI card. Slave System Monitors are connected to the master in a daisy chain fashion with an 8-conductor RJ type connector.

System messages reported to the CPU by the System Monitor are output to the system terminal. System messages include the following types of information: status or fault indication, hardware type, column number, module number and power supply unit number.

Maintenance and traffic messages are also output to the system terminal. Maintenance messages indicate the results of diagnostic routines and alert maintenance personnel to fault conditions. Traffic messages indicate the load on different areas of the system and the associated grade of service.,

Meridian 1 systems feature an advanced background diagnostic program which reports system status and identifies detected faults. The program automatically restarts where it stopped, following an interruption. Diagnostic routines may also be initiated by maintenance personnel as required.

A new series of circuit cards contain microprocessors which offload processing functions previously performed by the CPU. The on-board microprocessors significantly increase circuit card and system diagnostic capabilities, resulting in improved maintainability. Where possible, hardware switch selection has been replaced with software-controlled selection of circuit card options. The on-board microprocessors also allow for circuit card parameters to be changed without requiring hardware revisions. Parameters are stored on the system disk drive unit, and are downloaded to the circuit card at system reload or upon user command. The new cards also make use of on-board intelligence by reporting their product code, serial number, release number and manufacture location, assisting maintenance and inventory control.

Ease of installation

Every Meridian 1 system is shipped from the factory assembled and equipped to order. Installation effort is reduced to unpacking and positioning equipment, plugging in connectorized cables, ‘and adding customer-specific programming where required.

Ease of expansion

The modular packaging scheme employed by the Meridian 1 family of products accommodates growth by permitting easy expansion. System expansion simply requires adding one or more UEMs. The modular packaging scheme also provides for low cost, easy expansion from one system type to another. For example, the card cage assembly of a UEM containing CPU equipment for a small system may be removed and replaced with the CPU card cage assembly designed for larger systems. In addition, peripheral equipment, which is the bulk of the system investment, is common to all system types and may be retained when expanding.

Advanced features

By providing service capabilities defined by software, which can be expanded as needs evolve, Meridian 1 systems offer advanced features and capabilities in an economical, flexible, and maintainable form. In addition.- to a wide range of standard voice and data services, Meridian 1 systems also provide a number of sophisticated communications services and features, including:

- Automatic Call Distribution (ACD)
- Electronic Switched Network (ESN)
- Call Detail Recording (CDR)
- Integrated Services Digital Network (ISDN)
- Meridian Mail Voice Messaging

ACD

Automatic Call Distribution (ACD) is used when a large volume of incoming calls must be answered by a group of telephones allocated for this purpose. Incoming calls are served on a first-in, first-out basis and are distributed among the available telephones. For more information on ACD, refer to Northern Telecom Publication ***Automatic Call Distribution Basic features description*** (553-2671-100).

ESN

The Electronic Switched Network (ESN) group of features supports voice and circuit-switched voiceband data telecommunications for multiple-location customer applications. ESN applications range from a single network node (combined PBX and network switching system) to a widely-dispersed network with up to 256 locations. For more information about ESN, refer to the ESN Feature Document 6400-886 and to the following Northern Telecom Publications:

- ESN: 308-3001-100
- BARS/NARS: 553-2751-100, 553-2751-101
- CDP: 553-2751-102

CDR

Call Detail Recording (CDR) is a software package that gathers call processing data and produces call records used for accounting and administrative purposes. Call records provide information about the call, such as the time and date the call was placed, the identity of the caller, and the digits dialed. CDR is compatible with all Meridian 1 software generics. For more information, ***see Call Detail Recording general description*** (553-2631-100).

ISDN

Integrated Services Digital Network (ISDN) is an international specification of standards for digital communications. ISDN provides standard digital interfaces between telephones, terminals, and telecommunication networks. ISDN services are distinguished by two types of access: Primary Rate Access (PRA) and Basic Rate Access (BRA). For more information on PRA, ***see ISDN Primary Rate Access product description*** (553-2901-100).

Meridian Mail Voice Messaging

Meridian Mail is a comprehensive electronic voice processing system designed and developed to increase any organization's productivity by enhancing telecommunications activities. Meridian Mail provides a wide array of sophisticated features, including: telephone call answering, voice messaging, automated attendant service, call routing, information mailbox, and interactive voice response applications.

Meridian Mail voice messaging eliminates telephone tag and wasted calls by allowing detailed messages to be exchanged when parties are unavailable or busy. Guided by easy to follow prompts, a user can leave messages for others, retrieve messages, forward messages, and respond to messages with the touch of a single button.

System architecture

Meridian 1 modular architecture

An important characteristic of Meridian 1 systems is a modular system architecture. It utilizes an efficient and flexible approach, employing modular construction in all areas of hardware and software, and state-of-the-art commercial and custom components. The result is a system which is highly flexible in terms of operational, maintenance, and administrative characteristics. As demands dictate, any module may be enhanced, singularly or in combination with other modules. Each system is organized around three functional areas: Control, Switching, and Peripherals.

Control

The Control complex provides the sequences required by the system to process voice and data call connections, monitor call activity, and perform system administration, maintenance, and testing. It is composed of two elements: the central processing unit (CPU) which directs lower level subsystems in the hierarchy, and the system memory which stores the operating programs.

Switching

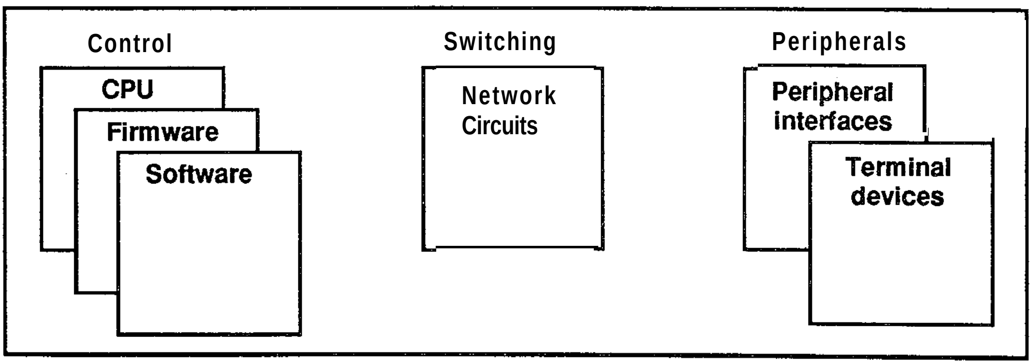
The switching function is performed by the network equipment, which interconnects terminal devices for communication with each other. The network architecture is based on the concept of a digital multiplexed loop. A loop is a bidirectional path between Network and terminal device which transmits voice, data and signalling information.

Peripherals

Peripheral equipment provides the analog and digital interfaces for all peripheral devices, and performs analog to digital conversion of all input signals before switching is performed by the Network. Additionally, Peripheral equipment circuits provide the supervisory and transmission functions needed for trunks connected to the external telecommunications network.

Meridian 1 systems use a star topology for connecting peripheral devices to the switching equipment, an approach which permits uniform distributed wiring methods. This approach provides significant benefits in the area of administration, installation, maintenance and reliability.

Figure 1
Meridian 1 modular architecture



Software architecture

The adaptability of software control provides a complete array of services and features tailored to meet changing requirements.

Call processing, maintenance and administration of Meridian 1 systems are controlled by software programs stored either as firmware programs, as software programs resident in system memory, or as non-resident programs on disk. The information which describes system configuration and associated peripheral equipment is termed office data. This data resides in the system memory and on disk.

Firmware

These are fundamental programs consisting of hard-wired logic instructions stored in Programmable Read Only Memory (PROM) which manipulate data in the central processor and control input/output operations, error diagnostic and recovery routines.

Software

Software programs consist of instruction sequences that control call processing, peripheral equipment, administration and maintenance functions. These sequences are interpreted by the fiiware programs into machine instructions. Several generic software programs with optional feature packages are available to satisfy varying requirements.

Office Data

The office data describes the characteristics of the system in terms of configuration and call dependent information such as features and services. Office data is arranged into blocks defining peripheral equipment, system configuration and transient data. These data blocks permit configuration of Meridian 1 systems to specific customer needs.

Resident Programs

Resident Programs are programs always available in memory during system operation. Firmware programs control other resident programs and provide all CPU arithmetic operations. The other resident programs are those which are automatically loaded into the system memory from the disk drive at system power-up. Once loaded, these programs remain in memory.

Non-Resident Programs

Non-Resident Programs are the overlay programs stored on disk which are loaded into the "overlay area" of system memory when required to perform specific tasks. Only one overlay program may be loaded at a time and is removed from the overlay area when no longer required. Overlay programs can be loaded automatically, under program control, or manually, via an administrative terminal.

Once the user has logged into the system, commands for specific overlay programs are processed by the overlay loader program. When loaded, the overlay program assumes control. Only one administrative terminal can input into the overlay arca at a time. More than one device, however, can receive output simultaneously. A terminal may be configured as an input only or output only device.

Overlay programs provide the system interface for maintenance, service change, and traffic measurement. Each overlay program is independent and has its own specific set of commands and formats. Overlay programs may be run concurrently with normal call processing without interfering with system traffic. There are five main categories of overlay programs:

Service Change and Print Routines

Service changes do not generally require hardware intervention. Instead, the service administration programs are used to create or modify all aspects of the system from individual feature key assignments to complete system configurations. There are also programs and print routines for retrieving the data from the system to check the status of office data assignments.

Maintenance Diagnostics

These programs are the primary instruments for maintenance purposes. Individual programs are used for automatically or manually testing the CE and PE. The programs may be loaded into the overlay area at the request of maintenance personnel, or as part of a daily maintenance routine automatically initiated by the system at a specified time. In addition, background and signaling diagnostic routines can occupy the overlay area when it is not in use.

Traffic

All systems are equipped with traffic data accumulation programs. There is also a resident traffic print program which examines the schedules, transfers data from accumulating to holding registers in accordance with schedules, and prints the traffic data. In addition, there is a traffic overlay program which is used to query and modify schedules, options, and thresholds.

Equipment Data Dump

After making service changes, the changes must be transferred to disk in order to save them. When the equipment data dump program is invoked, all the office data in the read/write memory is written to the system disk. The data dump program is also used to install a new generic version or issue and capture protected data store information which may be changed by the user, such as speed call lists. The program may be invoked automatically during a midnight routine or on a conditional basis (i. e. , data dump only occurs if a software service change has been made). It may also be invoked manually via the input/output (I/O) interface to the system.

Software Audit

This program monitors system operation and gives an indication of the general state of the system operation. The program is concerned mainly with the system software. When a software problem is encountered, the program attempts to clear the problem automatically.

Hardware architecture

Each Meridian 1 system is composed of the following hardware subsystems:

- Common equipment (CE): Provides the device control, software execution, and memory functions of the system.
- Network equipment (NET): Performs the switching function under CPU control.
- Peripheral equipment (PE): Provides the interface for line and trunk circuits.
- Terminal equipment: Telephone sets and attendant consoles.
- Power equipment Provides the electrical voltages required to operate equipment.

Common equipment

Common Equipment (CE) consists of one or more Central Processing Units (CPUs), memory circuits, and mass storage devices which control the operation of the system. The CE communicates over a common control bus which carries a constant flow of program instructions and data under direct control of the CPU. The digitized speech signals follow a separate path on a network switching bus which allows communications links to be established between any of the peripheral devices.

- The Central Processing Unit (CPU) provides the computing power essential for entire system operation.

- The system memory stores all operating software programs and data unique to the particular Meridian 1 system, including switching sequences, features, class of service information, and quantity and types of terminals.
- The Mass Storage Unit provides high speed loading of the operating programs and data into memory.
- The Digital Service Circuits provide functions such as dial and ringing tones, and call conferencing capabilities.
- The Serial Data Interface (SDI) provides a RS232C communications link for administration and maintenance on either a local or remote basis.
- The Network Circuit Cards provide a digital matrix for circuit-switched connections to associated peripheral devices.

Central Processing Unit (CPU)

The CPU performs the control and switching sequences required by the system. The software that directs these functions is loaded into the system memory from the mass storage unit by the CPU. Information flows between the CPU, I/O devices, and the system memory over the CPU bus.

The data required by the CPU to perform its control and switching functions is held during system operation in Random Access Memory (RAM) and fed to the CPU via the CPU bus. The operating data is loaded into the RAM from floppy diskettes on system power-up.

The CPU function is performed by circuit cards which include Read-Only-Memory fiiware that contains fault clearing programs and instructions to control the loading of system memory from the mass storage unit.

Meridian 1 systems incorporate a CPU design that is identical for most system options.

- 24-bit data words plus l-bit parity
- 24-bit linear addressing that permits memory allocation to be assigned on a contiguous basis instead of the 64K pages partitioning referenced above
- 16M words - subdivided for up to 12M words of physical memory space and a remainder of 4M words for I/O spaces

- asynchronous (handshake) bus operation
- 16 file registers used to hold address and data for all operations
- a sense (interrupt) input line to indicate that a particular device (tape, TTY, PE) requires action by the CPU
- a trap facility which, when activated by an external signal, causes the CPU to immediately begin executing instructions starting at a particular address; this facility is used to enter a recovery routine when a fault is detected

Mass Storage Unit

A mass storage unit equipped with two floppy diskettes and/or a Winchester hard disk is used for high speed loading of the resident operating programs and office data into system memory. The loading process is controlled by instructions held in the Read-Only-Memory (ROM) fiiware. When loading is complete, the diskettes remain in the mass storage unit to provide a non-volatile store for automatic loading purposes in the event of software being erased from memory during a power failure. Non-resident software is loaded from the disk automatically or by manual request when required.

The Mass Storage Interface (MSI) card is designed to interface with external devices that are compatible with the Small Computer System Interface (SCSI). This storage capability is provided by the following hardware configurations:

- NT8D68AA Floppy Disk Unit: two 3.5” 1.2 Mbyte floppy disk drives (providing 2.4 Mbytes of formatted capacity) as a standard system offering,
- NT8D69 AA Multi Disk Unit: a Winchester Hard Disk with 10 Mbytes of formatted capacity. When this option is equipped, the floppy disks are used for backup and system loading.

Both types of Mass Storage Unit (MSU) are compatible with any Meridian 1 system running Software Generic Xl 1 Release 8 or later. The upgrade procedure involves replacing the Magnetic Tape Transport and associated tape interface with the desired Mass Storage Unit and equivalent Mass Storage Interface card (MSI) or Floppy Disk Interface (FDI) card. The Mass Storage Unit requires the identical space required for the magnetic tape unit, See *Disk drive* upgrade procedures (553-3001-251) for more information about disk drive upgrades.

Input / Output (I/O) Interfaces

There are various methods of communicating with Meridian 1 systems. A family of Serial Data Interface (SDI) circuit cards provides from one to four communication channels which conform to EIA Data Interchange Standard RS-232-C. I/O addressing is under switch control of the SDI card and allows up to 16 RS-232-C compatible devices, such as a terminals, to communicate with the system. The devices are used to input commands and/or receive responses from the system during administration and maintenance procedures.

Memory

Firmware, software, and data are stored in a read/write Random Access Memory (RAM). The memory is a critical part of the stored program control system. It contains the memory stores of all of the basic operating instructions for the system, plus data on the configuration of the particular application being served. Memory utilization is dependent upon what features are programmed into the system and the number of peripheral terminations being served. The memory is split into four segments to facilitate processor address purposes and permit a functional separation of programs.

- Unprotected Data Store (UDS): These pages hold the transient or unprotected data that is required during call processing. Included are the timing queues and call registers.
- Protected Data Store (PDS) : This protected data store holds the office data blocks that are particular to specific installations.
- Program Store (PS): Allocations within the Program Store are as follows:

- Firmware — This portion of the memory is a non-volatile Read Only Memory (ROM) used for storage of all system fiiware. The ROM is programmed during manufacture and the instructions are permanent and indestructible. It stores the basic rules of operation necessary to initialize the system and bring it into a working state. A recovery or "trap sequence" is included in fiiware which is automatically invoked in response to power-on, system reset, or when certain faults are detected.
- Overlay — This portion of the memory may be loaded with various non-resident programs as required during automatic diagnostics, service order change, traffic measurement, or maintenance.
- Software — The remainder of this memory page is reserved for all of the system software such as the call processing and optional programs. Additional software storage capability is provided by the incremental addition of more memory pages within this category.
- Input / Output Addresses — There are no RAM modules utilized for this page. Instead the address range is reserved for Input/Output (I/O) device addresses. These devices include signaling for peripheral equipment along with magnetic tape and terminal assignments.

Network equipment

Network equipment consists of network circuit cards which perform the digital switching of voice and data signals, peripheral signalling cards which perform scanning and signal distribution. , and service circuit cards, such as tone and digit switches, which provide call progress tones and outpulsing as instructed by the CPU. Network circuits employ Pulse Code Modulation (PCM) and Time Division Multiplexing (TDM) to perform the switching function.

Loops and Superloops

Network equipment interfaces with peripheral equipment via digital multiplexed loops. A loop is a bidirectional path between Network equipment (NET) and Peripheral equipment (PE) for voice, data and signalling information. Upon commands from the CE, the network establishes a path, linking a specific input to a specific output.

Meridian 1 systems provide two network circuit cards, the QPC414 Network Card which provides 2 loops per card, and the NT8D04AA Superloop Network Card which provides 4 loops per card, grouped together in an entity called a Superloop. The Superloop permits all 120 'timeslots provided by the network card to be shared among the peripheral devices served by the superloop, providing higher traffic capacity and simplified traffic engineering.

The flexibility of the network loop plays an important role in the Meridian 1 architecture. Besides the ability to increase circuit-switched bandwidth on an incremental card basis for cost-effective growth, application may be varied for value added services. The network structure allows for the full connectivity of all devices irrespective of how they connect to the system.

The network loop is a key element in the implementation of Computer to PBX Interface (CPI) and Digital Trunk Interface (DTI). CPI provides an integrated interface for connecting large numbers of host computer ports via 24 channels each supporting up to 19. 2 kbps for asynchronous data or up to 56 kbps for synchronous data. DTI provides a digital link of 24 channels each of which may be flexibly allocated for both voice and data communications. Both CPI and DTI use the North American T-l standard (DS-1 format) and each equipped link is assigned an associated network loop.

Network organization

Network loops are organized into groups. Systems are configured as half, full, or multiple group machines. A half network group machine provides a up to 16 loops, a full group system provides from 17 to 32 loops, while a multiple group system provides from 33 to 160 loops.

For applications beyond the traffic handling capability of the single network group, additional switching stages are introduced to form a multi-group arrangement. These connecting paths , provided by the InterGroup Module, are merely an extension of the originating and terminating network loop involved in a call. There are eight one way junctors from each group to all others. Since each path provides thirty connecting channels, a total of 480 connection paths exist from one group to another - 240 in each direction. Five network groups may be interconnected to constitute a fully configured digital switching matrix.

Network/Peripheral configuration

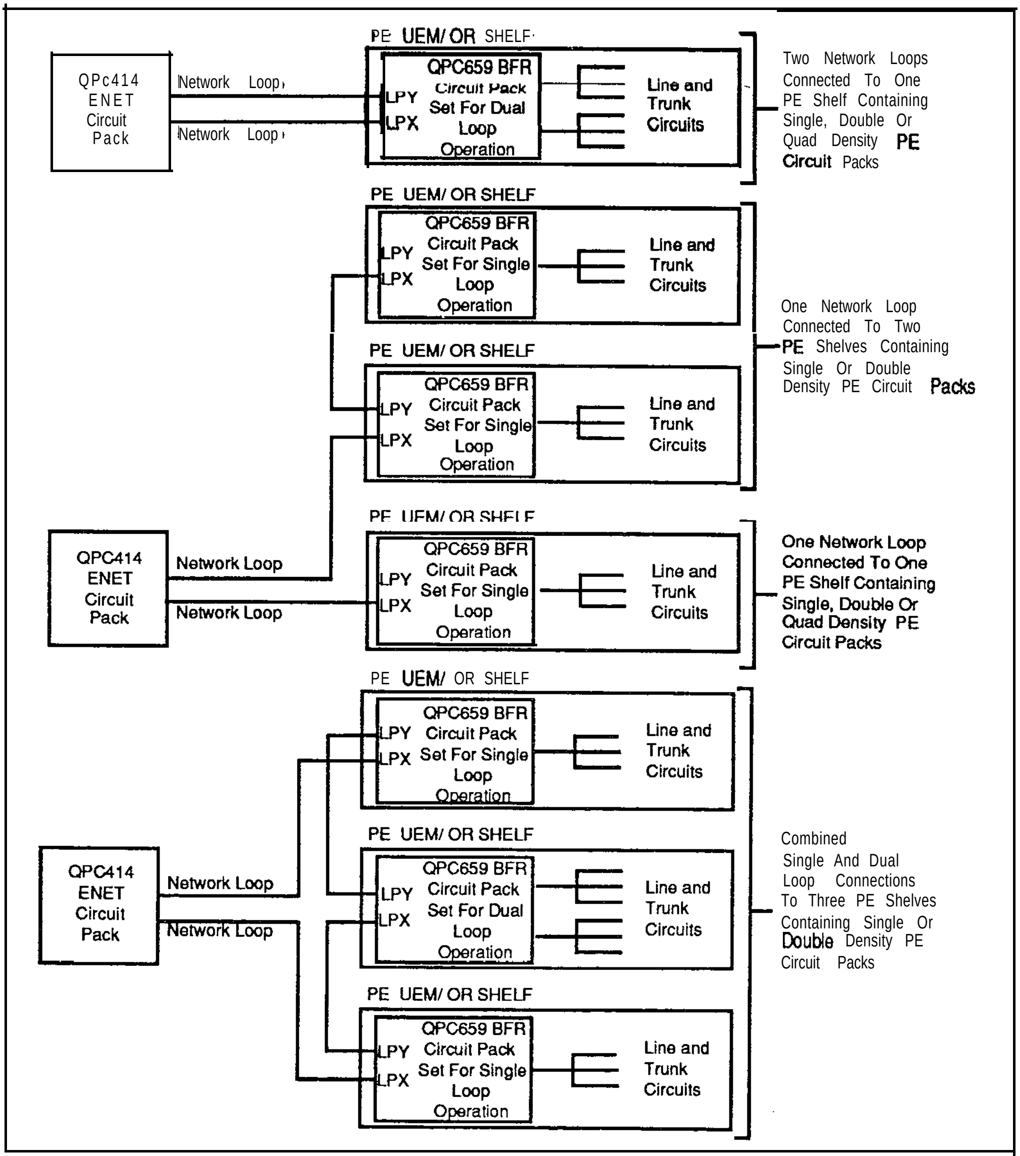
The allocation of peripheral equipment to the network loop determines the traffic handling capability of the switching network. The lower the number of terminations, the higher the loop traffic capacity. The quantity and type of terminal assignments are allocated to optimize the traffic handling capabilities of the switching network.

A universal PE bus structure permits any mix of PE card types to be located in a PE module. Provisioning of PE cards and their associated density (number of ports) determines the network loop to PE module configuration. Complete modularity permits voice and data modules to be segregated so that the specific traffic patterns of one may be met without impeding the other.

Enhanced Network Configurations

For peripheral equipment housed in NT8D13 PE modules, network capacity may be allocated in single loop mode and dual loop mode. In single-loop mode, one peripheral equipment module is connected to one network loop, yielding a maximum concentration of 160 terminations to 30 time slots. In dual loop mode, half of the PE cards in a module use one loop, and the other half use another loop, yielding two maximum concentrations of 80 terminations to 30 time slots.

Figure 2
Single and dual loop configurations

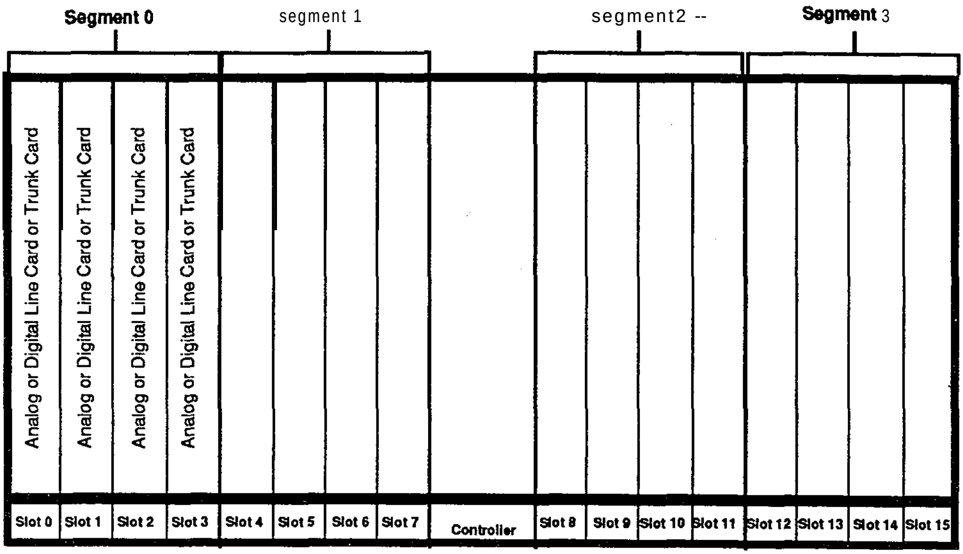


Superloop Network Configurations

The Superloop Network Card combines four regular network loops to make 120 timeslots available to PE cards housed in Intelligent Peripheral Equipment Modules. This increased bandwidth and larger pool of timeslots increases the network traffic capacity by 25% for each 120 timeslot bundle. The NT8D37 Intelligent PE Module is divided into segments of 4 card slots. These segments are numbered O-3. Segment 0 consists of PE slots O-3, segment 1 consists of card slots 4-7, segment 2 consists of card slots 8-11, and segment 3 consists of card slots 12-15.

A Superloop may be assigned from one to eight Intelligent PE segments. A number of different superloop to segment configurations are possible. The configuration chosen will depend upon system traffic requirements and the specific PE cards used. Figures 4 through 9 illustrate different superloop to segment configurations. Note that the TN to Timeslot concentration figures (figure 3) are nominal, and may vary from segment to segment.

Figure 3
NT8D37 Intellegent Peripheral Module segmentation



Line Cards:
NT8D02AA Digital Line Card 16 to 32 TNs
NT8D03AA Analog Line Card 16 TNs
NT8D09AA Message Waiting Line Card 16 TNs

Trunk Cards:
NT8D14AA Universal Trunk Card 8 TNs
NT8D15AA E&M Trunk Card 4 TNs

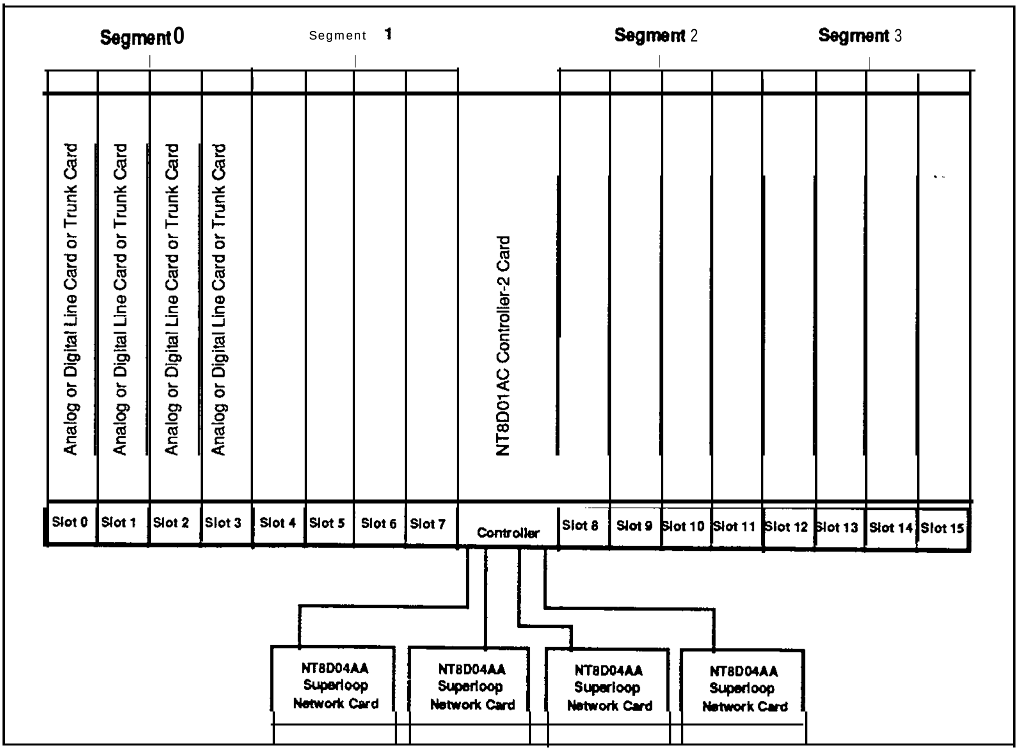
TN density:
Per segment 16 to 128 TNs
Per IPE module 64 to 512 TNs

Note: Maximum TN density assumes ail slots equipped with NT8D02AA Digital Line Cards with 16 voice and 16 data TNs provisioned. Typical mix of line and trunk cards yields a nominal density of 64 TNs per segment. 256 TNs per IPE module

1 segment per Superloop

In this configuration, 1 segment is assigned to 1 Superloop (see Figure 4). In cases where the segment is populated with NT8D02AA Digital Line Cards with all 16 voice and all 16 data TNs provisioned, the.1 segment per superloop configuration will provide a virtual non-blocking (120 Timeslots to 128 TNs) environment (see Figure 2) Four NT8D04AA Superloop Network Cards and one NT8D01AC Controller-4 Card are used to implement a 1 segment per superloop configuration.

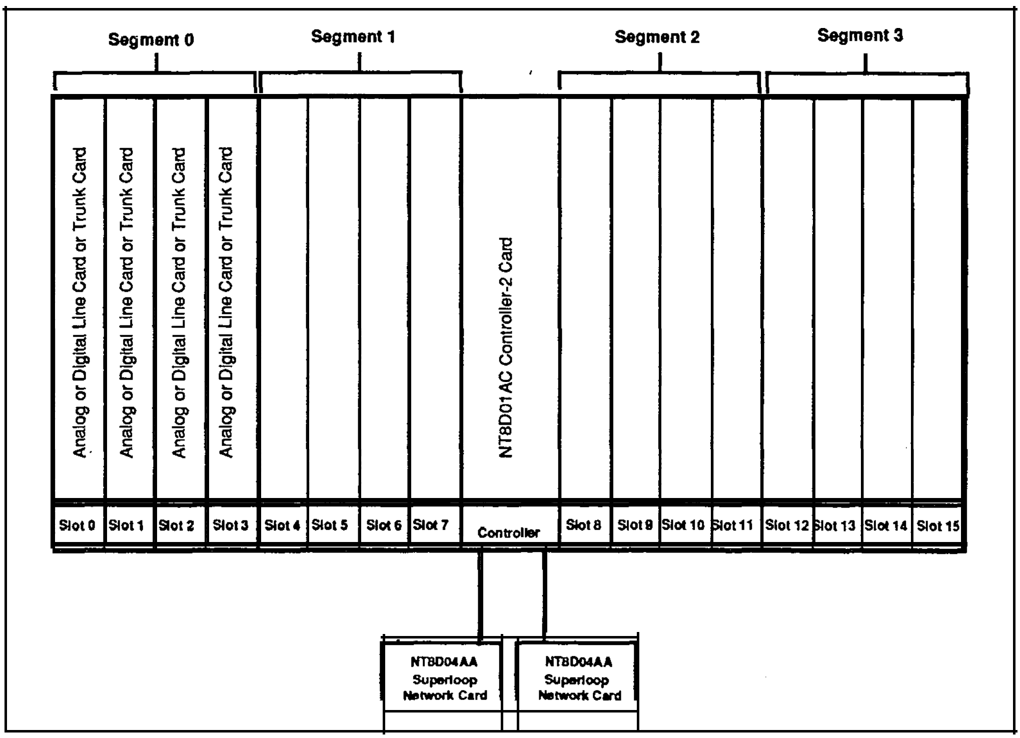
Figure 4
1 segment per Superloop configuration



2 segments per Superloop

In this configuration, 2 segments are assigned to 1 Superloop (see Figure 5). In cases where the segment is populated with NT8D02AA Digital Line Cards with no data TNs enabled, NT8D03 Analog Line Cards, NT8D09AA Message Waiting Line Cards, or NT8D14AA or NT8D15AA Tnmk Cards, the 2 segment per superloop configuration will provide a virtual non-blocking (120 Timeslots to 32-128 TNs) environment (see Figure 2). For instances where half of the data TNs on NT8D02AA Digital Line Cards are enabled, this configuration still provides a low concentration of TNs to timeslots (120 Timeslots to 1% TNs) and a very low probability of blocking. Two NT8D04AA Superloop Network Cards and one NT8D01AD Controller-2 Card are used to implement a 4 segment per superloop configuration.

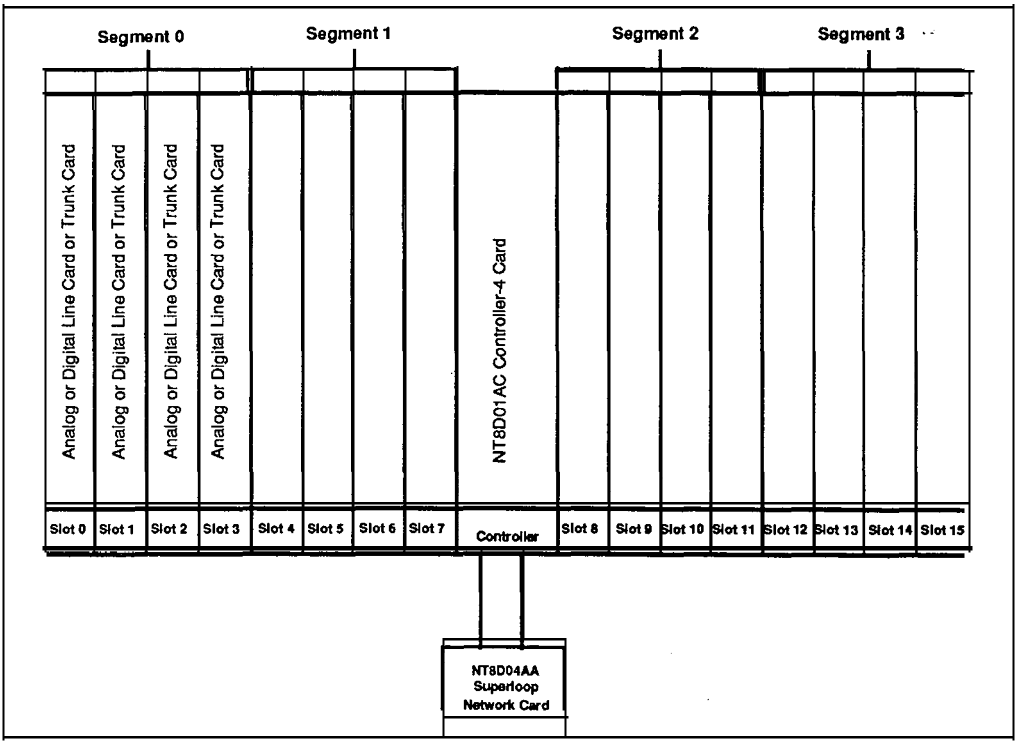
Figure 5
2 segments per Superloop configuration



4 segments per Superloop

In this configuration, 4 segments are assigned to 1 Superloop (see Figure 6). In cases where the segment is populated with NT8D02AA Digital Line Cards, NT8D03 Analog Line Cards, NT8D09AA Message Waiting Line Cards, or NT8D14AA or NT8D15AA Trunk Cards, the 4 segment per superloop configuration will provide a medium concentration (120 Timeslots to 64-256 TNs) environment (see Figure 2). In instances where half of the data TNs on NT8D02AA Digital Line Cards are enabled, this configuration provides a concentration of 120 Timeslots to 384 TNs. One NT8D04AA Superloop Network Card and one NT8D01AD Controller-2 Card are used to implement a 4 segment per superloop configuration.

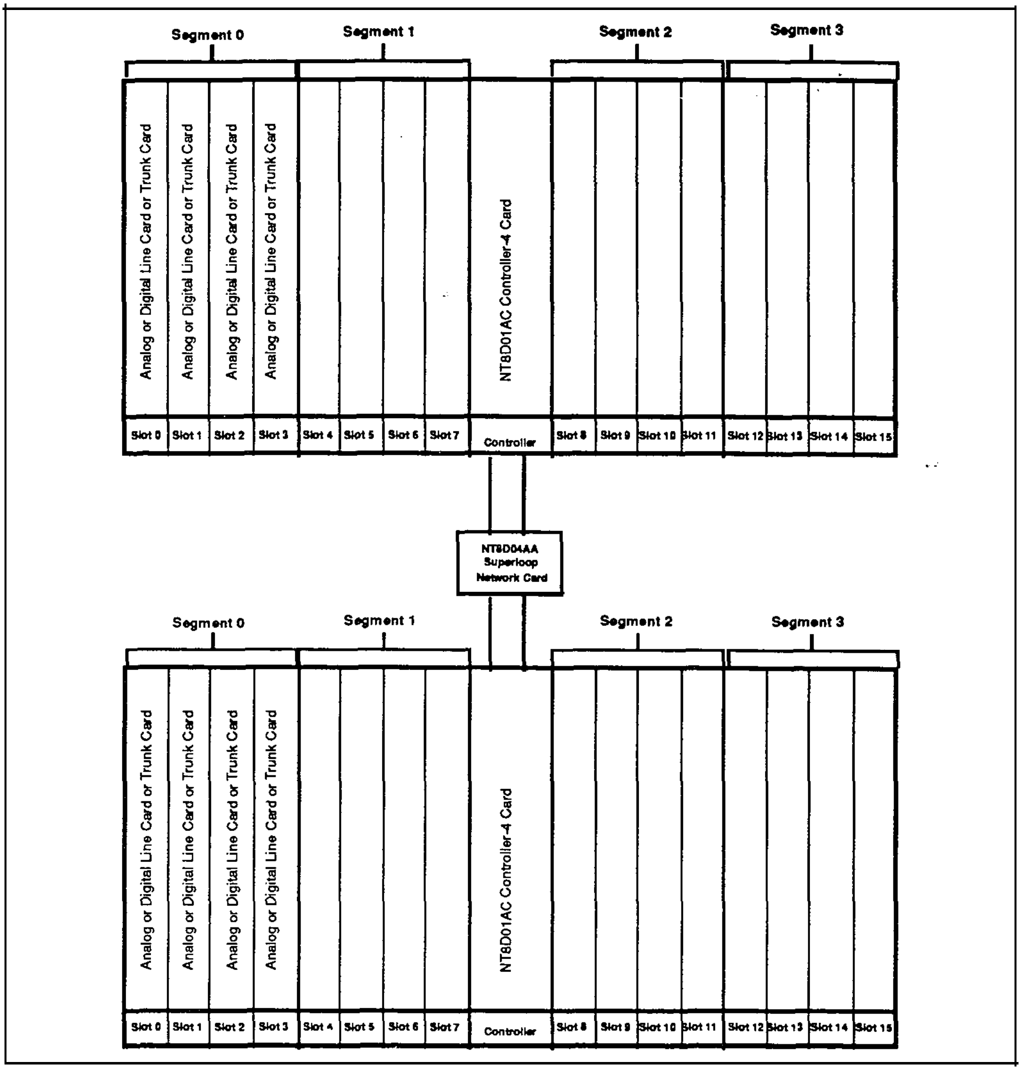
Figure 6
4 segments per Superloop configuration



8 segments per Superloop

In this configuration, 8 segments are assigned to 1 Superloop (see Figure 7). In cases where the segment is populated with NT8D02AA Digital Line Cards, NT8D03 Analog Line Cards, NT8D09AA Message Waiting Line Cards, or NT8D14AA or NT8D15AA Trunk Cards, the 8 segment per superloop configuration will provide a high concentration (120 Timeslots to 128-512 TNs) environment (see Figure 2). In instances where half of the data TNs on NT8D02AA Digital Line Cards are enabled, this configuration provides a concentration of 120 Timeslots to 768 TNs. One NT8D04AA Superloop Network Card and two NT8D01AD Controller-2 Cards are used to implement an 8 segment per superloop configuration.

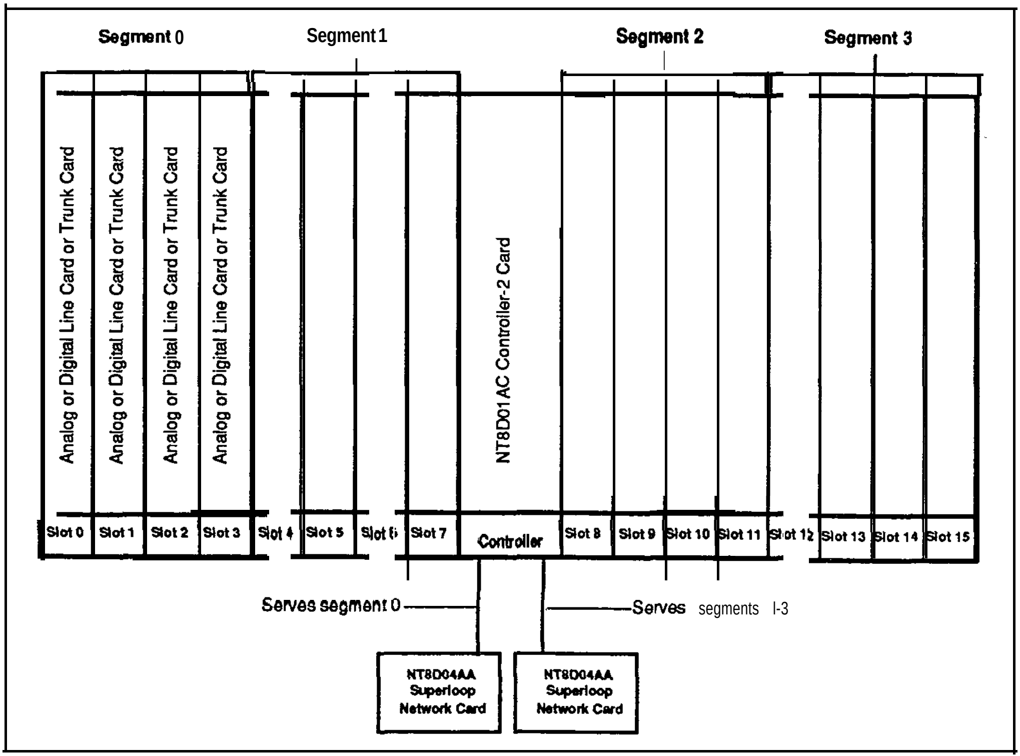
Figure 7
8 segments per Superloop configuration



1 segment per Superloop/3 segments per Superloop

In this configuration, 1 segment is assigned to 1 Superloop and an additional 3 segments are assigned to another Superloop (see Figure 8). This configuration provides a virtual non blocking environment for the single segment served by the first Superloop and a medium concentration of TNs to Tiieslots for the 3 segments assigned to the additional Superloop, as described in the preceding examples. Two NT8D04AA Superloop Network Cards and one NT8D01AD Controller-2 Card are used to implement a 1 segment and 3 segment per superloop configuration.

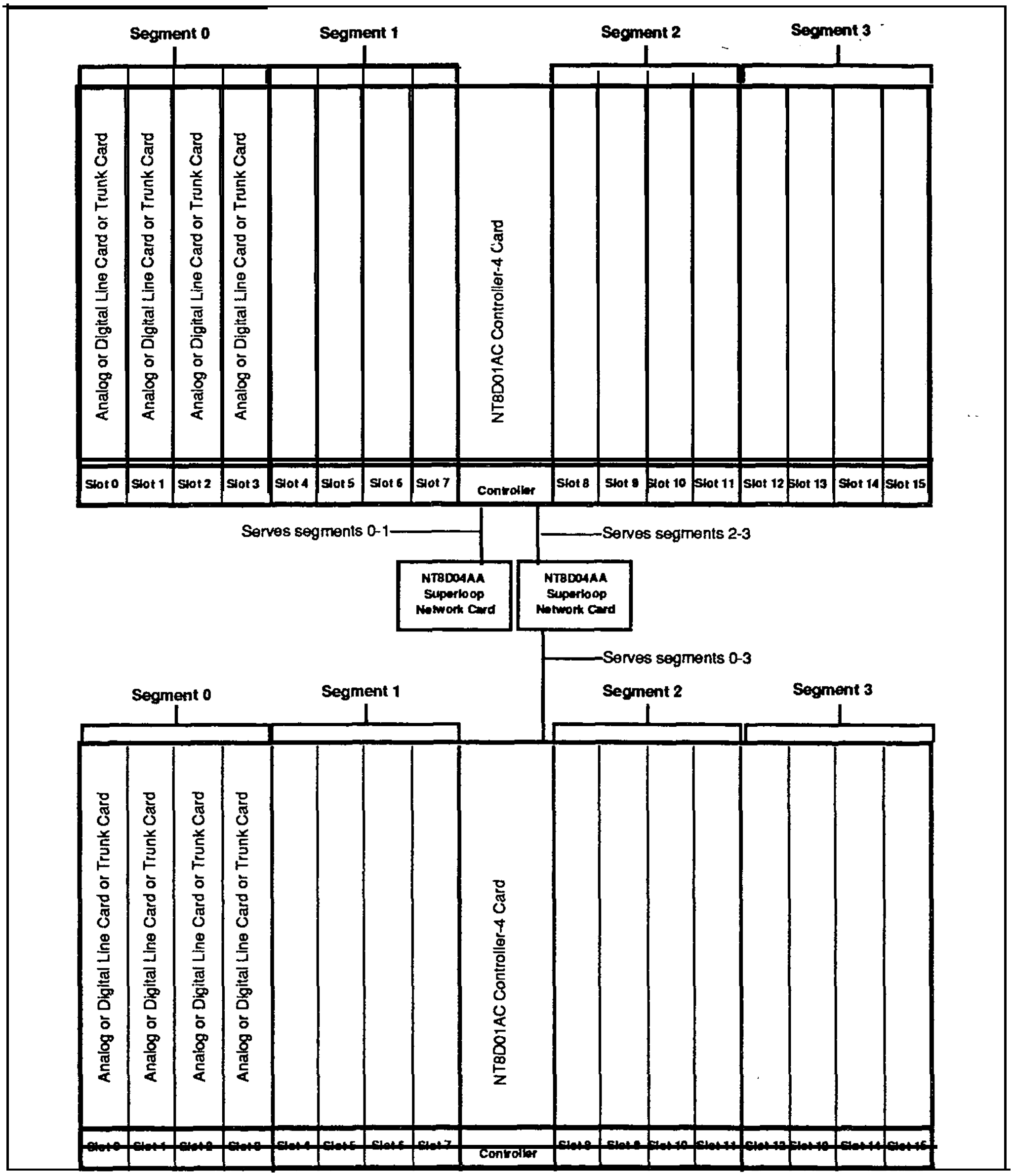
Figure 8
1 segment per Superloop/3 segments per Superloop configuration



2 segments per Superloop/6 segments per Superloop

In this configuration, 2 segments are assigned to 1 Superloop and an additional 6 segments are assigned to another Superloop (see Figure 9). This configuration provides a virtual non blocking environment for the two segments served by the first Superloop (or a very low concentration of TNs to Timeslots when some data TNs are enabled) and a medium concentration of TNs to Timeslots for the 3 segments assigned to the additional superloop, as described in the preceding examples. Two NT8D04AA Superloop Network Cards and two NT8D01AD Controller-2 Card are used to implement a 2 segment and 3 segment per superloop configuration.

Figure 9
2 segments per Superloop/6 segments per Superloop configuration



Peripheral Equipment

Peripheral Equipment consists of peripheral controller cards which provide the timing and control sequences for peripheral circuits, analog and digital line and trunk cards, which provide the interfaces for terminal devices, and circuit cards which provide Digital Trunk Interface (DTI) and Primary Rate Access (PRA) services.

The peripheral controller performs the first stage of multiplexing signals from the terminals, which are then passed on to the network for digital switching. The peripheral controller also transmits timing signals, and carries out other functions associated with the control of the peripheral circuits.

The line card converts incoming analog signals into digital signals which are then passed on to the peripheral controller. This conversion is accomplished by an integrated encoder/decoder (codec) chip. There is a codec for each port on the line card. Conversion from digital back to analog is also performed by the codec for outgoing signals. For digital telephones, the codec is located within the telephone set itself.

PCM

Pulse Code Modulation (PCM) is used to convert analog signals to digital signals. The PCM method converts the analog signal to digital by sampling the amplitude of the analog signal at a rate of twice the highest signal frequency and converting the amplitude of each sample into a series of coded pulses. The PCM sampling frequency standard for telecommunications is 8 kHz.

Companding (compressing - expanding) PCM is a standard technique for using 8 bits words to efficiently represent the wide dynamic range of voice and data signals. Two standards for companding are internationally recognized:

Mu-255 law for North American applications

A-law for international service

Meridian 1 codecs conform to both standards and are software selectable (in Intelligent Peripheral Equipment Modules) for use in North America and internationally. The codecs are also designed to pass signals up to 3.4 kHz with minimum time delay and low phase distort&, a requirement for the proper transmission of data signals.

Remote Peripheral Equipment (RPE)

In a local operating environment, the peripheral equipment may be housed up to 50 feet from the common equipment. The RPE feature extends this range to approximately 70 miles between local and remote facilities. This extension is made possible by converting the multiplexed loop signals to a form compatible with the commonly used T-l type digital transmission system.

Any medium conforming to DS-1 format (1.544 Mbps) may be used to link local and remote sites, including digital microwave radio and fiber optic transmission systems.

DTI/PRI

Allocation of circuit-switched bandwidth may also be made on a network loop basis to Primary Rate Access (PRA) or Digital Trunk Interface (DTI) circuits. These optional services are based on the standard T-l format (DS-1 24 channel) used in digital transmission networks.

DTI allows for the replacement of 24 conventional analog trunks by a single T-l digital link. Each of 24 channels provides up to 56 Kbps for voice and synchronous data transmission, or up to 19.2 Kbps for asynchronous data.

Power equipment

Meridian 1 systems feature a modular power distribution architecture which parallels the modular design concept of the Universal Equipment Module. Meridian 1 power systems provide the following features:

— AC-powered and DC-powered system options, providing flexibility to meet a wide range of customer requirements.

— A distributed, modular power architecture, with power supplies located in each Module, rather than in separate, centralized power shelves.

— All DC systems are available as complete systems, with rectifiers provided by Northern Telecom, or can be equipped for customer-provided external power.

- A new System Monitor has been designed to provide enhanced power, cooling, and general system monitoring capabilities. This new System Monitor interfaces to the CPU via a Serial Data Interface card, for intelligent error and status reporting.
- Maintenance messages that indicate the location of power faults and status down to the specific Column and Module.
- Equipment modules that are truly Universal, in terms of power and cooling. Meridian 1 systems are designed to eliminate power and thermal limitations: any card can go in any slot, and all modules can be filled to capacity with any logically valid combination of cards, with virtually no engineering rules.
- A universal quick-connect power wiring harness is used to distribute input voltages and monitor signals to power supplies located in each Module.
- An advanced cooling system which employs forced air impellers. The velocity of the impellers is automatically adjusted to meet the cooling requirements of the system.
- Fuses are eliminated, as the system exclusively uses circuit breakers for input power protection.
- Modular backup capabilities.

AC and DC systems differ primarily in the power components external to the UEM. See Figures 8 and 9 for block diagrams of the AC and DC powering schemes. DC systems always require the use of rectifiers. This can be a disadvantage in applications that do not require reserve power backup in the event of a utility power failure. The use of a rectifier in DC powering is an advantage in applications that do require battery backup, since all that is needed is to add batteries, as in the traditional central office powering scheme.

AC-powered systems are especially well-suited for those applications that do not require reserve power, as there are no external power components required. There are a wide variety of Uninterruptible Power Supply (UPS) systems available for AC systems that require reserve power, and the use of a UPS is an effective method of providing backup power in many situations.

The choice of which powering scheme to use is determined primarily by reserve power requirements and preferences, and by existing power equipment at the installation site.

Figure 10
AC power architecture

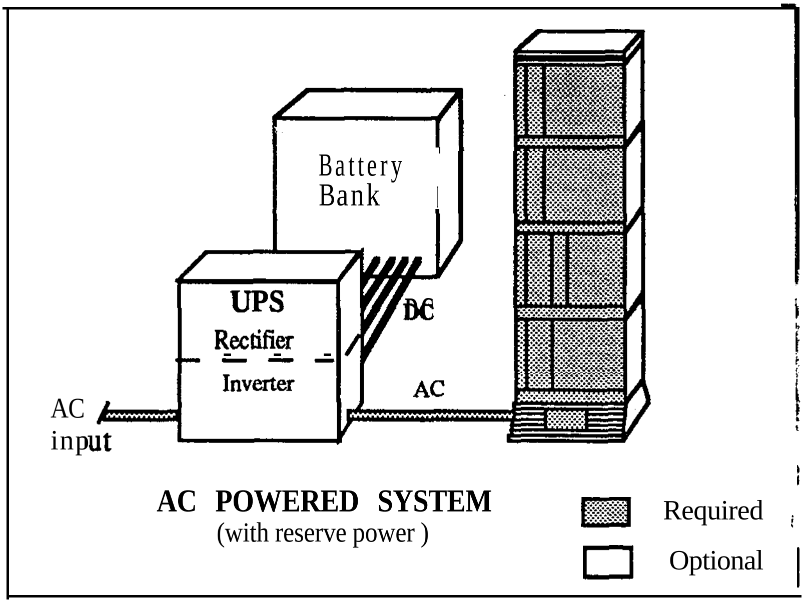
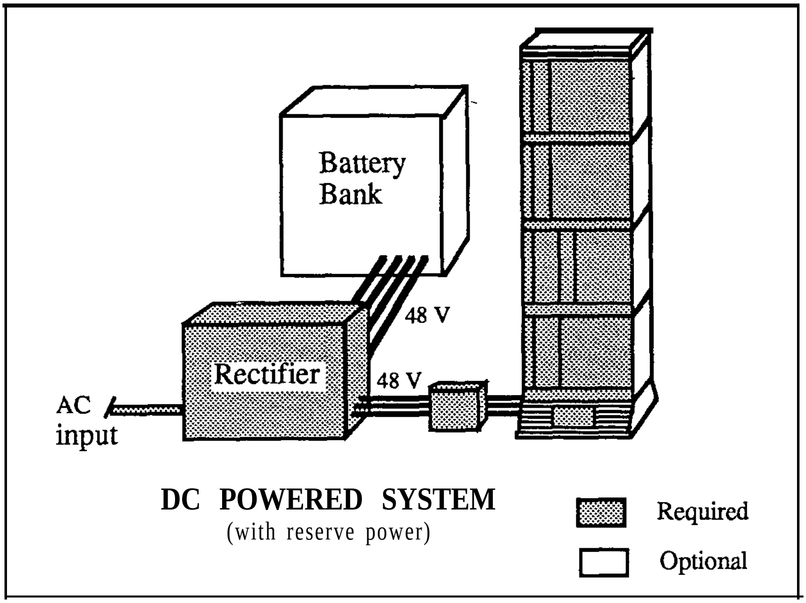


Figure 11
DC power architecture



Product description

Universal Equipment Modules

The Meridian 1 System is comprised of Universal Equipment Modules (UEMs), each containing everything needed (card cage assembly, power supply, I/O cabling, etc) to support a specific system function. These UEMs are assembled up to four high on a pedestal, to form a column. The pedestal contains a central Power Distribution Unit (PDU), cooling fans, air filters, and a System Monitor circuit. At the top of each column is a Top Cap, which consists of two air exhaust grilles and a thermal sensor assembly that works in conjunction with the System Monitor. Systems are comprised of one or more columns. Each Universal Equipment Module is available in AC or DC powered versions.

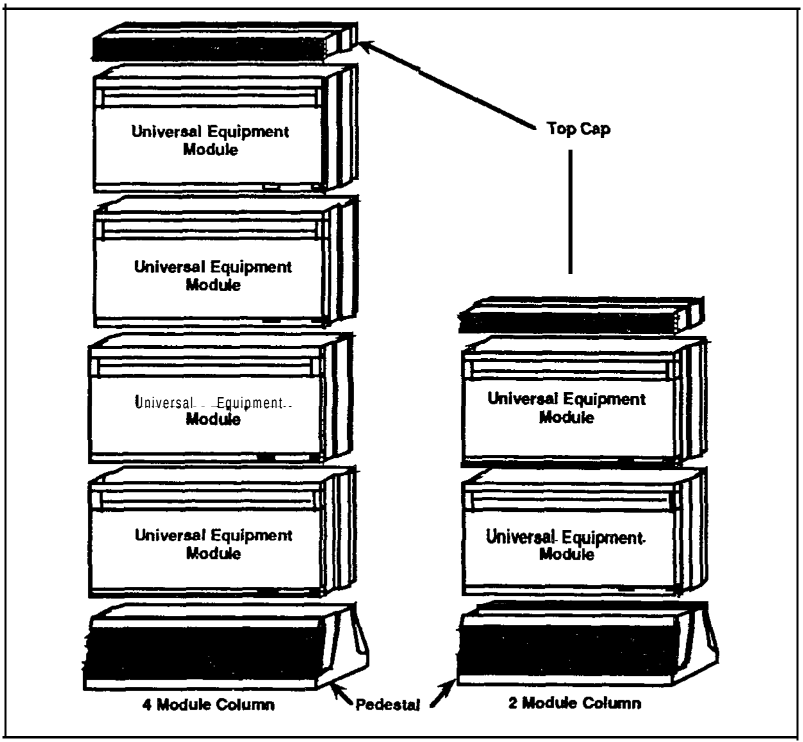
The Universal Equipment Modules are constructed of die cast aluminum, providing strength and durability. For ease of access each module has removable front and rear covers. All cable routing between the module and the Main Distribution Frame (MDF) is handled through the rear of the module. Cable exit can occur at the top, to access overhead cable racks, or at the bottom to take advantage of raised floors. Universal Equipment Modules are assembled on a pedestal that houses a central Power Distribution Unit, cooling units and system monitor circuitry. The pedestal can be equipped with either leveling feet or casters. UEMs may be assembled in columns up to four high.

The following Universal Equipment Modules are available:

- CPU module (NT8D34)
- CPU/Network module (NT6D39)
- Network Equipment module (NT8D35)

- Common/Peripheral Equipment module (NT8D11)
- Intelligent Peripheral Equipment module (NT8D37)
- Peripheral Equipment module (NT8D13)
- Remote Peripheral Equipment Carrier module (NT8D47)
- InterGroup module (NT8D36AA)
- Meridian Mail module (NT6D44)

Figure 12
Universal Equipment Modules



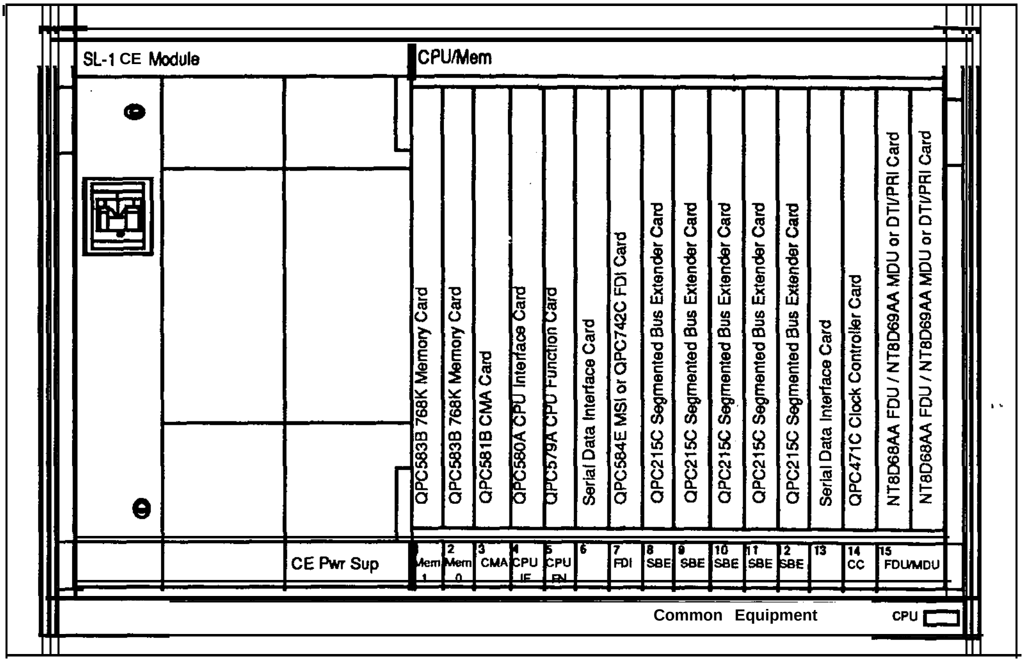
CPU module (NT8D34)

The NT8D34 CPU module houses the CPU and Memory cards used to provide system control and storage of data and programs, for the Meridian 1 system option 71. Each NT8D34 CPU module houses one CPU; two are required for the Meridian 1 system option 71. For configuration flexibility the NT8D34 CPU module is available with an AC power supply option or a DC power supply option. These power supplies provide the voltages to operate the circuit cards located in the modules.

The NT8D34 CPU module contains 17 card slots which support the following:

- slots l-2 : Memory
- slot 3: CMA
- slot 4: CPU Interface
- slot 5: CPU Function
- slot 6: SDI
- slot 7: MSI
- slots 8-12: Segmented Bus Extender (SBE)
- slot 14: Clock Controller
- slot 15- 17: FDU/MDU or Digital Trunk Interface (DTI)/Primary Rate Interface (PRI)

Figure 13
NT8D34 CPU module -typical configuration



CPU/Network module (NT6D39)

The NT6D39 CPU/Network module houses the CPU and Memory circuit cards used to provide system control and storage of data and programs for Meridian 1 system option 51 and 61. Each NT6D39 module houses one CPU and up to 16 network loops required for each Meridian 1 system option 51 and 61.

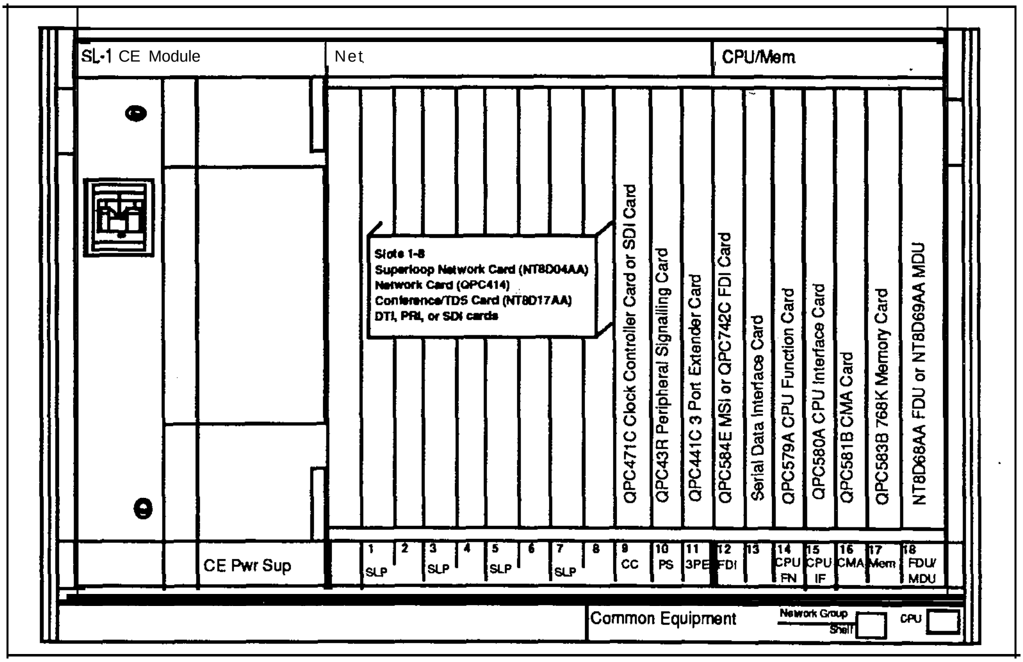
For configuration flexibility the NT6D39 CPU/Network module is available with an AC power supply option or a DC power supply option. These power supplies provide the voltages to operate the circuit cards located in the Modules.

For a half group, single CPU system (Meridian 1 system option 51) one NT6D39 module is required. For a full group, dual CPU system (Meridian 1 system option 61) two NT6D39 Modules are required.

The NT6D39 contains 17 card slots which support the following:

- slots 1 - 8: Network cards
- slot 9 : Clock Controller or Serial Data Interface (SDI)
- slot 10: Peripheral Signaling
- slot 11: 3-Port Extender (3PE)
- slot 12: Mass Storage Interface (MSI)/Floppy Disk Interface (FDI)
- slot 13: SDI
- slot 14: CPU Function
- slot 15: CPU Interface
- slot 16: Changeover Memory Arbitrator (CMA)
- slot 17: Memory
- slot 18: FDU/MDU

Figure 14
NT8D39 CPU/Network module -typical configuration



Network module (NT8D35)

The NT8D35 Network module houses the circuit cards which are used to provide the digital multiplexed network loops of the switching system, along with the control and signalling cards required to interface the switching function with the CPU. The NT8D35 Network Module is used in Meridian 1 system option 71 only. The NT8D35 module also supports Digital Trunk Interface (DTI) and/or Primary Rate Interface (PRI) cards.

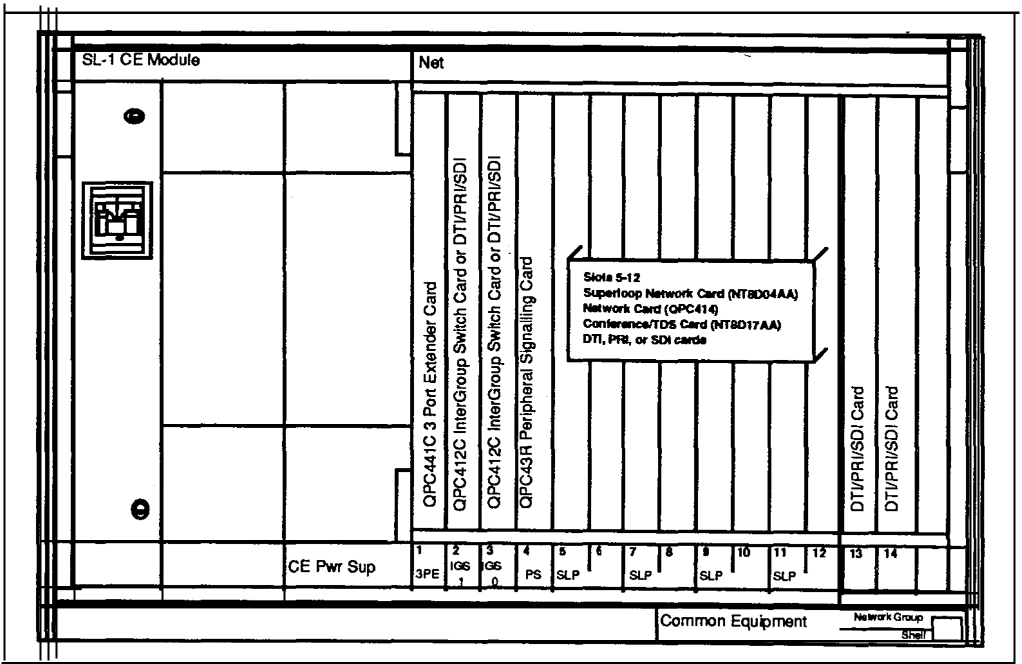
For configuration flexibility the NT8D35 Network module is available with an AC power option or a DC power option. These power supplies provide the voltages to operate the circuit cards located in the modules.

The NT8D35 Network module houses up to eight QPC414 (ENET) cards or four NT8D04AA SuperLoop Network cards, or any combination for a total of 16 network loops per module. In a typical configuration, 14 voice/data loops are available when one NT8D17 Conference/Tone and Digit Switch card is configured in the module. Two NT8D35 modules are required to make a full network group of 32 loops. A maximum of 10 NT8D35 Modules (5 network groups) may be configured.

The NT8D35 contains 15 card slots which support the following:

- slots 1: 3PE
- slots 2-3: InterGroup Switch (IGS) 1, DTI/PRI, or SDI
- slot 4: Peripheral Signaling
- slots 5-12: Network Cards
- slot 13: DTI/PRI or SDI/QSDI
- slot 14: DTI/PRI
- slot 15: not used

Figure 15
NT8D35 Network module — typical configuration



Common/Peripheral Equipment modute (NT8D11)

The NT8D11 module houses the common, network and peripheral equipment circuit cards for Meridian 1 system options 21A and 21.

The NT8D11 CE/PE module is available in two versions, AC or DC power. These power supplies provide the voltages to operate the circuit cards located in the modules.

The NT8D11 CE/PE module is divided into two functional sections:

- Common Equipment (CE)
- Peripheral Equipment (PE)

There are 10 Common Equipment (CE) and 10 Peripheral Equipment (PE) card slots. The CPU functions are provided by card slots 1-3. The Network Equipment functions are provided by card slots 3-10.

The NT8D11 module will utilize two specially designed circuit cards for Meridian 1 System Options 21A and 21 only.

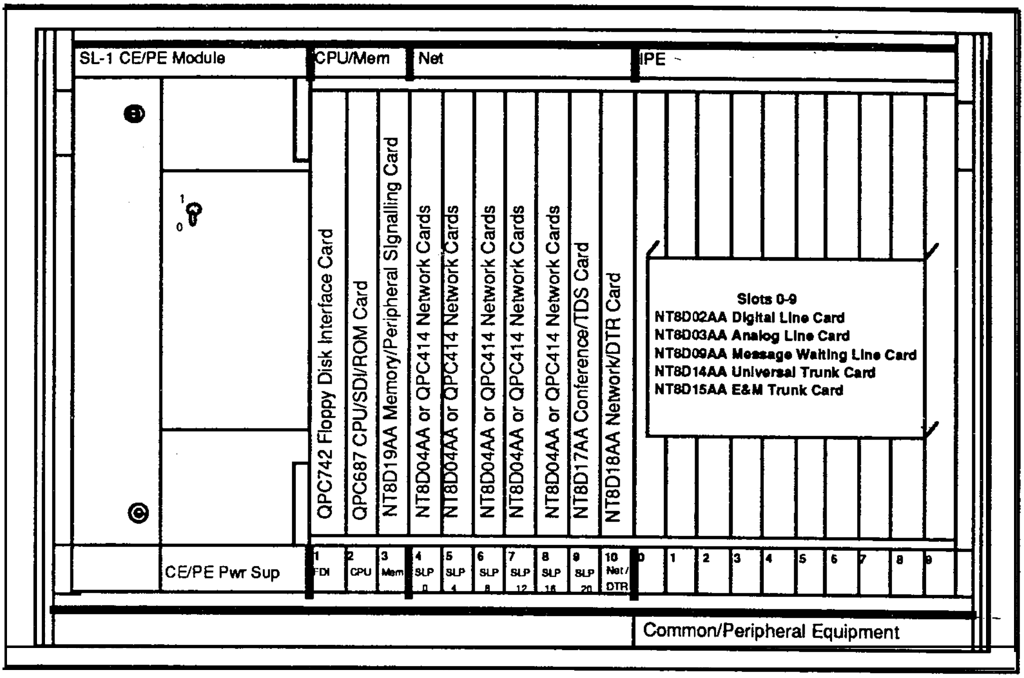
- Memory/Signaling card (NT8D19AA) — provides the peripheral signaling functions in addition to providing the memory and miscellaneous CPU equipment functions.
- Network/DTR card (NT8D18AA) — provides the Controller card -- (NT8D01) functions for the Intelligent PE cards installed in the NT8D11 module, along with a SuperLoop Network and Digitone Receiver functions.

The NT8D1 1 module uses the new Intelligent Peripheral Equipment cards to provide trunk and station interface in system options 21A and 21.

The **NT8D11 CE/PE Module** contains 20 card slots which support the following:

- slot 1 : FDI
- slot 2 : CPU
- slot 3: Memory
- slots 4-8: Network cards
- slot 9: Conference/Tone and Digit Switch card **(NT8D17AA)**
- slot 10: **Network/DTR** card **(NT8D18AA)** (Always configured as **SuperLoop** 28)
- slots O-9: Intelligent Peripheral Equipment cards only

Figure 16
NT8D11 CE/PE Module — typical configuration



Intelligent Peripheral Equipment module (NT8D37)

The Intelligent Peripheral Equipment module uses the new Peripheral Equipment cards only and may be used with system options 21A,.21, 51, 61, 7 1. With an upgrade assembly the Intelligent Peripheral Equipment modules may be used with all existing systems.

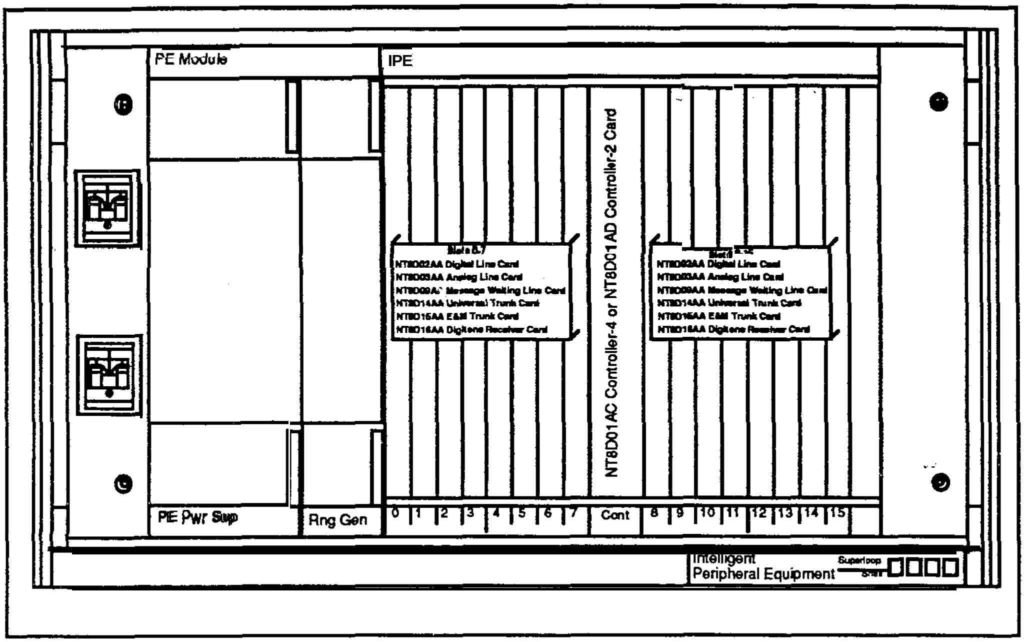
The NT8D37 Intelligent PE module is available in two versions, AC or DC power. These power supplies provide the voltages to operate the circuit cards located in the modules.

The NT8D37 module may only be connected to a SuperLoop Network (NT8D04AA) circuit card. It houses one Controller card (NT8D01) and up to 16 Intelligent Peripheral Equipment circuit cards. The card slots are numbered from 0 to 15, for a total of 16 PE card slots.

The NT8D37 Intelligent PE module supports 16 PE circuit cards, yielding a capacity of 256 Integrated Voice/Data (IVD) lines (512 TNs), although a typical configuration includes a mixture of Digital lines, Analog lines, Trunks and Digitone Receiver (DTR) circuit cards.

All cable connections to the MDF are made in the rear of the module through an I/O panel. To serve all 16 PE card slots, 12 PE cables are required to the MDF.

Figure 17
NT8D37 Intelligent PE module-typical configuration



Peripheral Equipment module (NT8D13)

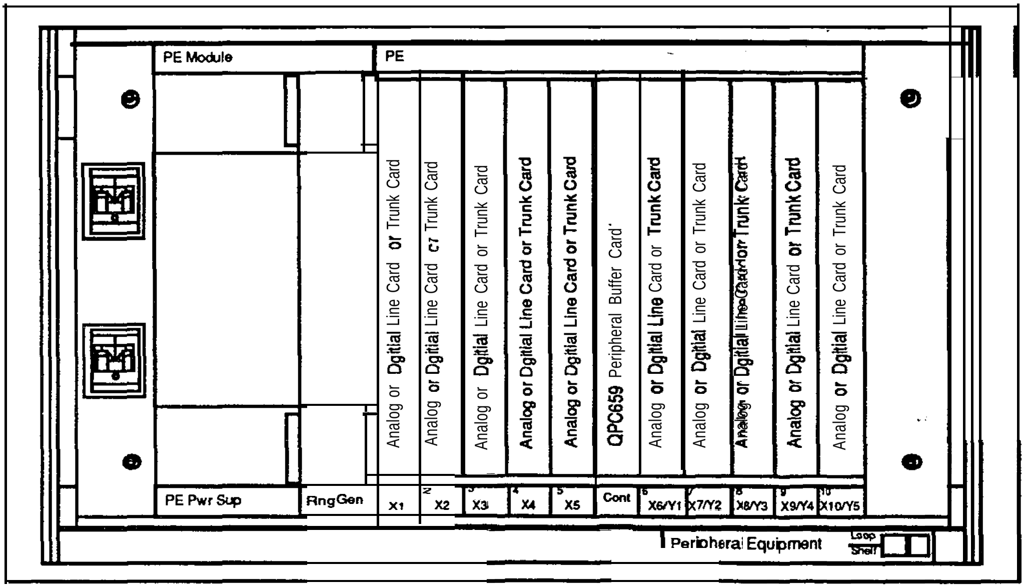
The Peripheral Equipment module uses the PE circuit cards currently housed in PE shelves for the Meridian SL-1 systems. It provides the interface to the system for trunks and stations. The NT8D13 module may only be connected to an ENET (QPC414) circuit card and maybe used in system options 21A, 21, 51, 61, 71 and the Meridian SL-1XT, NT, RT, ST, N, and XN systems. It houses one Peripheral Buffer circuit card (QPC659) and up to ten existing peripheral equipment circuit cards.

When the Meridian Data Service ADM, SADM, ASIM or AIM are required on system options 21A, 21, 51, 61, and 71, the NT8D13 PE module must be used.

For configuration flexibility the NT8D13 Peripheral Equipment module is available with an AC power supply option or a DC power supply option. These power supplies provide the voltages to operate the circuit cards located in the Modules.

All cable connections to the MDF are made in the rear of the module through an I/O panel. Seven PE cables are required to the MDF for all 10 card slots.

Figure 18
NT8D13 PE module — typical configuration



Remote Peripheral Equipment Carrier module (NT8D47)

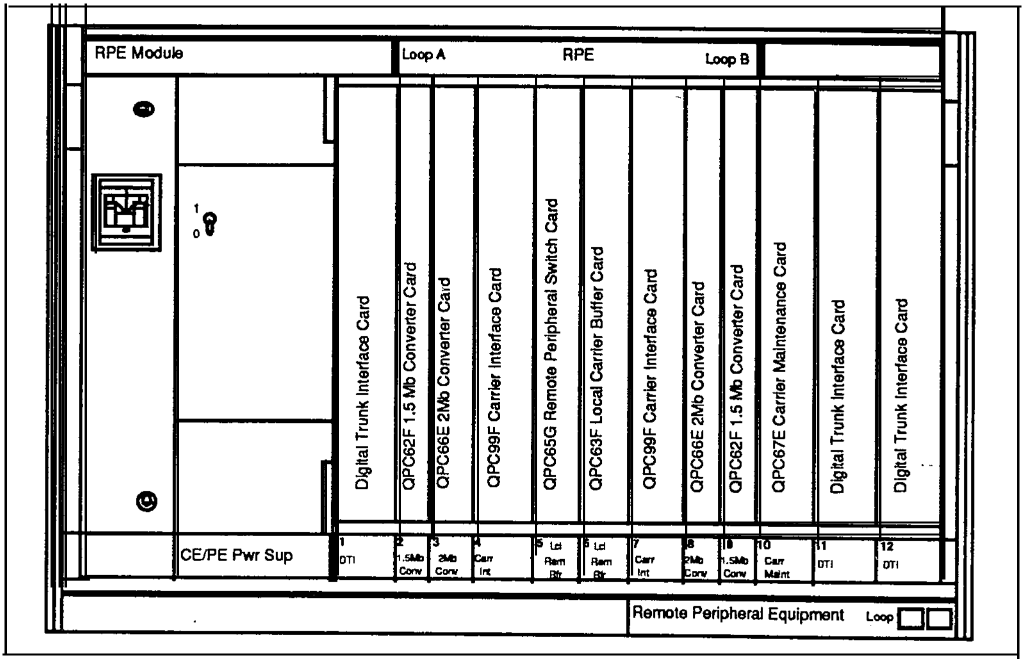
The NT8D47AA/DC RPE Carrier module is used to extend the Network to PE interconnection distance between local and remote sites. It, accommodates two network loops. The number of modules required per system depends on the number of stations in the remote site.

For configuration flexibility the Remote Peripheral Equipment Carrier module is available with an AC power option or a DC power option. These power supplies provide the voltages to operate the circuit cards located in the modules.

The RPE backplane contains 12 card slots which support the following:

- slot 1: DTI
- slot 2: 1.5 Mb Converter
- slot 3: 2 Mb Converter
- slot 4: Carrier Interface
- slot 5: Remote Peripheral
- slot 6: Local Carrier Buffer
- slot 7: Carrier Interface
- slot 8: 2 Mb Converter
- slot 9: 1.5 Mb Converter
- slot 10: Carrier Maintenance
- slots 1 l-12: DTI

Figure 19
NT8D47 RPE Carrier module -typical configuration

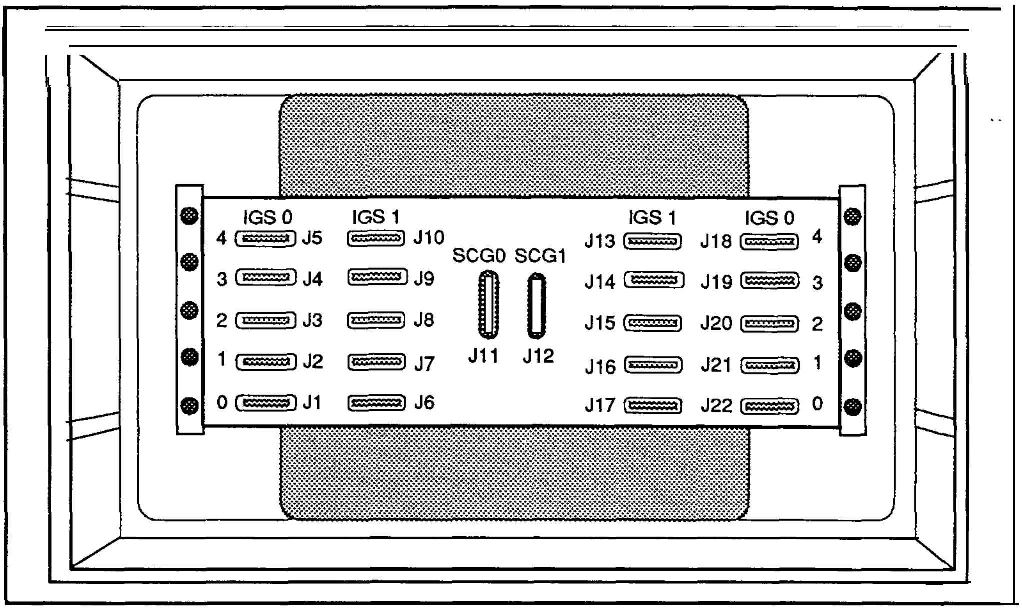


InterGroup module (NT8D36AA)

The InterGroup module provides a path for the switching of traffic between the network groups in system option 71. Faceplate cables from Segmented Bus Extender (SBE), System Clock (SCG) and InterGroup Switch (IGS) circuit cards are connected to the InterGroup module. These faceplate cables are accessed from the front of the module.

The InterGroup module does not require any power card for operation. Therefore it may be used with systems using the AC power option or the DC power option.

Figure 20
NT8D36AA InterGroup module



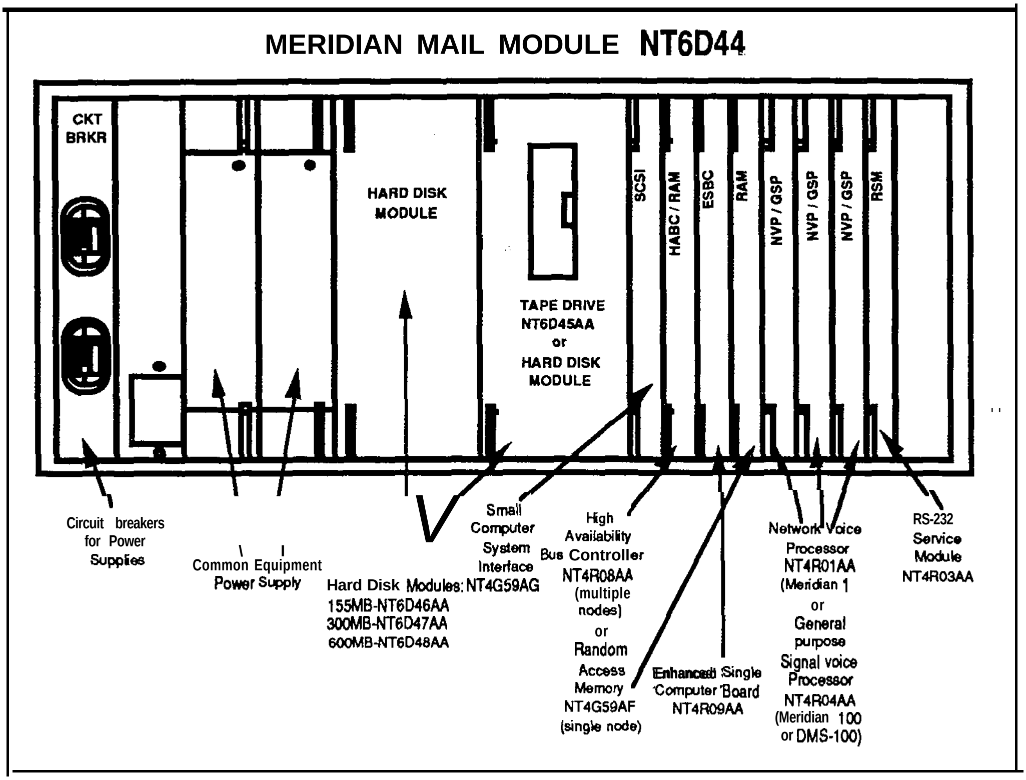
Meridian Mail module (NT6D44)

The NT6D44 Meridian Mail module houses the circuit cards currently used by the Meridian Mail Option for Meridian SL-1 systems: The NT6D44 Meridian Mail module may only be connected to an ENET (QPC4 14) circuit card and may be used in Meridian 1 system options 21A, 21, 51, 61, 71 and the Meridian SL-1 XT, NT, RT, ST, N, and XN systems.

For configuration flexibility the NT6D44 Meridian Mail module is available with an AC power supply option or a DC power supply option. These power supplies provide the voltages to operate the circuit cards located in the Modules.

Meridian 1 system option 21A must be upgraded to Meridian 1 system option 21 when the NT6D44 Meridian Mail module is equipped.

Figure 21
Meridian Mail module -typical configuration



Pedestal (NT8D27AB)

The NT8D27AB pedestal is a base unit made of die-cast construction and houses the power distribution unit, system monitor, blower unit, and fan unit connector. One pedestal is required per equipment column.

The pedestal is approximately 31.5 inches wide by 25.50 inches deep by 10 inches high and weighs 30 lbs empty. Leveling feet are provided for up to four tiers, while a caster option is provided for up to two tiers. Input power for the system is brought into and distributed by the pedestal. A Power Distribution Unit located in the pedestal contains an EMI filter and one 30 amp circuit breaker.

One pedestal distributes the input power for one column. Also located in the pedestal are two forced air impellers and a reusable dust filter. The impellers are protected by two 1 amp circuit breakers.

Top cap (NT7D00)

The top cap is mounted on the top module of each column. It provides additional EMI shielding, air exits, and I/O cable exits.

The top cap is approximately 31.5 inches wide by 22 inches deep by 3 inches high and weighs 8 lbs. It consists of a front and a rear air exhaust grills, each secured by two clips underneath the edge of the grill.

Three versions of the top cap are available:

- NT7D00AA — AC systems
- NT7D00BA — DC systems
- NT7D00AB — Meridian 1 System option 21A only

Expansion kit (NT8D49)

The Expansion kit bolts modules together for side-by-side expansion when in a contiguous row. The Expansion kits also maintain shielding against EMI/RFI. See Figures 22 and 23.

Figure 22
Multi-column system equipped with NT8D49 Expansion kits

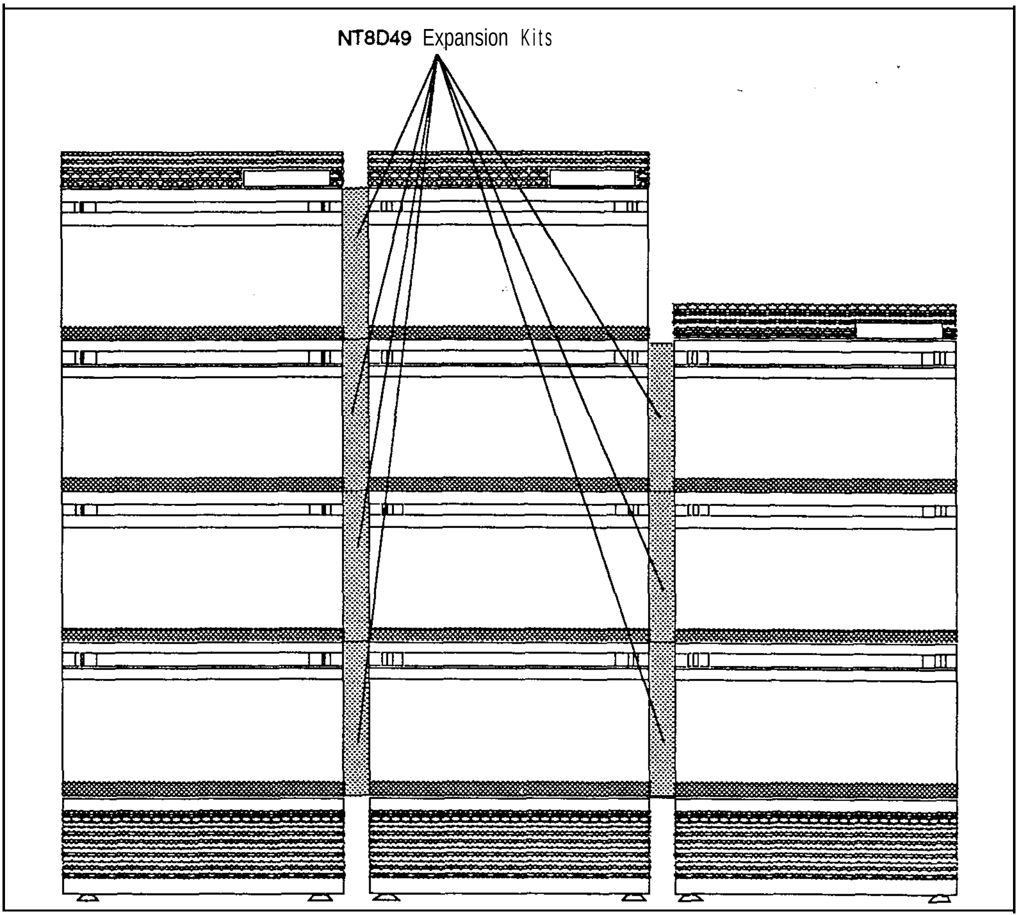
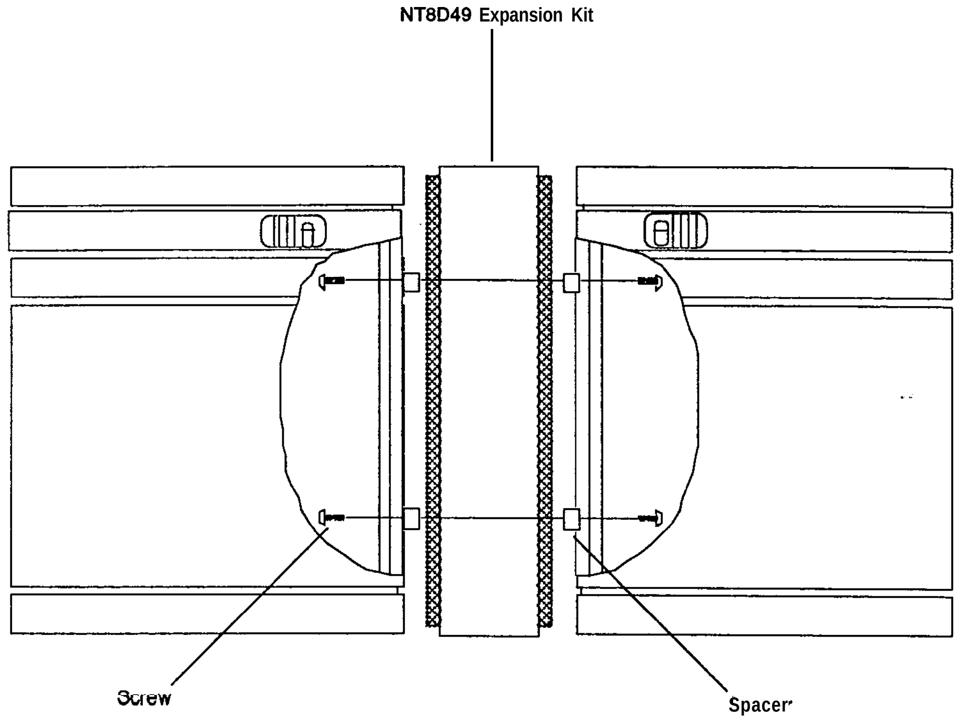


Figure 23
NT8D49 Expansion kit



Meridian 1 system options

Several system options are available. The use of the Universal Equipment Modules allows for seamless growth from one option to another by adding or replacing Universal Equipment Modules or card cages. The options are selected depending upon the application, line size, and other customer requirements:

- Meridian 1 system option 21A — Single CPU-l module only
- Meridian 1 system option 21 — Single CPU
- Meridian 1 system option 51 — Single CPU, Half Network Group
- Meridian 1 system option 61 — Dual CPU, Full Network Group
- Meridian 1 system option 71 — Dual CPU, Multiple Network Groups

Meridian 1 system option 21A

The Meridian 1 system option 21A package includes the CE/PE base hardware, 1 Network/DTR card, 1 Conf/TDS card, 1 Floppy Disk Unit (FDU), 2 SDI paddle boards. The Pedestal and Top Cap assemblies must be added. These assemblies include a Top Cap-21A, System Monitor-21A, Pedestal, AC power cord and a power distribution Unit-21A. The Meridian 1 system option 21A supports only the AC power option.

Figure 24
System option 21 A

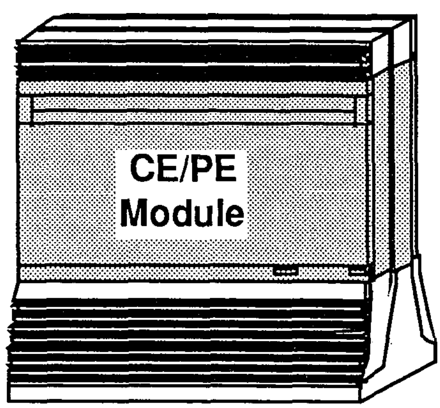


Table 1
System **option 21A specifications**

Power	**AC only**
Typical Number of Ports	160
Maximum Number of Ports	320
Maximum Number of Modules	1
AC Input Voltage	*208* V ac
Number of CPUs	1
Number of Network Loops •	7 SuperLoops or 12 ENET Loops plus two service loops (Conf/TDS)
Cooling	Fan in Top Cap
Memory	768K
Data Storage	Floppy Disk Unit
Software Generic	1011 Rls 15
Hardware Features	No Power Distribution Unit Contains System Monitor (NT7D15AA)

Note: Additional network loops require expansion modules (Intelligent PE or Peripheral Equipment Modules).

Meridian 1 system option 21

The Meridian 1 system option 21 package includes the CE/PE base hardware, 1 Network/DTR card, 1 Conf/TDS card, 1 Floppy Disk Unit (FDU), 2 SDI paddle boards. The Pedestal and Top Cap assemblies must be added. Figure 25 illustrates a typical configuration with the shaded area showing the base package.

Figure 25
System option 21

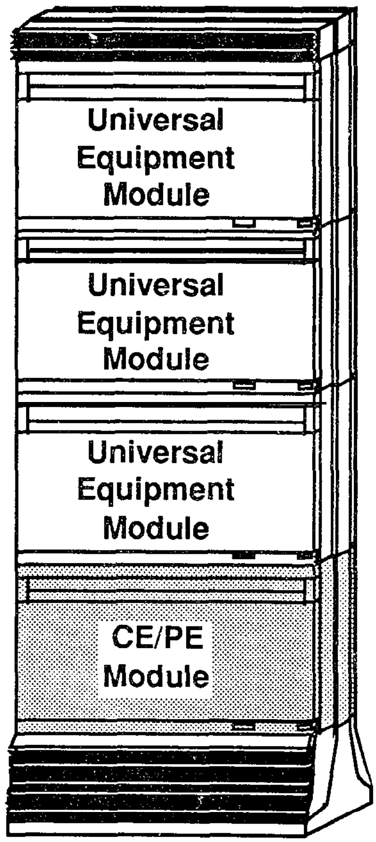


Table 2
System option 21 spcifications

Power	AC or DC
Maximum Number of Ports	800
Input Voltage	208 V ac or -48 V dc
Number of CPUs	1
Number of Network Loops	7 SuperLoops or 12 ENET Loops plus two service loops (Conf/TDS)
Cooling	Fan Impellers in pedestal
Memory	768K
Storage Media	Floppy Disk Unit
Software Generic	1011 Rls 15
Hardware Features	Standard Power Distribution Unit Contains System Monitor (NT8D22AB)

Meridian 1 system option 51

The Meridian 1 system option 51 package includes 1 CPU/Network module, 1 Conference and TDS card, 1 SuperLoop Network card, 2 SDI paddle boards, 1 Intelligent Peripheral Equipment module, 1 Pedestal assembly and 1 Top Cap. The FDU or MDU assembly must be added. Figure 26 shows a typical system configuration with the shaded areas showing the base package.

Figure 26
System option 51

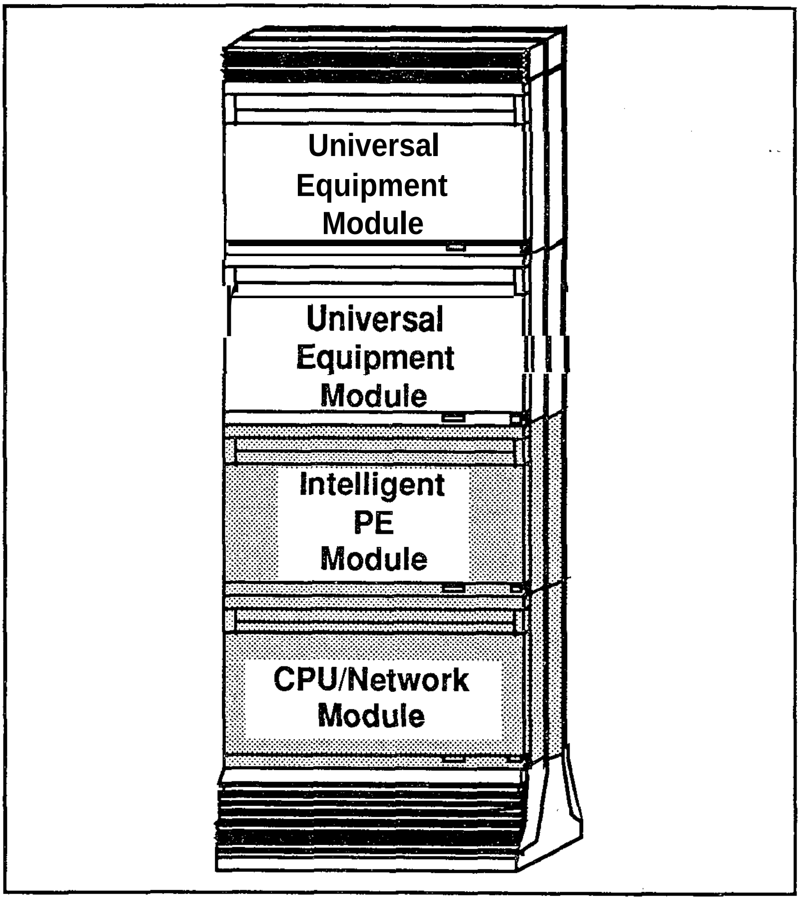


Table 3
System option 51 specifications

Power	AC or DC
Maximum Number of Ports	1000
Input Voltage	208 V ac or -48 V dc
Number of CPUs	1
Number of Network Loops	16
Cooling	Fan Impellers in pedestal
Memory	768K
Storage Media	Floppy Disk Unit or Multi Disk Unit
Software Generic	1111 Rls 15
Hardware Features	One Half Network Group, Standard Power Distribution Unit Contains System Monitor (NT8D22AB)

Meridian 1 System option-61

The Meridian 1 System option 61 package includes 2 CPU/Network Modules, 2 Conference and TDS cards, 1 SuperLoop Network card, 2 SDI paddle boards, 1 Intelligent Peripheral Equipment module, 1 Pedestal assembly and 1 Top Cap. The FDU or MDU assembly must be added. Figure 27 shows a typical system configuration with the shaded areas showing the base package.

Figure 27
System option 61

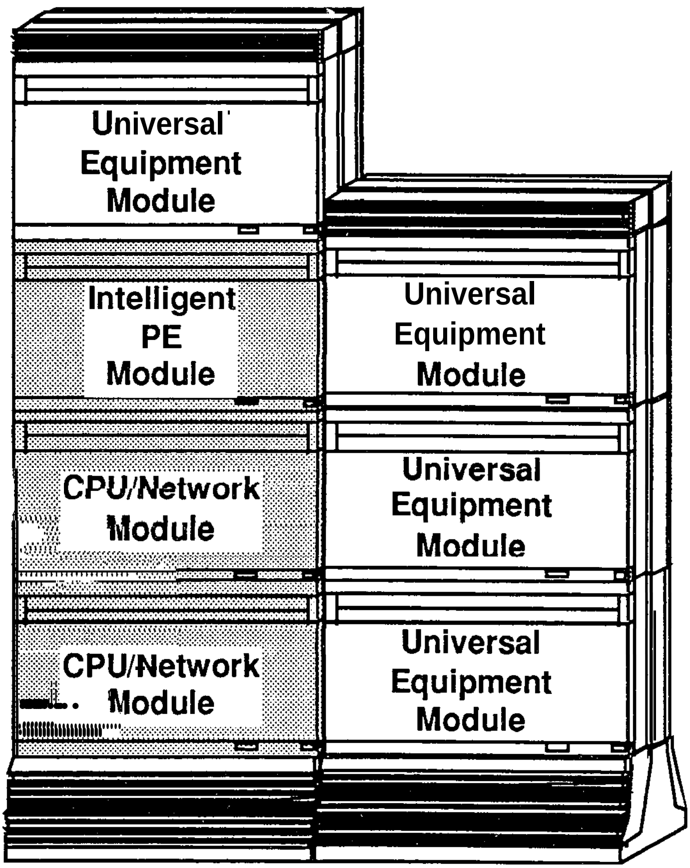


Table 4
System option 61 specifications

Power	AC or DC
Maximum Number of Ports	2000
Input Voltage	208 V ac or -48 V dc
Number of CPUs	2
Number of Network Loops	32
Cooling	Fan Impellers in pedestal
Memory	768K
Storage Media	Floppy Disk Unit or Multi Disk Unit
Software Generic	1111 Rls 15
Hardware Features	One Network Group, Standard Power Distribution Unit and Contains System Monitor (NT8D22AB)

Meridian 1 system option 71

The Meridian 1 system option 71 package includes 2 CPU Modules, 1 InterGroup module, 1 Network Group assembly, 2 Conference and TDS cards, 1 SuperLoop Network card, 2 SDI cards, 2 Intelligent Peripheml Equipment Modules, 2 Pedestal assemblies and 2 Top Caps. The FDU or MDU assembly must be added. Figure 28 shows a typical configuration with the shaded areas showing the base package.

Figure 28
System option 71

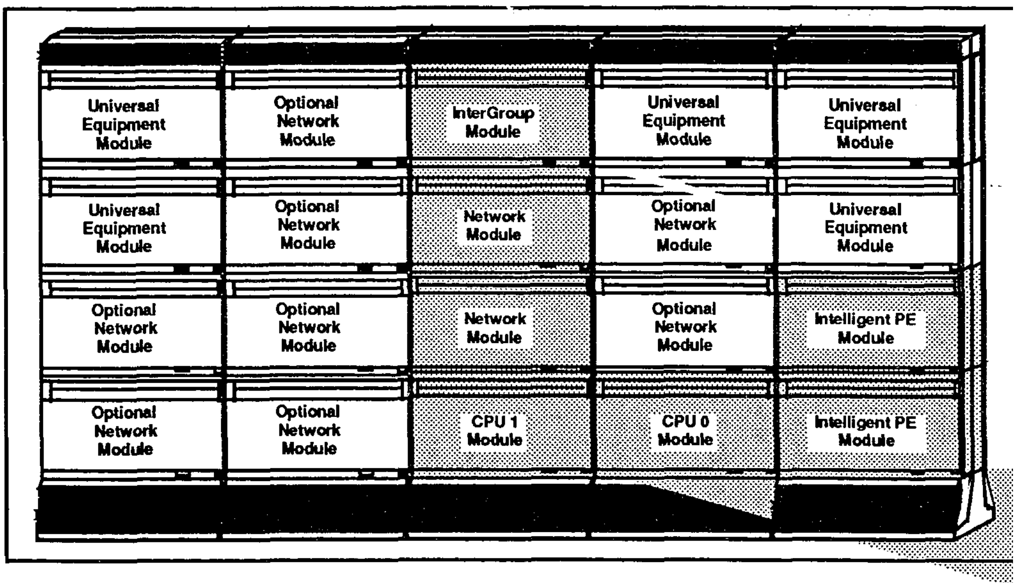


Table 5
System option 71 specifications

Power	AC or DC
Maximum Number of Ports	10,000
Input Voltage	208 V ac or -48 V dc
Number of CPUs	2
Number of Network Loops	160
Cooling	Fan Impellers in pedestal
Memory	1.5 Mbyte
Storage Media	Floppy Disk Unit or Multi Disk Unit
Software Generic	1211 Rls 15
Hardware Features	Up to five Network Groups, Standard Power Distribution Unit and Contains System Monitor (NT8D22AB)

List of terms

ACD

Automatic Call Distribution.

ADM

Add-On Data Module.

AIM

Asynchronous Interface Module.

ALU

Arithmetic Logic Unit.

Architecture

The interrelationship between the parts of a system. The framework of a system.

ASIM

Asynchronous/Synchronous Interface Module.

Analog

A process which models information in the form of a continuously varying parameter such as current, voltage, or phase.

Analog signal

A signal that varies in a continuous manner such as voice or music. An analog signal may be contrasted with a digital signal which represents only discrete states. The signal put out by a data set has both analog and discrete characteristics.

ANI

Automatic Number Identification.

Ampere

A unit of electrical current or the rate of flow of electricity which is equal to watts divided by volts.

Backplane

A printed circuit board that extends throughout the length of the shelf and connects to the circuit pack connectors. Also known as a motherboard.

Battery back-up

System power furnished by stand-by batteries that are charged by a charger. If commercial power fails, the batteries will maintain service for a limited period of time determined by the size of the batteries and the traffic on the system.

BISDN

Basic Rate Integrated Services Digital Network.

BTU

British thermal unit. The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at a specified temperature (as 39” F). Also means Bus Terminating Unit.

Capacity

The information-carrying ability of a telecommunications facility, group, network, or system measured in Bits Per Second.

Cards

See circuit packs.

Card Cage

Also referred to as card chassis. A frame for holding circuit cards in a microprocessor. A standard cage holds nine cards; units with motherboards can hold up to 20 cards.

CAS
Centralized Attendant Service.

CASM
Centralized Attendant Service, Main.

CASR
Centralized Attendant Service, Remote.

CC
Clock Controller.

CDR
Call Detail Recording.

CE
Common Equipment.

Central Office (CO)
The site where the telephone companies terminate customer lines and locate the switching equipment which interconnects those lines.

Central Processing Unit (CPU)
The main portion of a computer that contains the primary storage, arithmetic and logic units, and the control unit; Mainframe.

Centralized depot
A repair house for SL-1 systems that serves subdepots.

Centrex
Central Exchange. A telco PBX type of service incorporating Direct Inward Dialing (DID) and Automatic Identification of Outward Dialed Calls (AIOD).

Circuit packs
Also known as cards, circuit packs are individual circuit boards that carry the necessary electronics for particular functions (memory, disk drive control, etc.). These cards lit into expansion slots provided by Apple, IBM, Radio Shack, and other computer manufacturers.

CMA
Changeover and Memory Arbitrator.

CO

Central Office.

CPU

Central Processing Unit.

Common equipment (CE)

A hardware subsystem that houses one or more Central Processing Units (CPUs), memory circuits, mass storage devices, and service circuits.

Configuration

A group of machines (hardware) which are interconnected and are programmed to operate as a system.

Data Terminal Equipment (DTE)

Equipment or devices which are capable of transmitting and/or receiving data signals over a communications network commonly called a business machine.

dB

Decibel

DCHI

D-Channel Handler Interface.

Diagnostic programs

Software routines used to test equipment and pinpoint faulty components.

Digital

A process which models information as discrete values of some parameter such as voltage, current, or phase. Compare with analog.

Digital Multiplex Switching System (DMS)

A family of switching systems using new technology that provides digital circuit switched service for voice and data transmission. DMS is characterized by the use of pulse code modulation (PCM) and time division multiplexing (TDM) throughout the switched network. The system allows the direct switching of PCM signals without their conversion to analog format.

Digital signal

A signal made up of discrete, non-continuous pulses whose information is contained in theirduration, periods, and/or amplitude.

Directory number

The four-digit number or extension given to a Meridian SL-1 telephone set. Also known as DN.

DSL

Digital Subscriber Loop.

DTE

Data Terminal Equipment.

DTI

Digital Trunk Interface.

DTR

Digitone Receiver.

EIA

Electronics Industry Association.

EMI

Electromagnetic Interference. Unwanted electromagnetic coupling. Examples are ham radio heard on electric organs and church music heard in hearing aids. Also known as QRM or “static.”

ESN

Electronic Switched Network.

Failure rate

The estimated number of failures for that item during one million (106) hours of operation.

Firmware

A set of instruction sequences stored permanently in hardware (ROM).

FM

Frequency Modulation; A process whereby the frequency of a previously single frequency carrier wave is varied in step with the amplitude of a complex modulating wave. Also means Fully Modular.

Frame

A distributing frame. The structure on which all distribution and trunk cables into a central office are terminated (attached).

Frequency Division Multiplexing (FDM)

Combining two or more information channels into a single transmission channel by assigning each information channel an exclusive frequency band within the transmission channel bandwidth. (See “Multiplex” and “Time Division Multiplex.")

I/O

Input/Output; Refers to devices that communicate with customer equipment The result equals a properly functioning communications channel or system.

I/O Channel

Input/Output channel; A component in a computer system controlled by the central processing unit that handles the transfer of data between main storage and peripheral equipment.

I/O Panel

A separation plane that prohibits RF (Radio Frequency) emissions from passing through the cube and provides mounting for I/O cable connectors.

ISDN

Integrated Services Digital Network.

IVD

Integrated Voice and Data.

Kb/s

Kilobits per second.

Line

A communications channel or circuit; an electrical path.

Loop

A bidirectional path between network equipment and peripheral equipment.

MCDS

Multi-Channel Data System.

MDF

Main Distributing Frame. See "Frame" above.

MF

Multi-Frequency; A method of sending numerical address digits between telephone company switching centers coded as two or more frequencies between 300 and 3400 Hertz.

MFS

Multi-Frequency Signaling. Also means Multi-Frequency Sender.

MGS

Multi-Group Switch.

MSI

Mass Storage Interface.

MSL-1

Meridian SL- 1.

MSU

Mass Storage Unit.

Multiplex (MUX)

The process of combining two or more information channels into a single. transmission channel. (See "Frequency Division Multiplexing" and "Time Division Multiplexing.")

Network equipment (NET)

A hardware subsystem that provides digital multiplexed switching for voice, data, and signaling paths.

NFT values

The number of spares required for a field-replaceable item. NFT is calculated by multiplying the number (N) of that item in use by the failure rate (F) for the item from Appendix 1 by the turnaround time (T) in hours. (N X F X T = NFT value.) See Appendix 1 for details.

NTP

Northern Telecom Publication.

ODAS

Office Data Administration System; provides a method of retrieving administrative information stored in Meridian SL-1 memory.

Office data

Office data represents system configuration data, peripheral equipment data, and transient data (temporary) used for call processing.

PBX

Private Branch Exchange.

PCM

Pulse Code Modulation,

PDU

Power Distribution Unit.

PE

Peripheral Equipment.

Pedestal

Base assembly upon which Universal Equipment Modules are stacked; The pedestal houses the Power Distribution Module, System Monitor, Blower Module (and/or Fan assembly), Harnessing, and Air Grille and Filter units.

Peripheral equipment

A hardware subsystem that provides analog and digital telephone and trunk interfaces and houses a combination of line, trunk, and receiver packs.

Population range

The quantity of each type of SL-1 switch in the area served by a repair-house depot. See Appendix 1 for details.

Power supplies

Individual units that generate the different DC voltages required by backplanes installed in a module. Their primary function is to provide power to a shelf of cards housed within a UEM.

PRA

Primary Rate Access.

PRI

ISDN Primary Rate Interface.

Private Branch Exchange

PBX; A small telephone switching center enabling a customer's telephone stations to connect to the public switched network.

Private Exchange

A private (manual) telephone exchange that provides private telephone service to an organization that does not allow calls to be transmitted to or from the public telephone network.

PROM

Programmable Read-Only Memory.

Public Switched Network

The Direct Distance Dialing (DDD) telephone network; Any exchange type of service that is made available for public use.

Pulse Code Modulation (PCM)

A modulation technique whereby the signal is converted from an analog to digital format by sampling the signal at periodic intervals and digitizing the amplitude into a finite number of discrete levels; Five-bit information code.

RAM

Random Access Memory; Storage system or computer memory that is accessible by the user for either storing or retrieving information. RAM is volatile memory.

Redundancy

The duplication of software/hardware used as a standby in case one fails (redundant CPUs).

Retrofit

To furnish with new parts or equipment not available at the time of manufacture.

RF

Radio Frequency; A group of electromagnetic energy waves whose lengths are between the audio range and the light range.

RFI

The disruption of radio signal reception caused by any source which generates radio waves at the same frequency and the same path as the desired wave.

RH

Relative Humidity.

ROM

Read Only Memory: Storage system or computer memory that is “burned into” the microprocessor chip and can only be read, not written to or modified. Non-volatile memory.

RPE

Remote Peripheral Equipment.

Satellite operation

The operation of a telecommunications system at a remote location as a‘ completely unattended system connected to the main system by special point-to-point circuits. The two (or more) systems act as one total system served by attendants at the main system.

SBE

Segmented Bus Extender.

SDI

Serial Data Interface.

SEQ

Sequencer.

Single depot

A repair house that services SL- 1 systems.

Software

A set of programmed instruction sequences stored either as resident programs in the system memory or as non-resident programs on disk which are loaded into memory when needed.

Software generic

A term used to describe the software package being used. Each software generic (X11, for example), has a series of releases (like release 8).

Spare stock size

The quantity of spares for a given stock item.

Sparing interval

The period of time that stocks of replaceable SL-1 items should last without being replenished.

Stock confidence level

The allowed probability of not being out of stock when the sparing interval of one year is greater than 99. 9 percent.

System hardware

Hardware configuration.

System monitor

A microprocessor-based circuit pack used to monitor the UEM (Universal Equipment Module) power supplies, stack thermal status, and fan operation status. Each system monitor reports its status to the system CPU, and the head (master) system monitor checks their statuses. The master system monitor will trip the stack circuit breaker in the event of a problem (excessive temperature, for example).

TCM

Time Compression Multiplexing.

TDS

Tone and Digit Switch.

Time Division Multiplex (TDM)

Combining two or more information channels into a single transmission channel by assigning each information channel an exclusive periodic transmission time interval. (See "Multiplex: and "Frequency Division Multiplex. ")

Top cap

A drip-proof cover for the UEM (Universal Equipment Module). It provides airflow exits, RF/EMI shielding, I/O cable entries/exits, and overhead cable-rack mounting.

3PE

Three-Port Extender.

Trunk

A single circuit between two points, both of which are switching centers or individual distribution points.

TTY

Teletype machine.

2DFi

Two-Way Tie, Dial Repeating.

Turnaround time

The number of days it takes to replace a failed item and to return a useable item to stock.

UEM

Universal Equipment Module; a modular, self-contained hardware cabinet (or cube) that houses a card cage assembly, its associated circuit packs, power supplies, and I/O panels. A Meridian SL-1 system may consist of stacks of UEMs.

UPS

Uninterrupted Power Supply.

VAC

Voltage Alternating Current.

VDC

Voltage Direct Current.

VDT

Video Display Terminal; monitor.

SL-1

System options 21, 51, 61, 71

System overview

information subject to change without notice.
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SL-1

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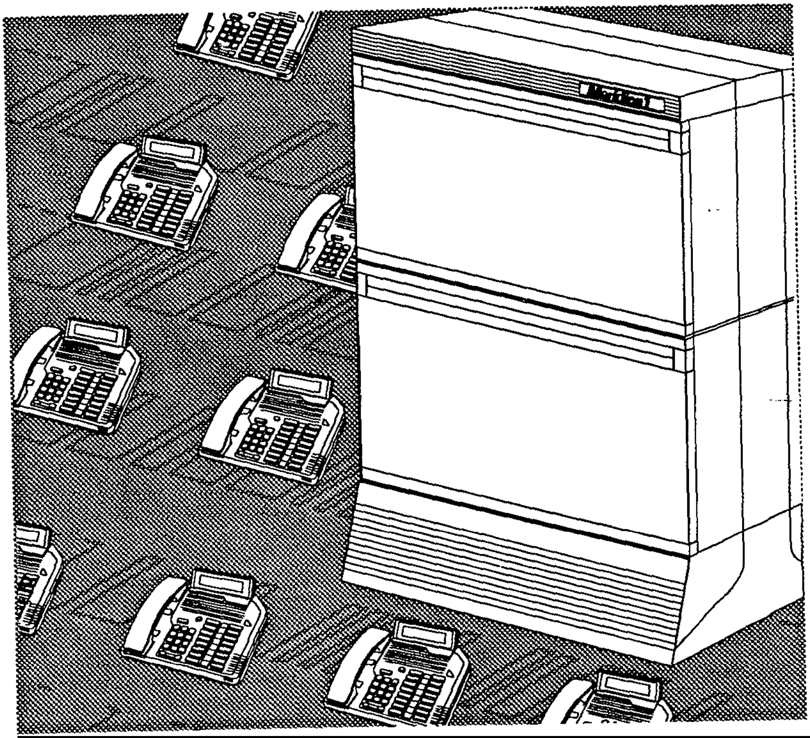
Installation planning

Standard



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Meridian 1
Communication Systems

SL-1

System options 21, 51, 61, 71

Installation planning

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January 29, 1990

Standard, release 1.0

Preface

Notice

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

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

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

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION
Proper electrical ground connections
Users should not attempt to make electrical ground connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate.

About this document

This section of the Planning and engineering guide deals with planning the environment that the SL-1 (Option 21, 51, 61, and 71) system will inhabit, including equipment location, commercial power requirements (AC and DC), grounding, and cabling requirements. Most of the considerations for site planning and installation are common for both AC- and DC-powered systems. Where there are differences, these are noted in the applicable sections. The information is intended to assist with the site selection, site planning, and installation planning process.

References

See the SL-1 planning & engineering guide for

— *Muster index* (553-3001-000)

— System overview (553-3001-100)

— *Installation planning* (553-3001-120)

— *System engineering* (553-3001-151)

— *Power engineering* (553-3001-152)

— *Spares planning* (553-3001-153)

— *Equipment identification and ordering* (553-3001-154)

See the list of line and trunk circuit descriptions in the *Muster index* (553-3001-000) for specific references to lines and trunks.

See the SL-1 installation and maintenance guide for

— *System installation procedures* (553-3001-210)

— *Circuit pack installation and testing* (553-3001-211)

- ***Installation procedures for telephone sets and attendant consoles*** (553-2201-215)
- ***Extended systems installation*** (553-3001-250)
- ***Disk drive upgrade procedures*** (553-3001-251)
- ***General maintenance information*** (553-3001-500)
- ***Fault clearing*** (553-3001-510)
- ***Hardware replacement*** (553-3001-520)

See the SL-I XII software guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- ***XII software management*** (553-3001-300)
- ***X11 features and services*** (553-3001-305)

See the SL-1 XII input/output guide (553-300140) for a description of all administration programs, maintenance programs, and system messages.

Related documentatiori

The following documents contain information that may be of value during the site planning and preparation process.

- 1987. "Maintenance, Testing and Replacement of Large Storage Batteries." IEEE, Vol. 450: all pages.
- 1987. "Design and Installation of Large Lead Storage Batteries." IEEE, Vol. 484: all pages.
- 1981, 1982, 1983. ANSI/IEEE Standard, Vols. 484, 142, 81: all pages. (484-1981; 142-1982; 81-1983)
- 1984. Gaseous Hydrogen Systems. NFPA, Vol. 50A: all pages.
- 1984. National Electrical Code. NFPA, Vol.. 70: all pages.
- 1986. Canadian Electrical Code. Canadian Standards Association, C22-1-1986
- Grounding Electrode System
  (NBC Articles: 250-23, 250-26, 250-54, 250-8 1, 250-83, 250-84 and, 250-86)

  (CEC 10-204, 10-206, 10-504, 10-520, 10-700-710)
- Grounding Electrode Conductor
  (NEC Articles: 250-23, 250-26, 250-51, 250-53, 250-9 1, 250-92 and, 250-94)

  (CEC 10-500, 10-502, 10-804, 10-808, 10-812)

- Grounded Conductor (i.e., Neutral)
  (NEC Articles: 250-26, 250-50, 250-51, 250-53 and, 250-61)

  (CEC 10-206, 10-900-908, 10-500, 10-502, 10-518)
- Equipment Grounding Conductor (NEC Articles: 250-50, 250-5 1, 250-53, 250-57, 250-91, 250-32, 250-92 and; 250-95)

  (CEC 10-900-908, 10-500, 10-502, 10-510, 10-804, 10-300, 10-302)
- Main Bonding Jumper (NEC Articles: 250-23, 250-26 and, 250-61)

  (CEC 10-204, 10-206, 10-518, 10-520)
- Grounding Evaluation-Practices and Equipment, ECOS Electronics Corporation, 205 West Harrison Street, Oak Park, IL 60304
- Full of Potential. James G Biddle Co. Plymouth Meeting, PA 19462.
- Protection of Electronic Computer/Data Processing Equipment -NFPA 75
- MIL-Handbook - 4 19 (raised floor installation requirements)
- "Network Equipment Building Systems Generic Equipment Requirements" specification TR-EOP-000063. Bellcore.
- OSHA - Occupational Safety and Health Administration Standards (29 CFR 1910)
- Recommended Practice on Static Electricity - NFPA 77
- Soares Grounding Electrical Distribution Systems for Safety
- Uniform Building Code 1982
- Local building codes

Note: If a conflict arises between a code included in this document and a local or national code, follow the local or national code.

Contents

Planning activities

The installation outline

Since installations differ from site to site, no single overall schedule of predelivery activity will apply in all cases. In each instance, prepare a detailed plan when the site has been selected and the equipment ordered. Use Table 1, "Outline for installation planning, " as a guide for making a detailed checklist. Use Table 2 for listing the activities that are involved in site preparation.

Table 1
Outline for installation planning

Items	Procedures
Research	Read the requirements identified in this document. Establish equipment environment, air conditioning requirements, floor loading requirements, and other requirements listed in this section.
Select a site	Check space, location, power and grounding, and delivery issues.
Develop the site	Produce a detailed checklist. Use this outline as a guide.
Prepare for delivery	Prepare equipment room environment and delivery route. Ensure safety conditions. Establish fire prevention.
Prepare for installation	Obtain work orders, equipment room floor plans, cabling plans, manuals, installation plans, preinstallation inspections, and delivery equipment.

Table 2
Site planning activities

Activities
Perform detailed site survey. Determine if building wire needs verification and gather preliminary customer data.
Hold contract review meeting.
Prepare project plan.
Hold customer meeting to discuss project plan and division of responsibilities.
Hold Construction Phase site survey to prioriiize site development tasks.
Identify environmental, space, power and grounding requirements and prepare site accordingly.
Gather customer data.
Perform site inspections to ensure site is ready for installation.
Plan customer user training.
Note: In all the activities above, the Northern Telecom distributor is generally responsible to ensure that these activities have been implemented.

The Milestone chart

Planning and monitoring site preparation activites is easier when you use a Milestone chart. The Milestone chart is a site planning schedule. It shows the sequence of activities necessary to complete a job and will be different with each site. Depending on the complexity of the site, the chart may be more detailed with scheduled due dates for each activity group.

When preparing your Milestone chart, consider not only the individual operations, but the overall installation schedule. A Milestone chart may show the necessary operations in order and may assign a start date and end date for each.

Remember to obtain the appropriate sign-offs when the site is ready for delivery and installation of the equipment. Sign-offs may include regulatory items such as electrical and air conditioning inspections and the approval of the cable plan.

Table 3 lists typical activities that should be included in the Milestone chart. Your chart may differ from this one.

The first Milestone prior to delivery should be used to prepare specifications and drawings, request bids, order equipment related to the site preparation, and begin renovations or construction of the equipment room.

Table 3
Milestone chart

l	Select the site.
	Plan the equipment room layout.
	Plan power and grounding, reserve and/or battery requirements.
	Plan cable requirements.
	Plan and start renovations to implement equipment room layout.
2	Continue site construction and renovation tasks.
	Install power, grounding, reserve power, air conditioning, and heating.
	Install special rigging such as overhead cable racks and distribution frame equipment as required.
	Test site wiring to ensure minimum requirements are met.
3	Complete construction and ensure power and grounding are in place.
	Test air conditioning and heating systems.
	Complete final equipment room inspection identifying and resolving any delivery constraints.
	Make equipment delivery arrangements.

Note: The Milestone chart shown is only an example of the activities recommended for site preparation. Depending on the complexity of the site, the chart will be more detailed with scheduled due dates (milestones) for each activity group.

Researching the requirements

Knowing the requirements for system installation saves valuable time and energy when the time comes for system delivery. The first step in planning a site, then, is researching those requirements. The purpose of this section is to define the general requirements necessary to plan and develop the site before system installation.

General requirements

The following general requirements must be considered (in addition to local and national building and electrical codes) when planning the installation of an SL-1 system:

- Equipment room environment (including preliminary floor plan and system layout)
- Power and grounding requirements
- Cabling requirements (including guidelines for ordering correct cable lengths)
- Fire protection (including location of sprinkler heads) and safety precautions

The equipment room environment

The environment that the SL-1 operates in and that spare parts are stored in can influence system performance and reliability. When establishing the equipment environment, control over these factors is necessary:

— temperature and humidity

— static electricity

— vibration

— electromagnetic/radio frequency interference

— dust

— lighting

— floor/walls/ceiling materials

Note: The location must provide sufficient cooling for efficient operation of the equipment and a suitable operating environment for the system.

CAUTION
Heat sources near equipment
Equipment exposure to absolute limits should not exceed 72 hours. Since temperature readings are taken at the front of the equipment and above the floor, no heat sources (such as floor heaters) should be placed near the equipment.

Table 4 shows the SC-1 operating environment:

Table 4
SL-1 operating environment

Equipment	Temperature and humidity considerations
Terminals (sets)	Absolute 0-50° C (32-122° F), RH 20-80%, non-condensing
SL-1	
Recommended 15-30" C (59-86" F) RH 20 to 55%, non-condensing	Absolute 10-45° C (50-113° F) RH 20 to 80%, non-condensing temperature change less than 10° C (18° F) per hour
Auxiliary (terminals and printers, for example)	Refer to specific NTP document or manufacturer's guidelines.

Note 1: Temperature readings should be taken 30 inches (760mm) from the front of the system.

Note ***2:*** Frequent and extended operation above the recommended temperature limits may degrade system reliability.

Note ***3:*** The CE/PE power supply, MDU, and FDU units must be located in the lower two module positions when the system is operated above the recommended temperature limits.

In addition to proper operating temperatures and humidity considerations, the SL-1 should be stored and/or transported under the following specifications:

Table 5
SL-1 storage/transportation environment

Equipment	Temperature and humidity considerations
Terminals (sets)	Absolute -50 to 70" C (-58 to 158° F) RH 5-95%, non-condensing
SL-1 Recommended 1 5-30° C (59-86° F) RH 20 to 80%, non-condensing	Absolute -20 to 60" C (-4 to 140" F) RH 5 to 95%, non-condensing temperature change less than 20° C (36° F) per hour
Auxiliary	Refer to appropriate Northern Telecom Publication
Floppy diskettes	Absolute 4-53° C (39-i 27" F) RH 8-90%, non-condensing temperature change less than 20° C (36° F) per hour

Environmental factors

Temperature and humidity

High temperatures tend to increase the rate of deterioration of most materials. Temperature fluctuations can cause temporary or permanent changes to equipment which can affect the grade of service. Low humidity conditions can increase the build up of static electricity, while high humidity can have an adverse effect on the performance of disks, tapes, and printers.

Static electricity

Microelectronic circuits are extremely sensitive to static discharge. Static discharge can cause permanent damage to any circuitry and/or interruptions in system operation and the loss of data. Static electricity could be the result of physical vibration, friction, and separation of materials. The most common collectors of static electricity are people.. Other common causes of static electricity build-up are low humidity, certain types of carpeting, the use of wax on equipment room floors, and plastic-soled shoes.

Plastic-soled shoes, for example, are noted for generating large amounts of static electricity. The insulative nature of the shoes, and certain flooring materials and levels of humidity, can cause the wearer to accumulate and carry body charges in excess of 15 kV.

> Note: IEEE Standard 142-1982 recommends that flooring resistance should be more than 25,000 Ω and less than 1 million megohms, measured by two electrodes 3 feet (0.91 m) apart on the floor. Each electrode must weigh 5 lb (2.2 kg) and have a dry flat contact area of 2.5 inches (63.5 mm) in diameter.

Some products that prevent static discharge include sprays, anti-static mats, and wrist straps.

Vibration

Vibration can cause slow deterioration of mechanical parts and, where severe, can cause serious disk errors. Structure-borne vibration and consequent noise transferred to the equipment room should be avoided. Raised floors should have extra support jacks at strategic places to prevent the transmission of vibration.

Vibration in the office environment should be limited to a frequency range of 0.5-200 Hz and a G-force magnitude of 0.1 G (according to the Bellcore Network Equipment Building Systems Generic Equipment Requirements specification TR-EOP-000063).

Electromagnetic Interference (EMI)

Sources of EM1 located close to the equipment may have an effect on system operation. Common EM1 sources known to disturb system operation are:

- thunderstorms, static electricity, high-voltage power lines
- radar, broadcast stations, mobile communications
- power tools, appliances (vacuum cleaners), and office business machines (copiers)
- industrial machines and ultrasonic cleaners
- vehicle ignition, arc welders, and dielectric heaters
- dimmer switches

Note: The SL- 1 system meets the United States Federal Communications Commission (FCC) Rules, Part 15, Subpart J and Canadian Standards Association (CSA) C108.8 for radio frequency interference and/or electromagnetic interference (RFI/EMI) radiation.

Dust

Average dust density for an office environment must be Zone 4 ($0.00014 g/m^3$) or better. False ceilings and tiled floors help maintain dust density requirements. Accumulation of dust and dirt can:

- scratch gold contacts on printed circuit packs, causing intermittent failures
- have conductive contents, increasing component susceptibility to damage by static electricity
- cause components to operate at higher temperatures
- be detrimental to system reliability and performance and increase maintenance and warranty costs

Lighting

Lighting illumination of 50-75 footcandles measured 30 inches (76 cm) above the equipment room floor is recommended. Lighting must not be powered from the equipment room power panel. For large system installations, provisions for emergency lighting in the equipment room should be considered. Direct sunlight in the equipment room should be avoided to prevent the malfunctioning of devices which employ light sensors (magnetic tape and disk units).

Earthquake bracing

In some equipment room environments, the need for earthquake bracing should be considered or may be required. See the ***System installation procedures*** (553-3001-210) for detailed instructions on how to install proper earthquake bracing.

Structural

Floors should either be sealed concrete, vinyl, or mastic tile and should meet floor loading requirements: avoid using sprayed ceilings or walls.

Air conditioning requirements

The air conditioning provided must be capable of handling the heat produced by the SL-1 system, as well as the additional heat produced by equipment room personnel, lighting, and the heat input of external walls, windows, floors and ceilings enclosing the room. A stable ambient operating temperature of approximately 22° C (72” F) is generally recommended. The temperature differential in the equipment room should not exceed ±3.0° C (± 5° F).

Note: For systems using reserve power batteries, consult the manufacturer’s specifications for recommended operating temperatures.

Heat dissipation of a system is estimated in BTU/hr. The amount of air conditioning required can be estimated at a rate of one U.S. ton of refrigeration for every 12,000 BTU/hr of heat generated by the equipment and equipment room personnel, plus one ton for each 500 square feet of floor space. Each person in the equipment room generates 600 BTU/hr.

These guidelines should be used along with the following tables when estimating air conditioning requirements. Exact requirements should be determined by a qualified air conditioning engineer.

CAUTION
Proper air conditioning standards
Digital systems require constant power regardless of the level of system activity (idle or busy) and therefore generate heat continuously. Ensure that proper air conditioning standards are met at all times.

Table 6 shows the maximum power dissipation in the form of heat for each SL-1 Module. These figures apply to both AC- and DC-powered systems. The power figures listed here do not necessarily correspond to total input power, since some of the power - especially for peripheral equipment - is distributed out to the sets and is not dissipated within the system.

Table 7 shows the maximum heat dissipation for some of the external DC power equipment supplied by Northern Telecom.

Table 6
SL-1 system heat dissipation

	Heat dissipation	
Module	Watts	BTU/hr
NT8D11 Common/Peripheral Equipment	450	1530
NT6D39 CPU/Network	400	1360
NT8D34 CPU	300	1020

-continued-

Table 6 continued
SL-1 system heat dissipation

Module	Heat dissipation Watts	BTU/hr
NT8D35 Network	300	1020
NT8D13 Peripheral Equipment	300	1020
NT8D37 Intelligent Peripheral Equipment	425	1450
NT8D47 Remote Peripheral Equipment	300	1020
NT8D36 InterGroup	0	0

Note: Thermal load (BTU/hr) = Total power dissipation (Watts) x 3.4

Table 7
External power equipment heat dissipation

Equipment	Heat dissipation Watts	BTU/hr
QRF12B 30A Rectifier	200	680
NT5C03 50A Rectifier	290	990

Note: Thermal load (BTU/hr) = Total power dissipation (Watts) x 3.4

Sk-l system power options

The SL-1 system is available in both AC and DC versions where DC power is connected to the commercial power panel by means of extended power rectifiers or power plants, and the AC power is connected directly to the commercial power panel. If an Uninterruptable Power Supply (UPS) is used in conjunction with the AC SL-1 system, the UPS connects to the commercial AC source and the SL-1 system columns are connected to the UPS. The SL-1 is available with the following power options:

— DC-powered systems

— DC power with reserve power (backup)

— AC-powered systems

— AC power with reserve power (backup)

For AC-powered SL-1 systems each column of equipment should have an AC receptacle provided within 10 feet of the column's pedestal. If the system is equipped with a UPS, the AC source should feed to the location of the UPS (see the UPS vendor's specifications). The UPS will then feed the equipment columns.

For DC-powered SL-1 systems the commercial source feeds to a centralized rectifier rack or to a centralized power plant. The rectifier rack/power plant provides -48 V dc to the system.

In either case the power connections to the SL- 1 system can be provided through the floor or by means of overhead racks.

DC-powered SL-1 systems

DC-powered SL-1 systems, which use direct current UEM power converters, operate at a nominal -48V dc. UEMs in a column are fed DC power from the pedestal Power Distribution Unit (PDU). The pedestal is powered from an external DC power plant

The NT7D12AA rectifier rack contains up to three NT6D52AA recitifers which operate from a nominal 120/240 V ac at 30 Amps. This configuration is typically used for Options 21, 51, and 61. The QCA13 power plant contains up to four NT5C03BJ rectifiers which operate from a nominal 208V/230 V ac at 23/21 Amps. This configuration is typically used for Option 71.

A typical column operating at -48 V dc using four UEMs will draw up to 60 Amps depending on the configuration.

Commercial power requirements for the DC power plant depend on the system size and power plant configuration. All SL-1 systems can be powered by customer-supplied or Northern Telecom-supplied -48 V dc. Refer to ***Power engineering*** (553-3001-152).

Reserve Power-DC-powered systems that require reserve power use battery backup. For battery requirements, refer to ***Power engineering*** (553-3001-152).

AC-powered SL-1 systems-

Power converters in SL-1 systems, which use alternating current, operate at a nominal 208/240 V ac. A typical system operating from 208 V using four UEMs will draw 15-25 Amps depending on the configuration. These are fed from a central point in the pedestal; access to these connections is provided and should be used to confirm that the line voltage is within the required range.

Reserve power-AC-powered systems with reserve power use an Uninterruptable Power Supply (UPS). The UPS must be installed according to the vendor's specifications. The UPS installation should be inspected and signed off prior to starting the SL-1 system installation.

Commercial AC power source

Although some smaller DC systems may use rectifiers that can be configured for 120 volts, Northern Telecom recommends that all systems use single-phase 240 volt or 208 volt single phase which is 208Y derived:

Input power specifications

The following tables provide input system power specifications as required for **AC** power:

Table 8
Input power specifications

Input		Minimum	Nominal	Maximum
Voltage (VAC) at pedestal		180	2081240	250
Frequency (Hz)		47	50/60	63
Transient tolerance (See note)				
	Amplitude		Duration	
Surges	288 V ac		8.34 mS to 50 mS	
	276 V ac		50 mS to 500 mS	
Sags	146Vac		8.34 mS to 50 mS	
	166Vac		50 mS to 500 mS	
Spikes	815 V pk		<4.17 mS	
	815 V pk to 408 V pk		4.17 to 8.3 mS	
Notches	to ov		<4.17 mS	
	0 V to 206 V		4.17 mS to 8.3 mS	

Note: These values are taken from the National Electric Code and various Telco specifications. All transients are applied at the peak of the AC waveform.

Commercial power conditioning

If the quality of the commercial power source continuously meets the SL-1 system requirements listed in this section, a power conditioner is not required, however, where the commercial power is of poor quality and cannot consistently meet the SL-1 system requirements, a powerconditioner may provide some improvement.

> *Note:* When using power conditioning equipment, simply install the equipment in series with the commercial power feed. Do not modify the SL-1 system grounding scheme.

Grounding

Essential to trouble-free system operation and the safety of personnel is the employment of proper grounding. The SL-1 system has several different grounds and signal returns that are generally referred to as grounds: logic return (for DC systems), AC "green wire" ground (in AC systems), and the personal hazard equipment ground.

The SL-1 system does not, by design, need an AC isolated ground (IG) system (though this may be required by local codes), but it does need a single point ground system. This means that each of the various grounds from each of the columns should terminate at a single connection point before attaching to the actual ground reference at the main AC panel or transformer. The single point ground may be implemented either by use of the isolated ground bus in the AC panel, or by a separate logic return equalizing bus for battery returns and logic returns where a non-isolated AC system is used.

The SL-1 system power must originate from the supply service (main AC panel or transformer) where the ground conductor and the neutral conductor connect and are referenced to the main building ground (MGM). Cold water pipes and ground rods should only be used to improve the ground reference of the building's main service panel. Do not use the MGM as the ground reference for the SL- 1 system.

The DC resistance of the system ground conductor, which runs from the SL-1 to the main building ground, should be as close to zero as possible with the maximum total resistance on all runs within the building not to exceed 0.5 ohms.

Failure to follow the grounding proceduresmay result in an installation that is:

- unsafe for personnel working on or using the equipment
- not protected from lightning or power transients
- subject to service interruptions
- subject to degraded system performance

Commercial power and grounding requirements

The commercial power source refers to the main AC utility power feed, for either AC-powered or DC-powered systems. For AC systems, this power is wired directly to the system. For DC systems, this power source connects to the rectifiers which convert to -48 V dc for distribution to the system.

In North America, the power supplied can be either 208Y or 240 V ac nominal. Three phase is not required by single power feeds fromalternate phases is normal practice where three phase power is available. Refer to Table 8 for the exact voltage range.

Building ground requirements

Although the SL- 1 system (by design) does not require an isolated AC ground system, the NEC does. For this reason Northern Telecom --- recommends the use of an isolated AC ground system. Non-isolated ground systems are acceptable only where not required by a national code.

This system does not need an isolated AC ground system, but it does need a single point ground system. Single point ground may be implemented either by the use of an Isolated Ground (IG) bus in the AC panel to terminate all AC grounds and other ground reference conductors, or by a separate logic return equalizer (LRE) ground bus for system ground and logic returns where a non-isolated AC system is used.

> ***Note:*** Where required, Northern Telecom will provide an LRE with each system delivery. Multi-column systems require the use of an LRE.

Isolated ground topology

A dedicated Isolated Ground (IG) bus bar is required with this method. This IG bus is located in the AC panel and serves as the ground window. It is used for all AC (green wire) grounds as well as logic returns. It also accommodates a conductor which references to the (+) battery bus in a DC system. An alternate form of this isolated topology is to use one or more isolated equalizing bars external to the AC panel but which connects to ground exclusively by means of the AC IG bus.

Isolated orange outlets are required (as per NEC 250-74 Exception 4). Grounding conductors shall be routed with the phase conductors (Article 300-20). All ground wiring-for IG receptacles are to be terminated on the dedicated IG bus per applicable codes (complies with NEC 384-27).

Non-isolated ground topology

In a non-isolated system the AC equipment ground (ACEG) connects to the metal panel, and the associated conduit may also contact various structural metal. This ground alone is not adequate for the SL-1 system, but a dedicated ground conductor which connects to the main building ground is then used for the main ground window to terminate logic returns and reference the (+) battery bus. Frame grounds will connect to the ACEG.

Grounding guidelines

The following must be observed to implement the single-point ground:

- All ground conductors must be identified in accordance with local codes and terminated in a manner that is permanent, resulting in low impedance connections.
- Terminations should be accessible for inspection and maintenance during the life of the installation.
- All grounding conductors must be continuous with no splices or junctions and tagged, **"Do not remove or disconnect."**

  They should also be insulated against contact with foreign grounds.
- Grounding conductors must be no-load, noncurrent carrying cables under normal operating conditions.

— In a steel-framed building, the SL-1 ground interface must have a connecting reference to the building steel on the same floor on which it resides (or within one floor).

Note: Northern Telecom does not recommend the use of building steel as part of the SL-1 ground system.

Proper wire sizing of the System Ground Reference conductor ensures compliance with this requirement provided the building ground has been properly installed as per NEC rules and regulations and the associated CEC regulations.

Using an Isolated Ground bus is often a lower cost method but may not be allowed by all telcos and may be prohibited by local ordinances.

Note: All voice and data lines leaving or entering the SL-1 system (which run external to the building) must have fault protectors that connect directly to earth ground. Fault protectors provide EMI/RFI protection outside of the SL-1 system.

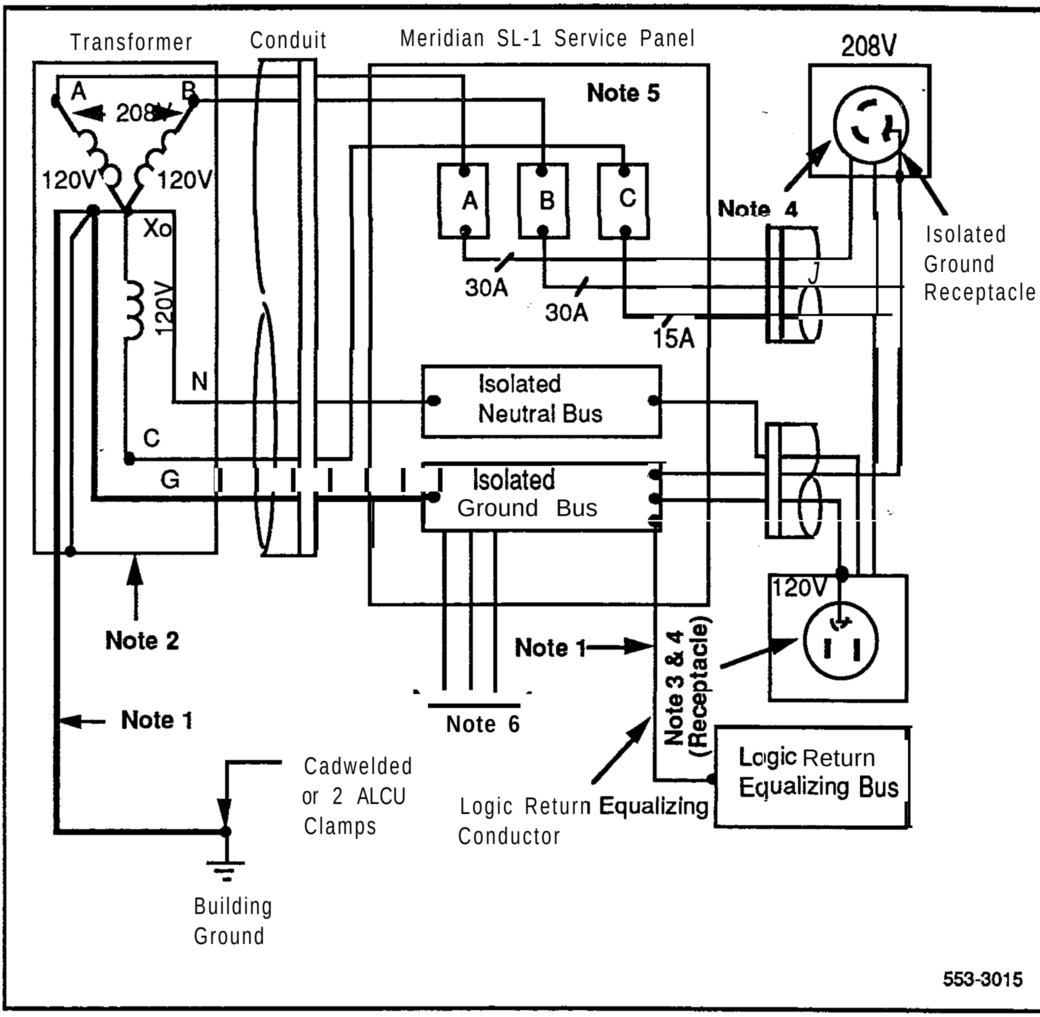
AC service panel

Dedicated versus shared power

Dedicated AC power transformers are preferred; however, a shared transformer or distribution is acceptable.

The following figures identify the differences between dedicated and shared distribution and between isolated and non-isolated grounds:

Figure 1
Dedicated transformer in isolated ground system



Notes for Figure 1:

1 Ground conductor should be the same size as the largest conductor run between the transformer and the AC panel.

2 Transformer (dedicated for SL-1 and Telco Interface Equipment) shall provide a secondary voltage of single phase 120/240 or three phase 208Y/120V and must have a system ground conductor.

3 Receptacles: All 120V service drops in the equipment room must have IG type receptacles. Each circuit must have individual hot, neutral, and ground conductors.

4 NEMA numbers for receptacles are:

208/240 @ 30 A IG-6-30

120 @ 15 A IG-5-15

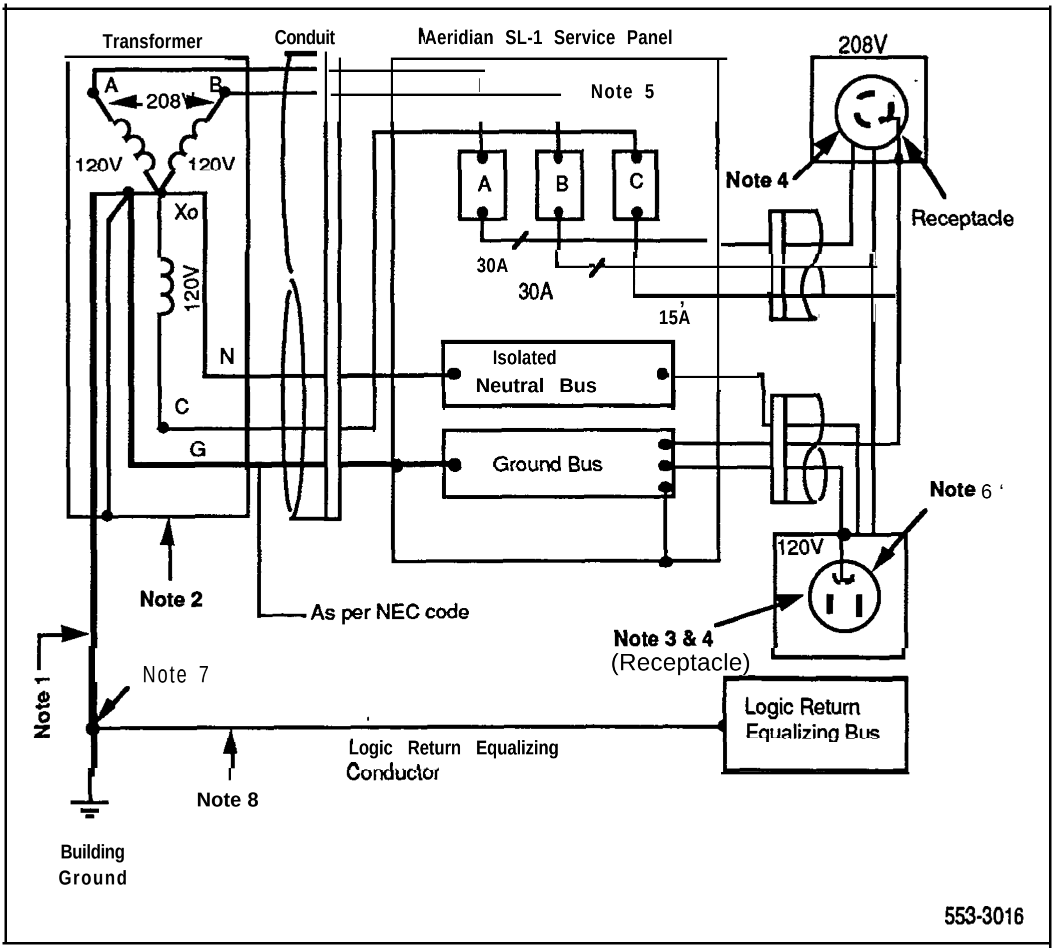
Panel circuit breakers are:

208V/240V 30A

5 A dedicated service panel should be located in the equipment room.

6 If the service panel has sufficient terminating points on the isolated ground bus, the logic return equalizer may not be required.

Figure 2
Dedicated transformer in non-isolated ground system



Notes for Figure 2:

1 Ground conductor should be the same size as the largest conductor run between the transformer and the AC panel.

2 Transformer (dedicated for SL-1 and Telco Interface Equipment) shall provide a secondary voltage of single phase 120/240 or three phase 208Y/120V and must have a system ground conductor.

3 Receptacles: Each circuit must have individual hot, neutral, and ground conductors.

4 NEMA numbers for receptacles are:

208/240 @ 30 A L6-30

120 @ 15 A 5-15

Panel circuit breakers are:

208V/240V 30A

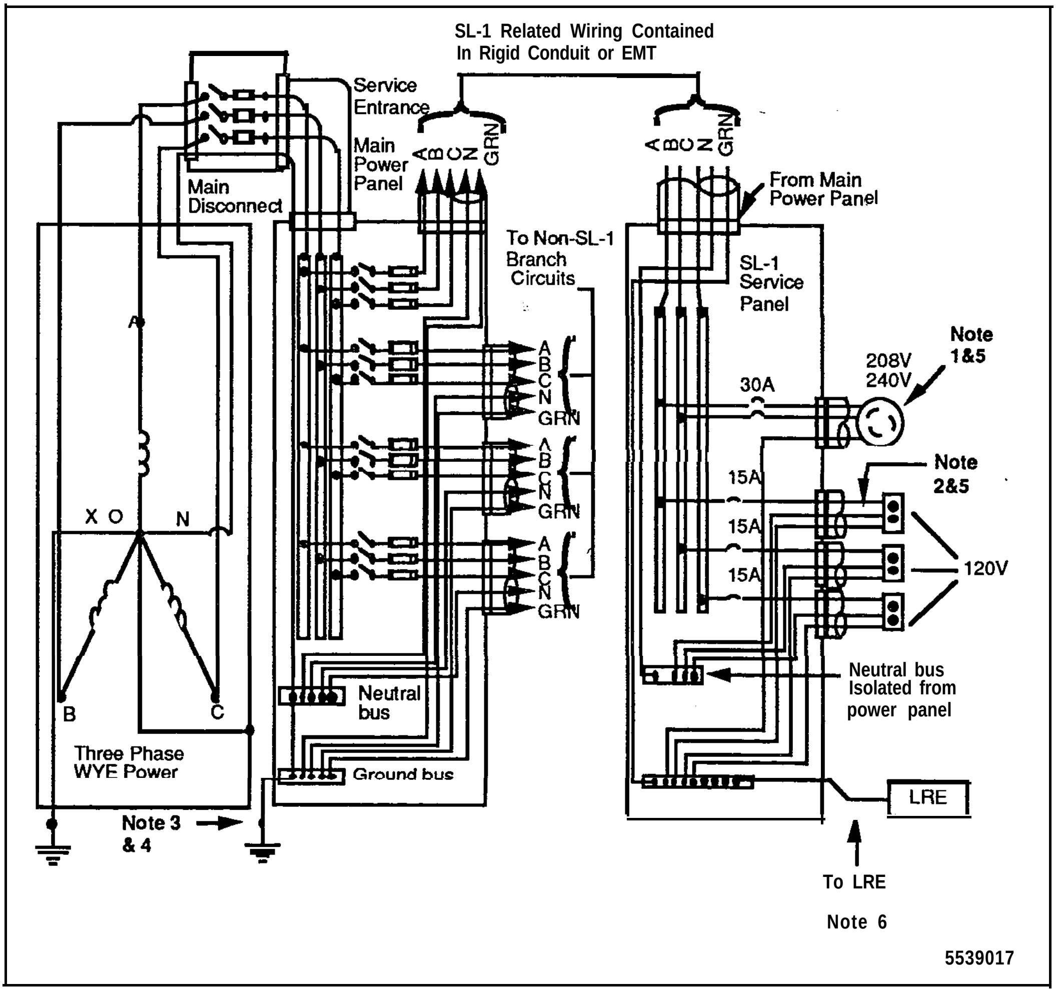
5 A dedicated service panel should be located in the equipment room.

6 Auxiliary equipment using an RS-232 interface will, if such equipment is too remote to be powered from the SL-1 service panel, require a modem or fiber link to provide ground isolation.

7 Connection to the building ground source should be made at the same physical location as the transformer grounding conductor. If the LRE is connected to a building ground point other than the transformer ground point, a bonding jumper must be installed between the two points.

8 Two approved fastening devices or cadwelded devices should be used here.

Figure 3
Shared AC distribution in an isolated ground system



Notes for Figure 3:

1 An isolated ground receptacle must be used for systems with isolated ground.

2 An isloated ground receptacle with individual hot neutral and ground conductors must be used for systems with isolated ground.

3 An alternate earthing electrode, if required, must be installed in a minimum of 6 ft. (1.8m) from the building earth reference.

4 Connections to the building earth reference must be either cadwelded or provided with two ALCU clamps.

5 NEMA numbers for IG ground receptacles are:

208/240 @ 20 A IG-L6-20

208/240 @ 30 A IG-L6-30

120 @ 15 A IG-5-15

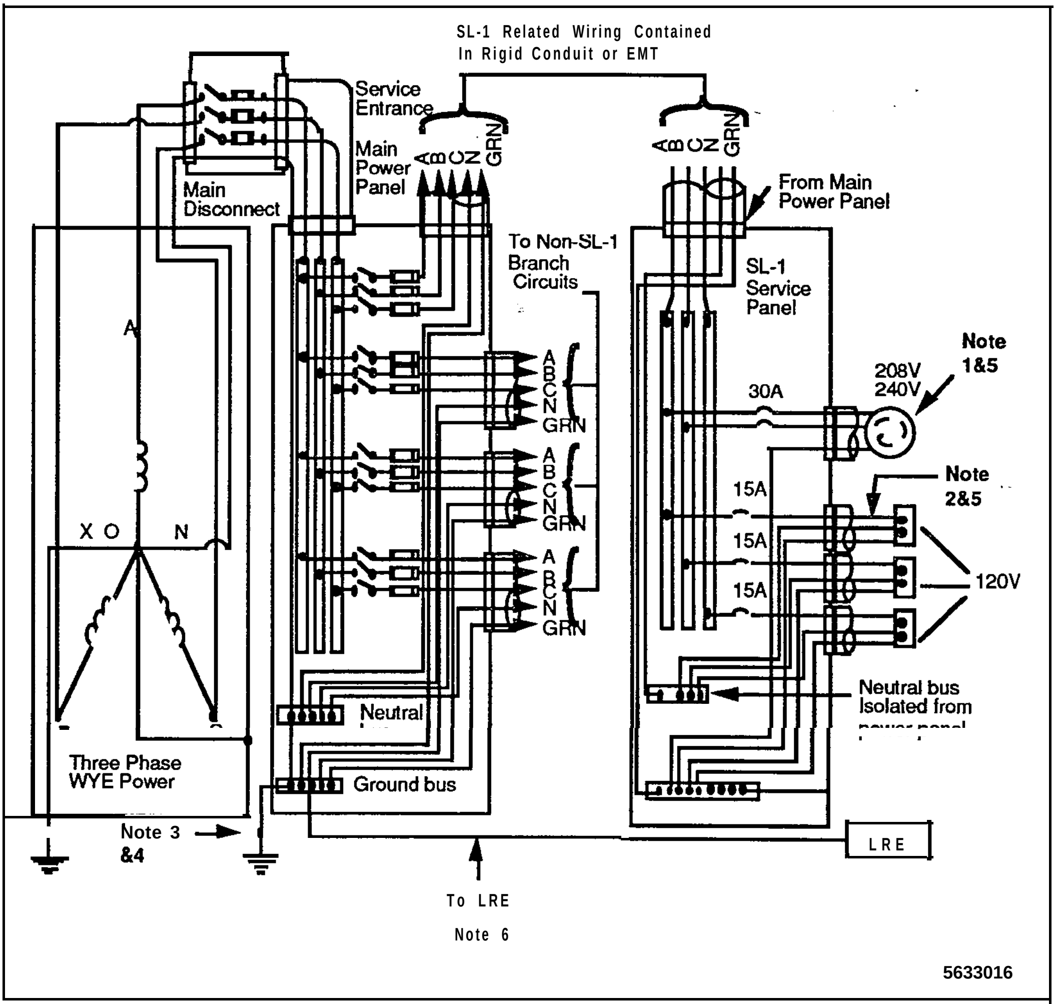
Panel circuit breakers are:

208V 30A

240V 30A

6 Connection to the building ground source should be made at the same physical location as the transformer grounding conductor. If the LRE is connected to a building ground point other than the transformer ground point, a bonding jumper must be installed between the two points.

Figure 4
Shared AC distribution in a non-isolated ground system



Notes for Figure 4:

1 An isolated ground receptacle must be used for systems with isolated ground.

2 An isloated ground receptacle with individual hot neutral and ground conductors must be used for systems with isolated ground.

3 An alternate earthing electrode, if required, must be installed in a minimum of 6 ft. (1.8m) from the building earth reference.

4 Connections to the building earth reference must be either cadwelded or provided with two ALCU clamps.

5 NEMA numbers for IG ground receptacles are:

208/240 @ 30 A IG-L6-30

120 @ 15 A IG-5-15

Panel circuit breakers are:

208V/240V 30A

6 Connection of the LRE to the building ground source should be made at the same physical location as the transformer grounding conductor. If the LRE is connected to a building ground point other than the transformer ground point, a bonding jumper must be installed between the two points.

Auxiliary power requirements

Integrated terminals, printers, modems, and data units require local power. Power for devices located in the equipment room must meet the following criteria:

- wired and fused independently of all other receptacles
- tagged at the power panel to prevent unauthorized interruption of power
- not controlled by a switch
- referenced to the same building interface point on the building system ground as the SL-1 AC panel ground

Isolated service receptacles

For isolated ground systems, the auxiliary power receptacles used should be 120V, 60Hz, 15A, individually fused, isolated ground circuits terminating on NEMA non-locking type IG 5-15 such as Hubbell, Cat. No. IG-5262, 2-Pole, 3-Wire, orange duplex receptacles. A green conductor must be used for extending the safety ground and must be wired according to the isolated ground specifications.

Note: This requirement is based on safety concerns and exceeds NRC/CRC requirements.

Non-isolated service receptacles

For non-isolated ground systems, the auxiliary power receptacles used should be 120V, 60Hz, 15A, individually fused circuits terminating on NEMA non-locking type 5-15.

In non-isolated ground systems auxiliary equipment which connects to the SL-1 system should be isolated through the use of fiber optic signal cables such as RS-232-C. Failure to provide this isolation will defeat the single point ground.

Power Fail Transfer Unit (PFTU) powering

The PFTU, when used with AC systems, operates with a separate 120 V ac to 48 V dc power supply. If the AC system is not backed-up (for example, when no UPS is present), the PFTU power supply requires a separate and dedicated auxiliary power outlet. Power to the PFTU is terminated when the system power goes down and vice versa.

Cabling

This section identifies the various cabling used in the SL-1 system and provides some guidelines for cabling. Equipment placement in relation to cable lengths should be considered and planned for. Depending on your system and future expansion (of PE modules, for example), the cables you choose must be the right length.

Cable types

All cables must be designated (tagged) at both ends. The SL-1 uses at least five types of wiring:

- Twisted-Pair Telephone Cables
- 25-Pair MDF Cables
- Twisted-Pair Shielded and Non-Shielded Cables
- Interface (I/O) Cables
- Power and Ground Cables

Twisted-pair telephone cables

These cables carry analog voice and digitized voice/data information between distribution frames and devices located throughout the office. They run from cross-connect panels to jacks (8-pin modular) located within 8 feet (2.4 m) of each peripheral device.

25-Pair MDF cables

These cables carry voice and data information between the SL-1 UEMs and the distribution frame. When the cables are run from the UEM to the distribution frame, one end of the cable must be equipped with a 25-pair female connector which terminates on the cabinet I/O panel.

Twisted-pair shielded cables

These cables are used to interconnect the trip power monitoring connections between power interface units and the main distributing frame. Typically, a 16 AWG, stranded (Belden type 8408-2 conductor or equivalent) type shielded cable is used for trip connections. All other connections are serviced by non-shielded, 16 AWG stranded cable.

Interface (I/O) cables

I/O cables are typically 25-conductor flat-ribbon or round cables interfaced through RS-232-C connectors. These cables are used to connect data units to printers, host computers, and modems.

UEM cable routing

Cables may be routed internally in the UEM horizontally in front and at the rear of the card cage, vertically on the right side only and vertically through square holes near the rear of the DEM. Cables may be routed externally in the back of and on the left and right side of the UEM between the EMI/RFI I/O panel and the rear cover. The cables may be routed in these channels up to the top of the column or down to the floor through the pedestal.

Note: Routing cables on the inside of a UEM from the front to the back on the left or Power Supply side is not recommended. This is because of the limited access in routing the cables and of the effects of EMI/RFI noise generated in this area to signals in the cables.

Network to PE cabling

IPE cabling from Network to PE originates from the faceplate of the Superloop Network card and extends to the backplane connectors on the Controller card of the IPE Module.

PE cabling originates from the faceplate of the Network card to the faceplate of the Dual Loop Buffer.

Power and ground cables

For AC-powered systems, a 9-foot, three-conductor line cord is normally supplied except in areas where conduit will be required. For DC-powered systems, wiring is generally done through conduit.

Cable access requirements

The customer is responsible for supplying all access for station, feeder, and riser cabling including where necessary:

- conduit
- floor boring
- boring all major walls on a particular floor
- access into hung ceilings, including removal and replacement of ceiling tiles

Fire protection and safety precautions

Fire protection and prevention

Building, fire, and safety codes establish the degree of protection required for an installation. Additional information is available from the National Fire Protection Association in its publications entitled "Standard for the Protection of Electronic Computer/Data Processing Equipment (NFPA 75) and "National Electrical Code" (NFPA 70).

Properly locating and installing sprinkler heads, fire and smoke sensing devices, and other fire extinguishing equipment require expertise. Local codes and experts should be consulted during the planning stage, and the recommendations of insurance underwriters and local building authorities should be sought and followed.

Some fire precautions can be implemented during the construction phase of preparation for an installation. Walls enclosing the equipment area should extend from floor to ceiling, and the walls, floor, and dropped ceiling, if any, should be constructed of noncombustible covering. Shatterproof windows and sprinklers outside and above the windows should be installed to prevent the spread of fire from an adjacent building.

If the structural floor is made from combustible materials, it should be covered with a noncombustible covering, and the space between the raised and permanent floors should be cleared of all debris before the system is installed.

Storage areas and the roof or floor above the equipment room should be watertight since water leakage from the floor above could easily damage the equipment below. In addition, ducts and plumbing work for air-conditioning systems should be designed to inhibitthe spread of fire, heat, and smoke from one part of a building to another. Smoke detectors should also be installed.

Services such as steam, water, and power should be checked regularly, and pipes should be inspected for excess condensation,.leaks, and corrosion. If power connections are made beneath a raised floor, waterproof electrical receptacles and connectors should be used.

Recommended fire extinguishing systems

In **most cases,** carbon dioxide or water sprinkler systems are to be used. Water sprinklers are generally less expensive than the carbon dioxide kind. Specifically, dry-pipe water sprinklers are strongly recommended since this type will interrupt power to the room and open a master valve to fill the overhead sprinklers.

Carbon dioxide systems are also effective in containing a fire, but they quickly exhaust the available oxygen supply. If a carbon dioxide system is used, an alarm should sound warning onsite personnel of the release of carbon dioxide. For health and safety reasons, employees must be evacuated within 30 seconds of the release.

CAUTION

Use of other fire extinguishing systems

Northern Telecom does not recommend the use of Halon or any other fire extinguishing system not stated above. Northern Telecom is supported by the Environmental Protection Agency to enforce any restrictions on the use of other fire extinguishing systems.

Security precautions and safeguards

Existing practices of building security should be extended and improved to provide adequate protection for the equipment.

Safeguards such as tamperproof keylock door controls and electrically taped glass doors and windows can be tied into an alarm system. A monitoring unit using closed-circuit television can also be installed.

Protect critical data such as business records or other information by storing backups well away from the equipment room. A regular updating program is highly recommended.

Safety procedures and training

Company personnel should be taught how to respond to emergencies. Some companies designate such individuals as security members. Training could include how and when to evacuate personnel and records, to notify the fire department, to shut off all electrical power, and to properly handle fire extinguishers.

In addition to training, temperature and humidity monitoring devices (both visual and audible alarm signals) should be installed in the equipment and storage rooms so that individuals can respond quickly to an emergency.

Occupational noise exposure

When employees are subjected to noise levels exceeding those listed in 1910.5 of the OSHA Standards, or local standards internationally, administrative and engineering controls should be initiated. If these controls fail to reduce sound levels effectively, protective equipment should be provided. The acoustic noise generated by an SL-1 UEM column should not exceed 60dBA (decibels "A"-weighted). Depending on the ambient external temperature, the acoustic noise could be as low as 45 dBA.

Planning the site

Planning the site is an important element to consider when planning the installation of an SL-1. It impacts the installation costs, operation and maintenance and can have an overall effect on system performance.

Selecting a site

Sites should be selected and evaluated according to the followingcriteria and the detailed information given in this document:

Space

The proposed site should provide adequate space for system unpackaging, system installation, operation, potential expansion, service, storage of supplies, and system operator area (if applicable). It should also provide sufficient cooling for efficient operation of the equipment and a suitable operating environment for the system.

Location

The location should be convenient for delivery of equipment and close to related work areas for efficient operation. The location of related equipment (distribution frame and batteries) must be considered when selecting the site.

Power and grounding

Sufficient power and proper grounding facilities must be available.

Structural integrity

The floor must be strong enough to support anticipated loads, and the ceiling must be able to support overhead cable racks, if applicable.

Developing the site

After selecting a site, the following items must be considered during site development:

- Space and equipment layout requirements
- Equipment room accessories
- Detailed floor plans and loading requirements
- Building cable plans
- System wire routing
- Cable termination points

The equipment room

Space and equipment layout requirements differ with each installation, depending upon equipment selected and the available physical area. The following categories of required space should be considered when planning site needs:

- Primary storage
- Secondary storage
- Maintenance/Technician area

Primary storage

The floor area required for an SL-1 depends on the number of columns of UEMs ordered, the length-to-width ratio of the area, and the location of walls, partitions, windows, and doors. To determine the exact layout required, prepare a detailed floor plan after reading all of the requirements provided in this section.

Operating needs determine the location of free-standing peripherals like printers and terminals. Printers and terminals must not exceed the maximum distances defined for their interface circuits. Wall jacks and outlets must be provided for all devices located in the equipment room. Within a system there are certain requirements that must be met when drawing up the equipment room floor plan.

Note: Sample floor plans may vary from your own depending on your system needs and the size/arrangement of your equipment room. **Follow** the engineering guidelines as specified in *System engineering* (553-3001-151).

Secondary storage

Provide space for the storage of disks, printer paper, printouts, and daily reports within the equipment area. A secure storage room for spare parts is recommended.

Similar environmental conditions should be maintained for storage and operation areas. If it is not possible to maintain the storage area environment exactly the same as that of the operating equipment, adequate time must be allowed for stored materials to adjust to the equipment room environment before they are used.

Maintenance/Technician area

The maintenance/technician area is used primarily to store tools, test equipment, manuals, spare parts, and as an online work center. The area should have good lighting and convenient access to the equipment. Typical items that would go into a maintenance/technician area are:

- shelf for instruction books
- spare parts storage room
- paper storage area
- locking cabinet or storage area for back up disks
- table or desk
- printer/VDT or equivalent device

Equipment room accessories

The following equipment room accessories are recommended:

- Temperature/humidity recorder(s)
- A key or combination with option keylock for the switchroom door (electric locks, such as push button access code or card reader, are not recommended unless battery backup or key override is provided)>
- Desk or table, file cabinet, and storage shelves

- Storage cabinets for spare parts, backup tapes or disks, and printer paper

The floor plan

Since the space requirements and the overall layout of the equipment room can have an effect on the installation, operation, and maintenance of a system, a detailed floor plan should be drawn up for each site.

The floor plan should show the location of utility closets and cross- connect terminals. All cables running from distribution points to the zones should be clearly designated with the zone ID. The zones are typically the termination point of conduits throughout the office. (See Figure 8 "Sample building cable plan" for an illustration of zones.) Within a zone the cables should be identified by their number within the zone.

> *Note:* According to the National Fire Code, equipment must be located at least 12 inches from a sprinkler head. If your system has four UEMs and a cable rack, do not place the equipment directly under any sprinkler heads.

Consider the following guidelines when planning the equipment room floor plans:

- a recommended minimum ceiling height of 8 ft (2436mm) or greater
- a minimum distance between equipment aisles of 30 inches (760mm)
- a minimum distance between end of aisle stacks and wall and between rows of 3 ft (914mm)
- location of modems, printers, and terminals
- size and location of reserve power
- size and location of cross-connect terminal
- size and location of maintenance/technician area
- number of rows and future expansion needs (RPE or Meridian Mail, for example). Refer *to System engineering* (553-3001-151) for guidelines on system expansion.

The weight and dimensions of the SL-1 system should also be considered:

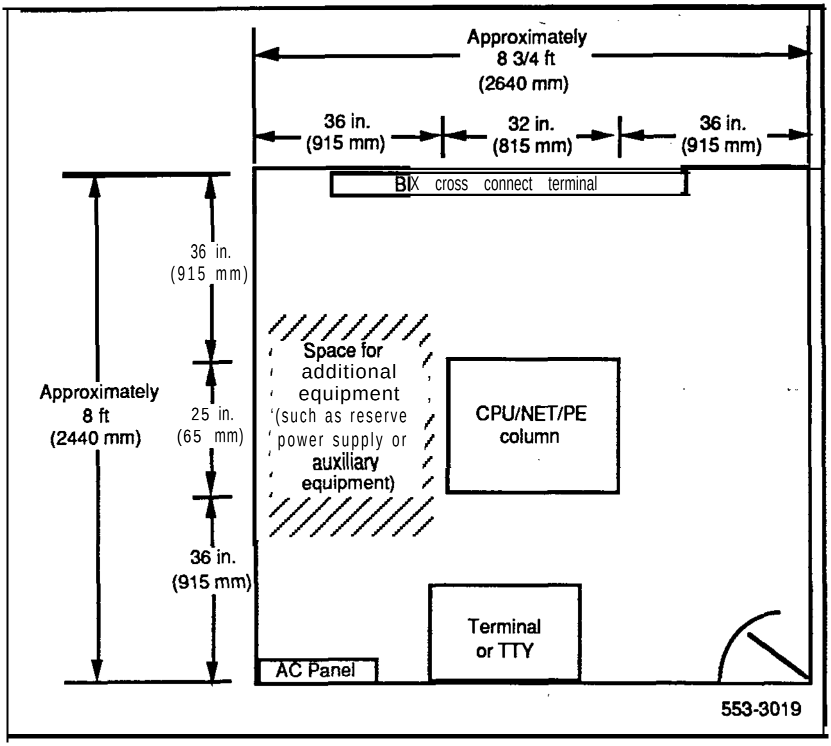
Table 9
Weight and dimensions of an SL-1 system

Assembly item	Weight empty	Weight full	Size width	Size depth	Size height
Pedestal	40 ibs.	70 ibs.	32 in.	26 in.	10 in.
Top Cap	15 ibs.	15 ibs.	32 in.	22 in.	4 in.
UEM	50 ibs.	130 lbs.	32 in.	22 in.	17 in.
1 Module stack	N/A	215 ibs.	32 in.	26 in.	31 in.
2 Module stack	N/A	345 ibs.	32 in.	26 in.	48 in.
3 Module stack	N/A	475 ibs.	32 in.	26 in.	65 in.
4 Module stack	N/A	605 ibs.	32 in.	26 in.	82 in.

Note: Multi-column systems require a three inch spacer between each column for cable routing and to provide EM1 shielding.

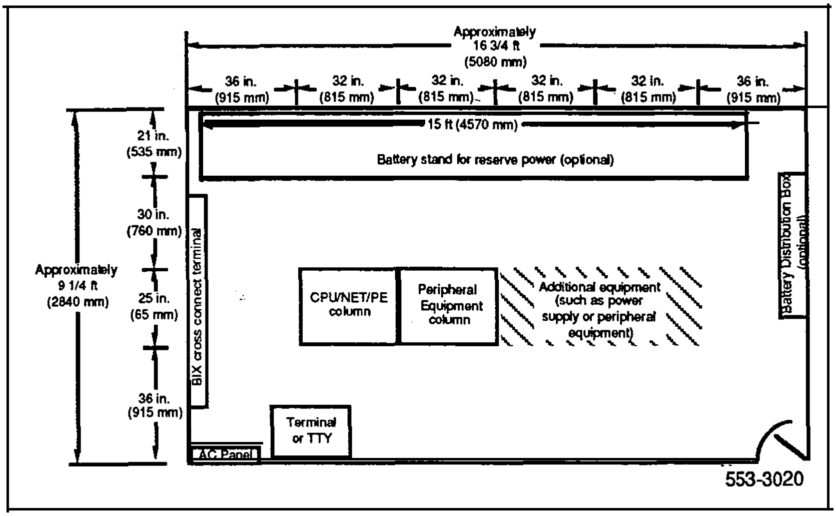
Figures 5, 6, and 7 show some sample equipment room floor plans. These may vary from your own.

Figure 5
SL-1 Option 21 equipment room floor plan



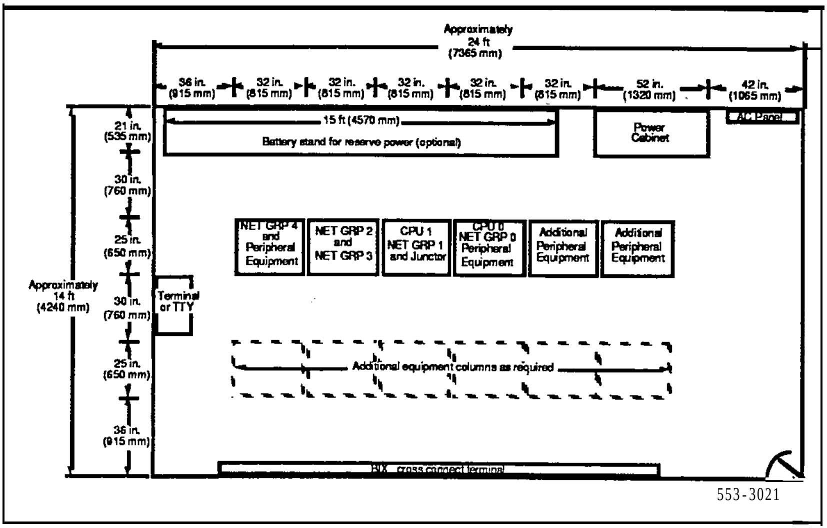
Note: This sample floor plan may vary from your own depending on your system needs and the size/arrangement of your equipment room. A template for floor drilling procedures is available. The drawing, (number PO709207), is delivered with the packing instructions.

Figure 6
SL-1 Options 51 and 61 equipment room floor plan



Note: This sample floor plan may vary from your own depending on your system needs and the size/arrangement of your equipment room.

Figure 7
SL-1 Option 71 equipment room floor plan



Note: This sample floor plan may vary from your own depending on your system needs and the size/arrangement of your equipment room. SL-1 Option 71 may also expand to a second row of Peripheral Equipment modules.

Floor loading estimates

Floor loading estimates should be obtained in order to plan for proper stacking of modules. (Floor loading is the weight of the system divided by the occupied floor area; Point loading is the local pressure exerted by the system feet on the floor.)

Table 10 shows the floor loading estimates for stacking an SL-1 system. The estimates given represent a fully-loaded module complete with pedestal, maximum circuit pack allowances, power supplies, and cables.

Table 10
Floor loading estimates

Modules	LBS/FT^2 (kPa)	Point Load (lbs/in^2) (kPa)
One	38.1 (1.8 kPa)	11 .O (75.8 kPa)
Two	60.3 (2.8 kPa)	17.3 (119 kPa)
Three	82.4 (3.9 kPa)	23.7 (163.4 kPa)
Four	104.6 (5 kPa)	30.0 (206.8 kPa)

Note: The numbers under "LBS/FT^2 (kPa)" are based on a floor area of the system of 5.64 square feet. These numbers do not include the weight of the optional overhead cable rack. The numbers under "Point Load (lbs/in^2) (kPa)" are based on distributing the system weight among four feet, each with an area of 4.91 square inches; these numbers do not reflect the use of optional casters.

The building cable plan

The building cable plan should be divided into zones. The zones are typically the termination point of conduits throughout the office. Each zone on the building cable plan should be identified with a letter or number, and a block of numbers should be assigned to each zone. Be sure to leave room for expansion. See Figure 8 "Sample building cable plan" for an illustration of zoning.

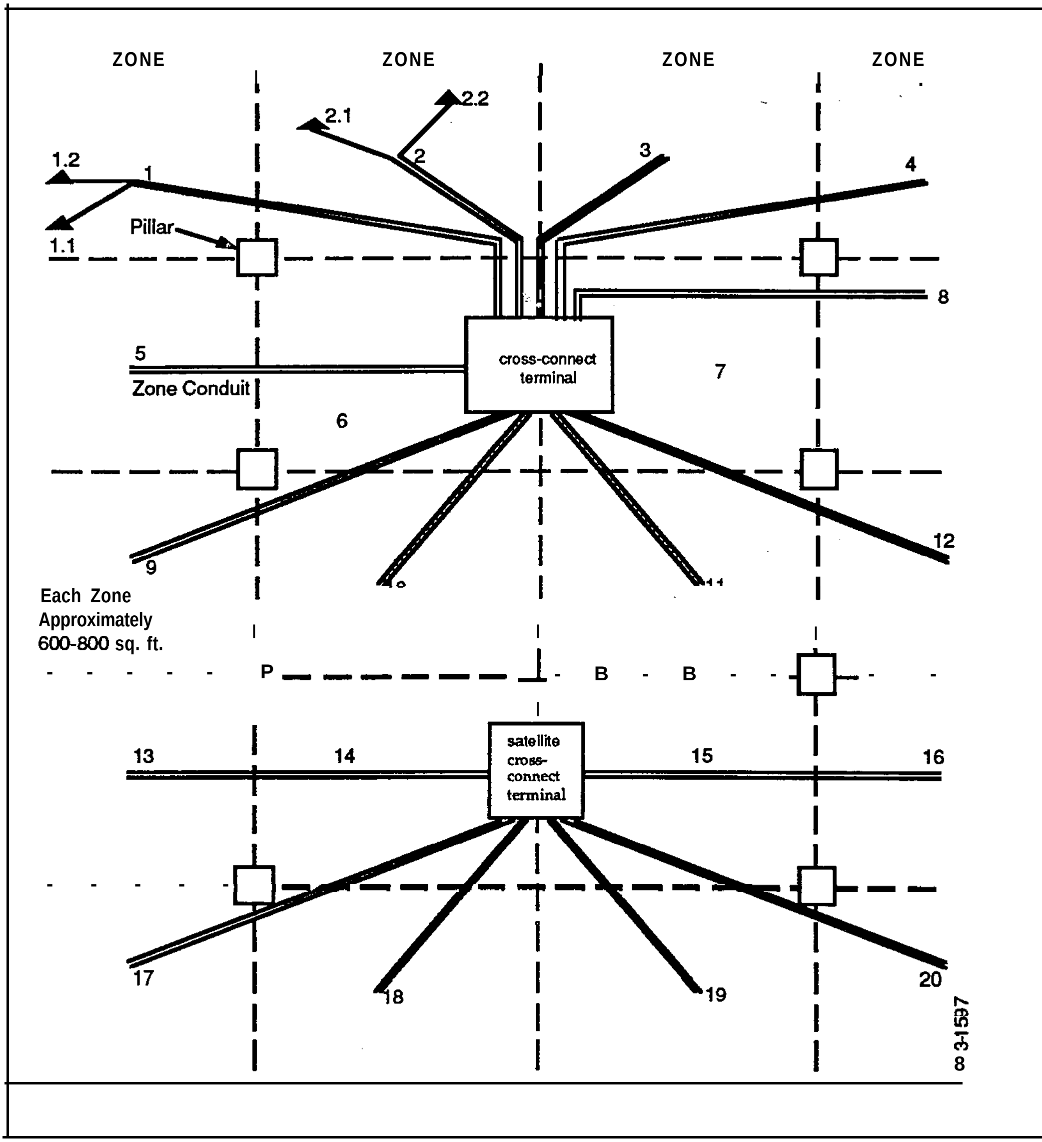
In addition, the following information and guidelines should be consider&

Each telephone, console, or data set connected to the SL-1 requires telephone wire run from a nearby telephone jack to a cross-connect location. Also, each component connected to the system requires a termination. (Modular jacks should be within 8 ft [2436 mm] of the device.) The location of all devices that interface with the SL- 1 should be known.

- Telephone directory number, features, and Office Data Administration System (ODAS) designator of each telephone in the office should also be known.
- Three-pairs of telephone wire should be provided from the telephone or data set location to the distribution frame. Location of all distribution points (main and intermediate) should be known.
- Consoles require a 16-pair (or 25-pair) cable equipped with an Amphenol-type connector.
- If any existing wire is to be used, ownership of that wire must be clearly defined.
- All wiring carrying high-speed data must pass a verification test at the time of installation. The test is performed as part of the installation procedures.

- A random sampling of in-place wiring'is taken during a site survey to ensure that it meets specifications for high-speed lines.
- When telephone cable is run in conduit, that conduit must not be used for any other wiring. The location of conduits and floor ducts, for example, should be known.
- The wiring plan should show the routing of all wiring, the location of each telephone, console, or data set, and any other relevant information about the device. It should also show the location of any power outlets that the device will require. Power outlets must be equipped with safety ground.
- Flat under-carpet cables are not recommended.
- Bridge taps for sets are not recommended.

Figure 8
Sample building cable plan



Wire routing

The routing of all wires for the SL-1 must be specified as part of the plan. To plan wire routing, establish the start and end point of each cable relative to the location of telephones in the office. Remember that each modular jack (8-pin or 6-pin, for example) must be within 8 feet. (2.4 m) of the telephones.

At this point the construction of the office must be investigated to determine the best wiring routes. Consider the following information when performing this task

Floors

Telephone wire travels along floors in one of two ways:

- Out in the open: In some cases wires are tacked to the surface of walls and other physical structures. For the safety of employees, wire should never be stretched across the top of floor. Run the wires along baseboards, ceiling mouldings, or door and window casings.
- Concealed: In other cases wires are run inside a floor conduit. The conduits can travel between utility closets and jack locations. In some cases the floor conduits connect to a conduit passing through walls or ceilings. In all cases the conduit must be used exclusively for telephone cables. The use of under-carpet cables is not recommended.

Ceilings

The National Electrical Code and local building codes specify what types of telephone wire may be run in each type of ceiling. Local building codes take precedence.

Walls

Wiring that needs to be run horizontally cannot be blind fed through walls. Cables that need to be run vertically should, when possible, run inside a wall, pole, or similar facility for vertical wire drops.

Between floors

Telephone utility closets should be located as closely to one another as possible. In many cases, contractors are hired to install the conduit. Local coding laws will specify whether a licensed contractor is required.

Electromagnetic Interference (EMI)

Data degradation may occur if wires travel near strong sources of electomagnetic interference. See "The equipment room environment" in this document for common sources of interference.

Termination points

Once the routes for the wires have been determined, the termination points for the these wires must be decided. The cables can terminate at various locations:

- main cross-connect terminal-typically in the equipment room
- intermediate cross-connect terminals-typically on each floor in telephone utility closet
- wall jacks or terminal boxes-typically near the final device location (within 8 ft [2.4 m])

Distribution frames

House cables terminate on the vertical side of two-sided frames and cross-connect to equipment which is typically located on the horizontal. When a color field approach is taken, the house cables typically terminate in the blue field and the equipment terminates on the purple (USA) or white (Canada) field.

In all cases the block where the cables are terminated must be clearly designated with the cable location information and the cable pair assignments.

Note: A log book (cable record) of all termination information should be kept See Table 11 for an example.

Table 11
Sample cable record

CABLE RECORD

Customer ____________________

Location ____________________

Cable ____________ Binder ____________ Page ____ of

D.N.	TN M	TN S	TN C	TN U	NAME	FEATURES / REMARKS	TERMINAL DEVICE	BLOCKS DF / HOUSE	COLOR
									W BL
									W OR
									W GR
									W BR
									W SL
									R BL
									R OR
									R GR
									R BR
									R [illegible]
									[illegible]
									[illegible]
									BK BR
									BK SL
									Y BL
									Y OR
									Y GR
									Y BR
									Y SL
									V BL
									V OR
									V GR
									V BR
									V SL

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Preparing for delivery

The route the equipment must take from the receiving area to the installation area must be studied in advance. The route should be measured to ensure problem free delivery of the equipment. The following factors must be considered:

Considerations

- size and security of the loading and storage areas
- capacity and availability of elevators
- the number and size of aisles and doors en route
- restrictions such as bends or obstructions in halls
- floor loading capacity of the loading, storage, and equipment room areas
- number of steps and stairways
- dimensions of fully-loaded, packaged system complete with shipping pallet (39"W x 30"D x 70"H)

Note: The SL-1 system is shipped with a software package, three UEMs, a pedestal, and a shipping pallet (five inches high). The fourth UEM is shipped separately. Refer to Table 9 for the weight and dimensions of an SL-1 system.

In addition, here are some questions to consider when preparing for delivery:

— Has a request been made for equipment delivery?

— Is a list of all equipment ordered available on site?

— Are transportation arrangements to premises completed?

— Is assistance available to prepare the switchroom?

From unloading area to equipment room

— Are unloading/unpacking facilities available?

— Are unloading/unpacking tools available? (pallet jack, for instance)

— Is there access to and from unloading area to equipment room?

— Is the equipment room threshold large enough for the equipment to enter?

Note: The equipment should be located as close to the final installation area as possible. This will provide for an easier, perhaps safer, installation.

Equipment handling precautions

The following general guidelines should be followed when handling SL-1 equipment:

- Circuit packs, disks, and tapes are very sensitive to static discharge; all static electricity should be discharged-from the body prior to handling.
- Circuit packs should be handled carefully: only handle packs by the edges, only remove and insert packs when necessary, and only unpack or handle packs away from machinery such as electric motors or transformers.
- If your system is using reserve power, the batteries may weigh in excess of 500 pounds each and may be packaged four to a shipping pallet. To prevent stressing of the floor, do not place the pallets side-by-side in the equipment room.
- Special ramps supplied with the product must be used to move the product off the pallet. Follow the instructions on unloading the machine provided on the side of the product. (See CAUTION box below.)

CAUTION

Lifting the pedestal

The pedestal of the SL- 1 must never be pried up in order to lift the stack. This could cause major damage to the pedestal. Carefully slide the pedestal and associated stack manually, and use the special ramps provided with your system.

Preparing for installation

The following items should be provided at the time of installation:

- Work orders
- Equipment room floor plan
- Building cable plan
- Installation, Administration and Maintenance Manuals, and User Guides
- Installation plan
- Delivery equipment (pallet jack, for instance)
- Unloading/unpackaging instructions

Work orders

The Work order may include:

- Terminal Number (TN) assignments
- Directory Number (DN) assignments
- individual terminal, data unit feature assignments
- terminals and user profiles
- system and terminal cross-connect assignments
- a detailed listing of the equipment ordered
- administration database entries for features and services

Note: The work order will vary depending on the distributor for a specific system.

Equipment room floor plans

The equipment room floor plans should show the location of:

- each SL-1 module, power module, and future expansion module (UEM)
- a reserve power unit (if applicable)
- maintenance and administration terminal and printer (if equipped) and printer locations (if applicable)
- the cross-connect terminal
- the AC panel and outlets
- any cable racks
- miscellaneous external equipment (data units, modems, etc.)
- auxiliary processors

Note: The suggested floor plans are provided for your assistance. Depending on the complexity of your equipment room, your floor plan may vary from the ones provided in this document.

Cabling plan

The cabling plan should show:

- cable routing and designation information
- location of peripheral devices and printers (if applicable)
- directory numbers (DNs) assigned to each peripheral device and Office Data Administration System (ODAS) designators (if the software package is equipped)
- features available to each terminal
- type of cable or wiring to each terminal, printer, and PC
- location of cross-connect terminal
- location of conduits, floor ducts, including access points (junction boxes and hand-holes)
- auxiliary processors

The installation plan

The installation plan may consist of a floor plan, a cabling plan, and an ITS (Installation and Test Sequence) chart, The chart shows typical installation tasks, the sequence of the tasks, and task start and duration information.

Manuals

The following manuals should be at hand when installing an SL-1:

— ***SL-1 master index (553-3001-000)***

— ***SL-1 installation and maintenance guide***

— ***SL-1 planning & engineering guide***

— ***SL-1 X11 software guide***

— Product Bulletins (where applicable)

— User Guides

See the References list in "About this document" located at the beginning of this publication for more information.

Preinstallation inspections

The following items should be inspected and signed off prior to starting the installation:

— Equipment room

— General inspections

— Reserve power (if applicable)

Equipment room inspections

An equipment room inspection ensures that the following conditions are met:

- physical and environmental requirements met
- system power and utility outlets installed and tested
- lighting installed and working
- AC power distribution installed according to Northern Telecom specifications
- equipment room is dry, clean, and ready for installation
- equipment locations have been marked on the equipment room floor
- entranceways, doorways, halls, and elevators from the loading dock to the equipment room are large enough for system transport
- terminal, printer, and PC locations ready
- sufficient wiring is provided
- single point grounding is implemented
- sufficient and appropriate terminal connecting blocks are provided_-

General inspections

General inspections ensure that the following conditions are met:

- building cross-connect terminals are provided
- conduits or floor ducts to terminal locations are installed (including service fittings)
- access conduit for raceway is in place
- sufficient terminal blocks are provided
- sufficient cross-connect wire is provided

Reserve power inspections

For reserve power inspections if batteries are used, ensure that the following conditions are met:

- reserve power room is well ventilated and operating at optimum temperature (specific gravity readings are based on a temperature of 77° F (25" C)
- proper lighting is available
- reserve power room is located within manufacturer's recommended proximity to the switch
- protective equipment is available (goggles, face shields, acid-resistant gloves, protective aprons, water for rinsing eyes/skin, and bicarbonate soda)
- reserve power room is well secured
- floor loading requirements are met
- reserve power room is accessible (no blocking of doorway)
- noise levels meet OSHA standards 1910.5 or local standards internationally
- reserve power area properly interfaces to the equipment

Note: For detailed instructions on battery usage, see ANSI/IEEE Standard 450-1987: "IEEE Recommended Practive for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

An Uninterruptable Power Supply (UPS) is used for reserve power in AC-powered systems. It includes basic and supporting equipment, including rectifier/charger, inverter, controls and instrumentation. A battery bank is a separate item but may be required together with the UPS. The following items should be inspected and signed off prior to starting the installation:

- Environmental requirements are met: both operating and storage/transportation.
- Other requirements are met such as flammability, reliability (MTBF), and electrostatic discharge.
- Since a UPS also makes use of batteries, see "Reserve power inspections" above for more details on pre-installation inspections.

Note: Refer to the manufacturer's specifications for details on the storage and operating environment of UPS. Temperature and humidity ranges should be considered for proper maintenance of the UPS.

SL-1

System options 21, 51, 61,71

Installation planning

Information subject to change without notice.
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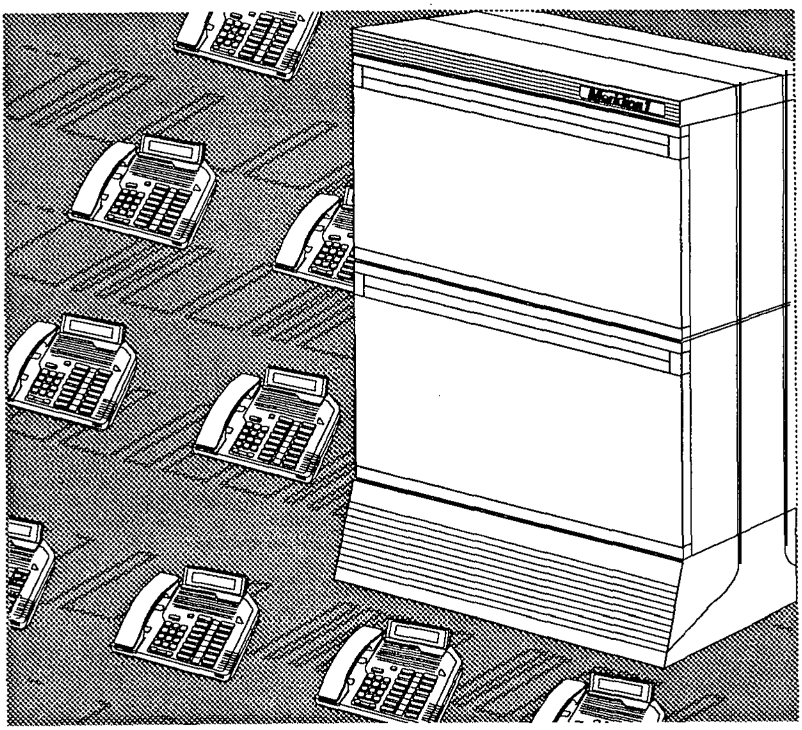
System engineering

Standard



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Meridian 1

Communication Systems

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System engineering

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About this document

General information

The following document has been updated to include new naming conventions and system engineering guidelines for the SL-1 System. Acronyms and abbreviations for the new names are identified in the text using parentheses.

This section provides the necessary information to:

— determine the equipment requirements for an SL-1 installation

— configure and assign equipment in the system

— distribute traffic equally over the system components

— maintain traffic distribution and equipment utilization levels when adding or removing equipment or when altering the system configuration

Note: The figures and limits used in this section are not necessarily typical and should not be interpreted as limits of the system capacity. The figures should be altered to suit the application of a particular system. Memory and real time figures, which vary for each generic of SL-1, are given in an appendix to this publication.

References

See the SL-I planning & engineering guide for

- *Master index* (553-3001-000)
- *System overview* (553-3001-100)
- *Installation planning* (553-3001-120)
- *System engineering* (553-3001-151)
- *Power engineering* (553-3001-152)
- *Sparesplanning* (553-3001-153)
- *Equipment identification and ordering* (553-3001-W)

See the list of fine and trunk circuit descriptions in *the Master index* (553-3001-000) for specific references to lines and trunks.
See the SL-I installation and maintenance guide for

- *System installation procedures* (553-3001-210)
- *Circuit pack installation and testing* (553-3001-211)
- *Installation procedures for telephone sets and attendant consoles* (553-2201-215)
- *Extended systems installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-251)
- *General maintenance information* (553-3001-500)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

See the SL-1 XII software guide for an overview of software architecture, procedures for software. installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- *XII software management* (553-3001-300)
- *X11 features and services* (553-3001-305)

See the SL-I XII input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Contents

System organization and capacities

The SL-1 System is basically organized into different kinds of systems and can support from 32 to 10,000 analog or digital lines, depending on traffic and feature requirements. System configurations are determined by customer requirements and the physical limitations of the equipment. Both AC and DC power options are available.

The following figures show a high level view of each system configuration. For information on power packs, cooling system, and system monitor, refer to the *System overview* (553-3001-100) document, Both AC and DC power is available.

Option 21

This cost effective unit comes in two sizes. The standard version is a single-CPU system that may contain up to four UEMs. It can be configured with an optional fan shelf for up to two UEMs (AC or DC power options). The modified version, Option 21A, is an optimized single-module AC system. See Figure l-l.

Options 51 and 61

Option 51 is a CPU/Network-based (NT-type) system; one shelf contains single CPU/half group; it serves from 800 to 1,000 lines. Option 61 is a CPU/Network-based (NT-type) system; two shelves contain dual CPU/full group; it serves from 1,000 to 2,000 lines. See Figures 2 and 3.

Figure l-l
Option 21 with multiple UEMs

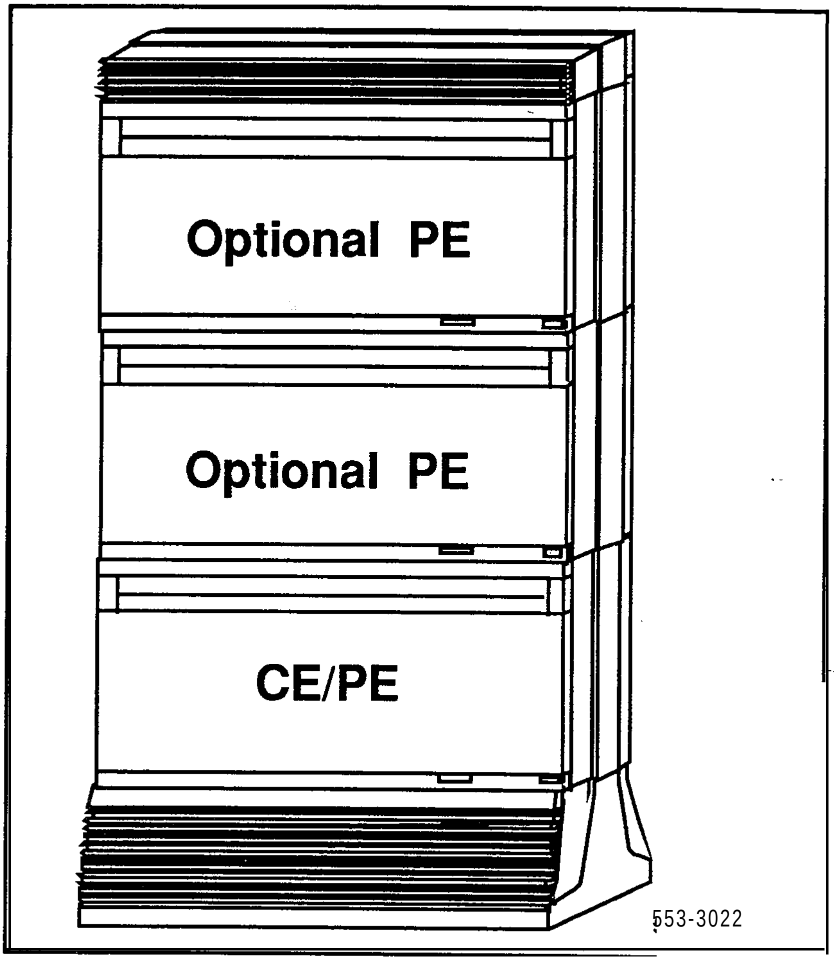


Figure 1-2
Option 51 with half network group

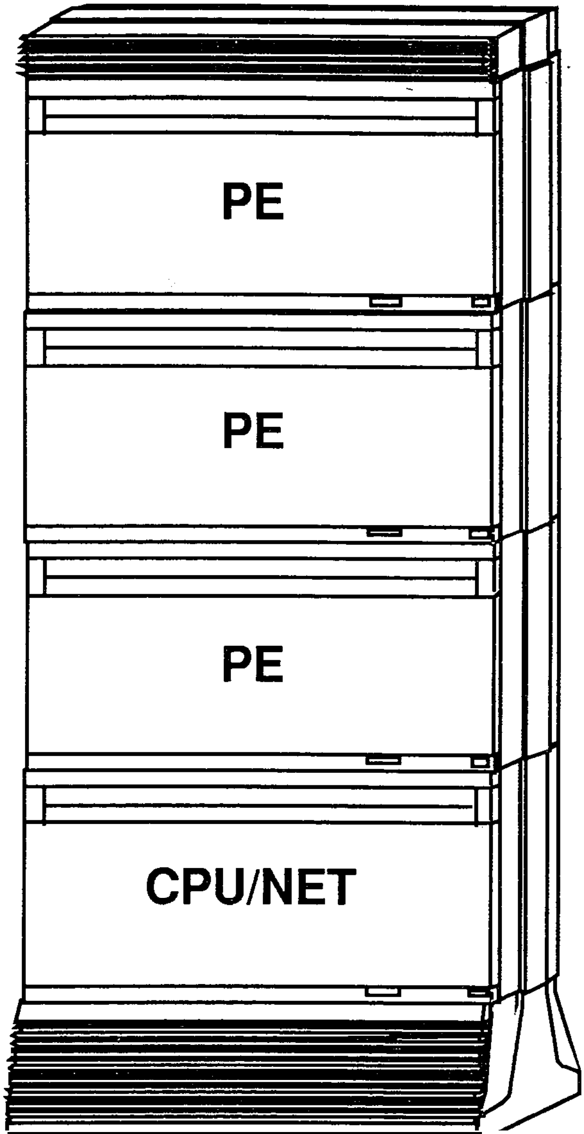
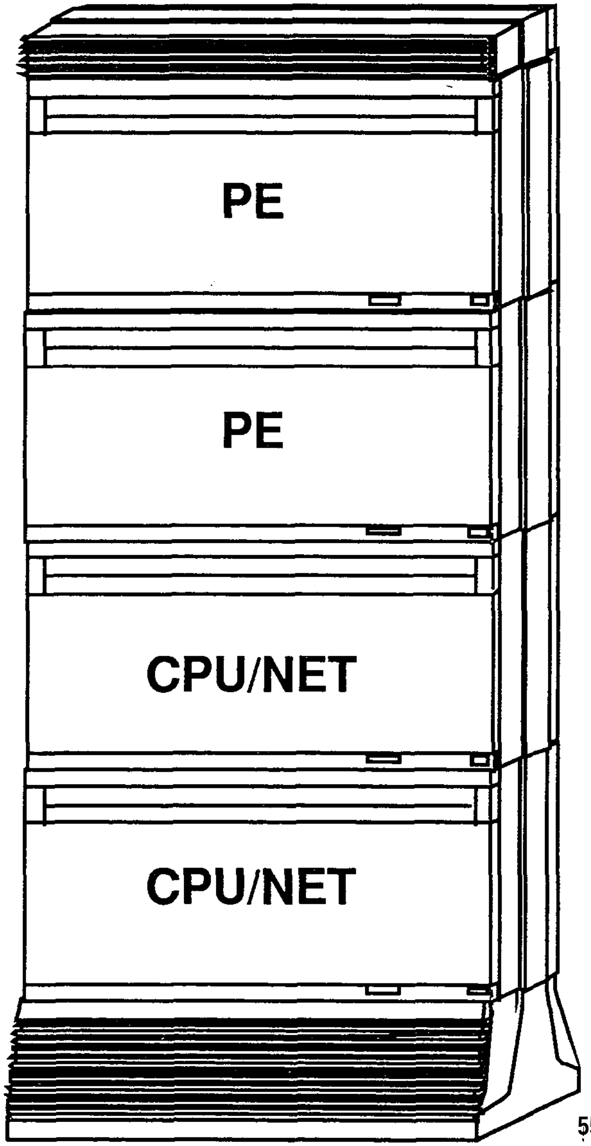


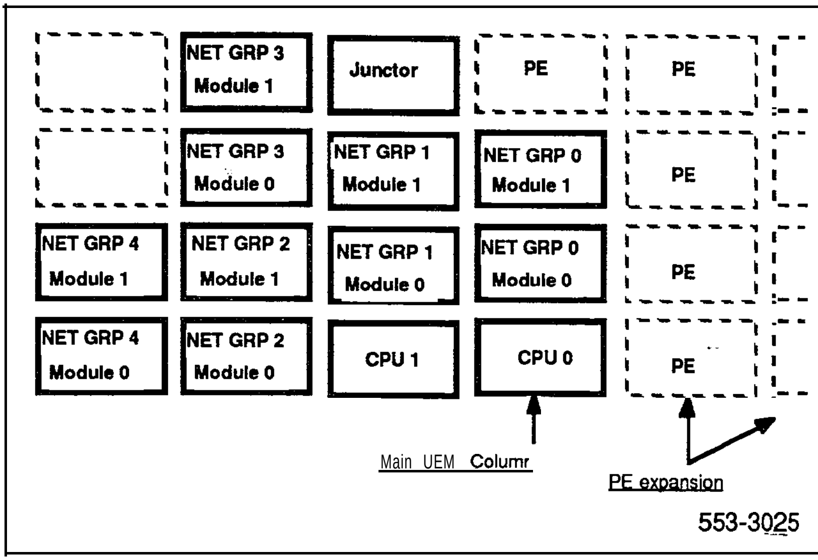
Figure 1-3
Option 61 with full network group



Option 71

Option 71 is a multiple network group machine with redundant CPU and serves from 2,000 to 10,000 lines. See Figure 1-4.

Figure 1-4
Option 71 with multiple network group



Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Universal Equipment Modules

This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Each configuration of the SL-1 consists of a number of Universal Equipment Modules (UEMs). Each module can be identified by its function. There are nine different types of UEMS:

Table l-1
Identification of UEMs

Universal Equipment Module	Number required per system
Common/Peripheral Equipment (CE/PE) (NT8D11AC/DC)	1
CPU/Network (NT6D39AA/DC)	1
CPU (NT8D34AA/DC)	2
Network (NT8D35AA/DC)	2 (see note)
Peripheral Equipment (PE) (NT8D13AA/DC)	depends on system size
Intelligent Peripheral Equipment (IPE) (NT8D37AA/DC)	depends on system size
Remote Peripheral Equipment (RPE) (NT8D47AA/DC)	depends on system size
InterGroup (NT8D36AA)	1 (see note)
Meridian Mail (NT6D44AA/DC)	Optional

Note: In Option 61, two network UEMs are required per network group; InterGroup UEMs are required in SL-1 Option 61 only. For more information on UEMs, refer to *Equipment identification and ordering* (553-3001-l 54).

CE/PE UEM (NT8D1 1 AC/DC)

Table 1-2
Identification of CE/PE UEM (NT8D11 AC/DC)

Unit	Number required per UEM
Common/Peripheral Equipment Power Supply (CE/PE Pwr Sup) (AC-NT7D14AA) (DC-NT7D04AA)	1
Floppy Disk Interface card (FDI) (QPC742)	1
CPU card (QPC687)	1
Memory/Peripheral Signalling card (NT8D19AA)	1
Network/DTR card (NT8D18AA)	1
Conference/TDS card (NT8D17AA)	1
Network cards	≤ 6
Enhanced Serial Data Interface (ESDI)	
Serial Data Interface Paddle Board (Dual Port) (NT8D41AA) supporting 6 SDI ports	≤ 3
Peripheral Equipment Line Cards	≤ 10

Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Description of CE/PE UEM (NT8D11AC/DC)

Slots 1, 2, and 3 are reserved for the following circuit cards:

- Floppy Disk Interface (FDI) (QPC742)
- Central Processing Unit (CPU) (QPC687)
- Memory/Peripheral Signalling Card (NT8D19AA)

Slots 4 through 9 in the Network area can be used by the following cards:

- Superloop Network Card (NT8D04AA) serves one superloop (four loops).
- Enhanced Network Card (QPC4 14) serves two loops.
- Conference/TDS Card (Conf/TDS) (NT8D17AA) uses two loops in the Network area; at least one Conf/TDS is required in the system.
- Digital Trunk Interface Card (DTI) (QPC472) occupies two slots.
- D-Channel Interface Card (DCHI) (QPC757)
- Quad Serial Data Interface Card (QSDI) (QPC84 1)
- Floppy Disk Unit (FDU) (NT8D68AA)

  Note: FDU occupies two slots and resides either in Network slots 4-9 or Peripheral Equipment (PE) slots O-9, depending on slot availability. If all slots in the first column of the CE/PE UEM are occupied, FDU can reside in the second PE module.

Slot 10, Net/Cont, must be occupied by the Network/DTR card (NT8D18AA) which combines the functions of a Network and Peripheral Equipment controller and a Digitone receiver. The card provides ten loops for ten PE cards.

Peripheral Equipment slots 0 through 9 can be occupied by any of the following cards:

- Digital Line Card (NT8D02AA)
- Analog Line Card (NT8D03AA)
- Analog Message Waiting Line Card (NT8D09AA)
- Universal Trunk Card (NT8D14AA)
- E&M Trunk Card (NT8D15AA)
- Floppy Disk Unit (NT8D68AA)—see note above

CPU/Network UEM (NT6D39AA/DC)

Table 1-3
Identification of CPU/Network UEM (NT6D39AA/DC)

Unit	Number-required per UEM
Common Equipment Power Supply (CE Pwr Sup) (AC-NT8D29AB) (DC-NT6D41AB)	1
Network cards (QPC414)	≤ 8
Superloop Network cards (NT8D04AA)	≤ 6
Clock Controller/Serial Data Interface (SDI) (QPC471 /QPC139)	1
Peripheral Signalling card (QPC43)	1
Three Port Extender (QPC441)	1
Mass Storage interface (MSI) (QPC584) or Floppy Disk Interface (FDI) (NT8D68AA)	1
CPU Function card (QPC579)	1
CPU Interface card (QPC580)	1
Changeover and Memory Arbitrator (CMA) card (QPC581)	1
768K Memory card (QPC583)	1
Serial Data Interface (SDI) card (QPC139)	1
Multi-Drive Unit (MDU) (NT8D69AA) or Floppy Disk Unit (FDU) (NT8D68AA)	1
Note: The Multi-Disk Unit (MDU) requires MSI cards; the Floppy Disk Unit (FDU) requires FDI cards. MDU/FDU occupies two slots.	

Description of CPU/Network UEM (NT6D39AA/DC)

Slots 1 through 8 are reserved for the following cards:

— Network cards (QPC4 14 or NT8D04AA)

The rest of the slots contain the following cards:

— slot 9 : Clock Controller or Serial Data Interface (SDI)
— slot 10: Peripheral Signaling
— slot 11: Three Port Extender (3PE)
— slot 12: Mass Storage Interface (MSI)
— slot 13: SDI
— slot 14: CPU function
— slot 15: CPU interface
— slot 16: Changeover and Memory Arbitrator (CMA)
— slot 17: Memory

Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

CPU UEM (NT8D34AA/DC)

Table I-4
Identification of Single CPU UEM

Unit	Number- required per UEM
Common Equipment Power Supply (CE Pwr Sup) (AC-NT8D29AB) (DC-NT6D41AB)	1
CPU function card (QPC579)	1
CPU interface card (QPC580)	1
Changeover and Memory Arbitrator (CMA) card (QPC581)	1
Memory cards (QPC583)	2
Mass Storage Interface card (MSI) (QPC584) or Floppy Disk interface (FDI) (NT8D68AA):	1
Segmented Bus Extender (SBE) cards (QPC215)	≤5
Clock Controller card (QPC471 or QPC775 international)	1
Multi-Drive Unit (MDU) (NT8D69AA) or one DTI (Digital Trunk Interface) card (QPC742)	1
Bus Terminating Unit (BTU) (QPC477 -A20 or -A21)	2

Note: MDU requires MSI cards; **FDU** requires **FDI cards; MDU** occupies three **slots** in the **UEM, FDI** occupies two.

Description of CPU UEM (NT8D34AA/DC)

Slots l-2 are reserved for the following cards:

— Memory cards (QPC581)

The rest of the slots contain the following cards:

slot 3: CMA

slot 4: CPU interface

— slot 5: CPU function

— slot 6: SDI

— slot 7: MSI

— slots 8-12: Segmented Bus Extender (SBE)

slot 13: available

— slot 14: Clock Controller

— slot 15: Mass Storage Unit (MSU) or Floppy Disk Unit (FDU), or Primary Rate Interface (PRI)/Digital Trunk Interface (DTI)

Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Network UEM (NT8D35AA/DC)

Table I-5
Identification of Network UEM

hit	Number_ required per UEM
;ommon Equipment Power ;upply (CE Pwr Sup) (AC-IT8D29AB) (DC-NT6D41 AB)	1
'hree-Port Extender (3PE) QPC441)	1
nter-Group Switch (IGS) cards QPC412)	2
'eripheral Signalling card QPC43)	1
;erial Data Interface (SDI) card QPC139)	1
uperloop Network cards NT8D04AA)	≤ 4
letwork cards (QPC414)	≤ 8
ligital Trunk Interface (DTI) QPC472) cards	≤ 6
;onference/Tone and Digit ;witch (Conf/TDS) (NT8D17AA) ards	≤ 8
us Terminating Units (BTU) QPC477)	2

Note: IGS cards are for Option 71 only. In Options 51 and 61, these slots are occupied by Clock Controller Cards [QPC471 B or higher vintage].) The four Superloop Network cards (NT8D04AA) or eight QPC414 Network cards can be configured in any combination for a total of 16 loops. Also, as a DTI/PRI-only UEM Network UEM contains one CE Pwr Sup and up to six DTI/PRI cards.

Description of Network UEM (NT8D35AA/DC)

The slot assignment of cards is as follows:

- slots 1: Three Port Extender (3PE)
- slots 2-3: Intergroup Switch (IGS) (for Option 71 only), PRI/DTI, or SDI
- slot 4: Peripheral signaling
- slots 5- 12: Network cards
- slot 13: PRI/DTI or SDI
- slot 14: PRI/DTI
- slot 15: not used

Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Intelligent Peripheral Equipment UEM (IPE) (NT8D37AA/DC)

Table I-6
Identification of IPE UEM

Unit	Number required per UEM
Peripheral Equipment Power Supply (PE Pwr Sup) (AC-NT8D06AA) (DC-NT6D41AB)	1
AC Ringing Generator (NT8D21AA) (required only when analog cards are present)	1
Controller-2 (Cont-2) (NT8D01 AD) Card or Controller-4 (Cont-4) (NT8D01AC) Card (See note.)	1
Line cards or a combination of analog, digital, trunk, and Digitone receiver cards (Table I-7 shows the port-to-line card orientation.	≤ 16

Description of IPE UEM (NT8D37AA/DC)

The NT8D37 IPE backplane (NT8D3701) contains 16 card slots. Slots O-15 are for line cards. Slot 16 is for miscellaneous. The Controller Card is situated near the center of the module, between slot 7 and slot 8.

If one or two superloops are to be served, use Cont-2; If three or four superloops are to be served, use Cont-4. The Controller-4 card is required when a large number of Integrated Voice and Date (IVD) lines are non-blocking and when they require, on average, more than four Digital Line Cards (Dgtl LCs) per IPE DEM.

The nominal capacity.of the IPE UEM is 256 Integrated Voice and Data (IVD) or analog lines; however, a typical configuration of the PE UEM includes a combination of line, trunk, and Digitone Receiver cards which provide about 160 lines with the appropriate trunks.

Table 1-7
Port-to-line card orientation for IPE (NT8D37AA/DC) line cards

Line card	Ports served
Digital Line Card (NT8D02AA)	16 Digital
Analog Line Card (NT8D03AA)	16 Analog
Analog Message Waiting Line Card (NT8D09AA)	16 Analog with Message Waiting features
Universal Trunk Card (NT8D14AA)	≤ 8 trunks with any combination of CO/DID/RAN/Page
Digitone Receiver Card (NT8D18AA)	8 channels of DTMF or MF receivers
E&M Trunk Card (NT8D15AA)	≤ 4 trunks with any combination of E&M/Page trunks

PE UEM (NT8D13AA/DC)

Table 1-8
Identification of PE UEM (NT8D13AA/DC)

Unit	Number required per UEM
Peripheral Equipment Power Supply (PE Pwr Sup) (AC-NT8D06AA) (DC-NT6D41 AB) See note.	1
AC Ringing Generator (Rng Gen) (NT8D21 AA) (required only when analog cards are present.)	1
Dual Loop Peripheral Equipment Buffer (QPC659)	1
Line cards or a combination of analog, digital, trunk, and Digitone receiver cards	≤ 10

Note: QPC710 DTR can be used if required by the customer; If QPC710 DTR is used with a single loop on the QPC659, then slot 10 cannot be used. Both AC and DC versions of PEPS are available.

The NT8D13 PE backplane (NT8D1302) contains 10 line card positions. The PE Buffer is situated near the center of the module, with five line cards to the left and five line cards to the right.

The nominal capacity of the PE UEM (NT8D13AA/DC) is 160 Integrated Voice and Data (IVD) or analog lines; however, a typical configuration of the PE UEM (NT8D13AA/DC) includes a combination of line, trunk, and Digitone Receiver cards which provide about 100 lines with the appropriate trunks.

RPE UEM (NT8D47AA/DC)

Table I-9
identification of RPE UEM

Unit	Number per UEM	Number per RPE loop
Common/Peripheral Equipment Power Supply (CPE Pwr Sup) (NT7D14AA)	1	
1.5Mbps Converter cards (QPC62)	2	1
2Mbps Converter cards (QPC66)	2	1
Carrier Interface cards (QPC99)	2	1
Local Carrier Buffer (QPC63)	2	1
Remote Peripheral Buffer (QPC65)	2	1
Carrier Maintenance card (QPC67)	1	1
Digital Trunk Interface cards (QPC472) / Primary Rate Interface (PRI) (QPC720)	≤ 3	

Note: Each RPE UEM can support up to two RPE loops.

Description of RPE UEM

The slot assignment of cards is as follows:

- slot 1: PRI/DTI (optional)
- slot 2: 1.5 Mb converter
- slot 3: 2 Mb converter
- slot 4: carrier interface
- slot 5: remote peripheral
- slot 6: local carrier buffer
- slot 7: carrier interface
- slot 8: 2 Mb converter
- slot 9: 1.5 Mb converter
- slot 10: carrier maintenance
- slots 11-12: PRI/DTI (optional)

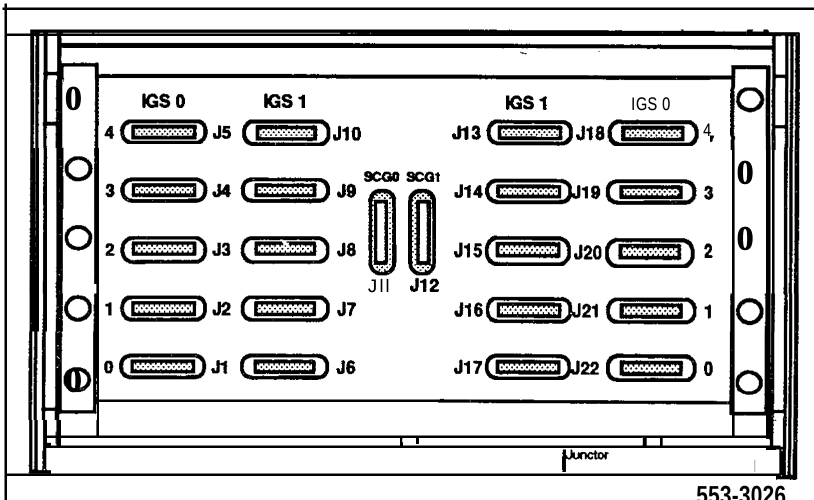
The minimum configuration for RPE consists of an RPE UEM at the main PBX site and the following equipment at the remote site:

- one RPE UEM (NT8D47AA/DC)
- one PE UEM (NT8D13AA/DC)
- one pedestal
- one top cover

The engineering rules for RPE UEM are the same as for the existing RPE shelf except there are three 2” slots available for DTI/PRI Cards in the RPE UEM.

InterGroup UEM (NT8D36AA)

Figure I-5
InterGroup UEM



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Description of InterGroup UEM

The NT8D36AA InterGroup UEM provides a path for the switching of traffic between the network groups in the system. Faceplate cables from the Segmented Bus Extender (SBE), System Clock (SCG), and Intergroup Switch (IGS) circuit cards are connected to the InterGroup Module.

System capacities

Network terminating capacity

The Superloop Network Card (NT8D04AA) has four network loops grouped as one superloop. One superloop can serve up to, two Intelligent Peripheral Equipment UEMs (IPE) (NT8D37AA/DC).

Network traffic capacity

Each superloop is capable of carrying 3500 CCS (or 875 CCS/loop) of combined station, trunk, attendant console and Digitone traffic during Average Busy Season Busy Hour (ABSBH) subject to the following grades of service:

- the loss of no more than 1% of the incoming terminating calls, provided the called line is free
- the loss of no more than 1% of the originating outgoing calls in the system, provided an idle trunk is available
- the loss of no more than 4% of the intra-office calls, provided that the called line is free
- no more than 1.5% of the originating calls wait longer than 3 seconds for dial tone
- the loss of no more than 1% of tandem calls, provided an idle outgoing trunk is available

Memory capacity

The memory capacity is a function of the machine type. Memory requirements are a function of the system size and features available. See Table l-10 for the memory capacities of each system:

Table l-10
Memory capacity per system

System	Memory	Mbytes
Option 21	768K words	1.5
Options 51 and 61	768K words	2.3
Option 71	1.5M words	4.5

Configuration capacities

The maximum configuration capacities of the SL-1 Options 51, 61, and 71 are:

- 100 customers
- 30 steps in a hunting group
- 8191 speed call lists per system
- 4095 ringing number pickup groups per customer
- 5 12 trunk routes per customer
- 254 members per trunk route
- 4 listed directory numbers per customer (DID only)
- 1 lamp field array per customer, may be repeated once on other console or SL-1 set
- 150 lamps per array (all numbers to be consecutive)
- 63 consoles per customer (Release 8 and later releases)
- 10 feature keys per console
- 20 incoming call indicators per console
- 16 trunk group busy indicators per console
- 2 additional key/lamp strips per console
- 6 additional key/lamp strips per SL-1 set
- 16 input/output devices (TTY etc.)
- 30 appearances of the same directory number

A system may not be able to accommodate simultaneously all the maximum values listed due to system limitations on the real time, memory, or traffic capacity.

Definitions

General rules

Apply the following rules for system engineering when arranging various Universal Equipment Modules (UEMs) within an SL- 1.

> ***Note:*** This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

UEM and column designations

Columns of Universal Equipment Modules (UEMs) are numbered from 0 to 63. The column with CPU 0 is Column 0. Within a column, the UEMs are numbered as 0 to 3 starting from the bottom UEM.

A UEM column can be built up to a maximum of four UEMs before moving to the next column; however, three UEMs per column can be configured if it is easier for installation and maintenance.

All the SL-1 Common Equipment (CPU UEMs) must be at the bottom or one level up for proper cooling and reliability. The mass storage unit--Multi-Disk Unit (MDU) or Floppy Disk Unit (FDU)--is usually located in a CPU UEM and requires lower operating temperatures than the cards. For this reason, do not install MDU/FDU in the third or fourth UEM.

The Common Equipment (CE) UEMs must be located next to each other at the same horizontal level. The CPU/Network Modules (NT6D39AA/DC) (CNE) must be located on top of each other.

The CPU, InterGroup, and CE UEMs must be located in the same vertical column. For these UEMs, all inter-UEM cabling must be internal, not through the I/O panels or EM1 filters. In addition, all vertical routing of the internal signal cables should be done on the right side of a column.

The InterGroup UEM should be located at the top of a column and adjacent to the CE UEMs.

Peripheral Equipment (PE or IPE) UEMs may be located away from CE and CPU UEMs by a maximum network cable length of 45 feet. This means that typically at floor level the CE UEM serving its PE cannot be more than 20 feet apart.

Configurations

A full network group consists of two half network group UEMs stacked one on top of the other. This rule does not apply when the Network Module is used only as a DTI/PRI shelf.

SL-1 Option 51 can be configured using one Network Module (half network group) or two Network Modules (full network group). SL-1 Option 71 must be expanded in increments of full network groups.

In multiple-group machines, the addition of network groups should be considered in the floor plans. Make sure the network groups are located in one contiguous equipment bay. One possibility is to provide space for expanding network groups to the left of CPU UEMs and Peripheral Equipment (PE or IPE) to the right of CPU UEMs. Another possibility is to keep Peripheral Equipment (PE or IPE) expansion as a separate bay. See Figure 14 "Option 71 with multiple network group."

Peripherals

One superloop (the equivalent of four regular loops) should serve two, four, six, or eight segments. A segment is one-fourth of the Intelligent Peripheral Equipment (IPE)(NT8D37AA/DC) shelf containing four slots.

A superloop can serve from one segment to two IPE UEMs in increments of one segment, depending on the ratio of TN to TS. Preferably, a superloop should be configured to serve an even number of segments. Assign full traffic and IPE Cards to one superloop before assigning to the next.

For every superloop which has "empty" IPE slots associated with it (because it is not assigned to exact multiples of eight cards), there should be spare traffic to use those slots when the system grows. Future additions of IPE Cards can be made to these superloops.

For traffic purposes, Network/DTR (Net/DTR) may be typically assigned to serve 96 lines, 32 trunks, and 8 DTR ports (10 IPE Cards total) even though it has higher traffic capacity.

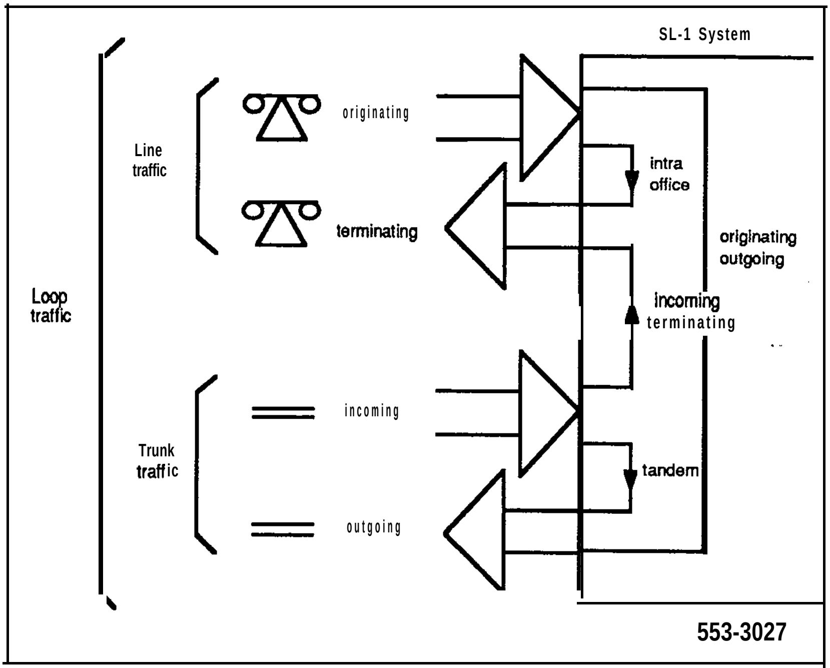
The total number of AC Ringing Generators (Rng Gen) in a system can be minimized by consolidating all Analog Line Cards in a few IPE UEMs and CE/PE UEM, if applicable. For traffic and reliability reasons, no more than three-fourths of the IPE and CE/PE UEMs should be filled with Analog Line Cards (Anlg LC)(NT8D03AA) or Analog Message Waiting Line cards (Anlg M/W LC) (NT8D09AA).

> Note: This document has been updated to include new naming conventions. Acronyms and abbreviations for the new names are identified in the text using parentheses.

Traffic distribution

The traffic distribution in the SL- 1 is **illustrated in** Figure 2-1. This illustration is valid when considering individual customer or system traffic.

Figure 2-1
Traffic distribution over the SL-1



Traffic definitions

The following are definitions of traffic terminology used in determining the provisioning requirements of an SL-1 System:

— ccs =
Hundred call seconds. The unit in which amounts of telephone traffic are measured. One call which lasts for one hundred seconds equals one ccs.

— Line=IT+OO+IOT+IOO

where:
Line = Line traffic in CCS
IT = Incoming Terminating traffic in CCS.
0 0 = Originating Outgoing traffic in CCS
IOT = Irma-Office Terminating traffic in CCS
100 = Inn-a-Office Originating traffic in CCS

— R = (IOT + IOO) / Line

where:
R = Intra-Office Ratio

— Loop=Line+IT+OO

where:
Loop = loop traffic in CCS

= Line + Line - R x Line

= Line x (2-R)

— Total line capacity = Total loop capacity / (2-R)

— Total trunk capacity = Total line capacity x (1-R)

= Total loop capacity x (1-R) / (2-R)

— Total I/O capacity = Total loop capacity x R / (2-R)

— Network = Total CCS handled by the SL-1 switching network or:

= Traffic received from stations + trunks, attendants, Digitone receivers, conference circuits and special features.

— InterGroup = Traffic flow between two network groups in SL-1s having more than one network group.

Equipment utilization

Equipment is provided and maintained throughout the SL-1 location life at an 85% utilization level.

Network loop traffic

The recommended traffic level for a Network superloop is:

- 3500 CCS without Digitone-using apparatus
- 2975 CCS with Digitone-using apparatus

The traffic level per network loops depends on whether or not the Peripheral Equipment uses Digitone trunks.

Partitioning

The SL-1 can be configured as a partitioned or non-partitioned system when it is to serve more than one customer.

A partitioned system dedicates each customer and the customer's associated lines and trunks to actual partitioned segments of the system in terms of loops and shelves. Consoles and Digitone receivers are normally spread over all loops and shelves in a partitioned system.

In a non-partitioned system, all customers, trunks, lines, consoles, and Digitone receivers are spread over all loops and shelves. A non-partitioned system provides the following advantages:

- fewer traffic loops are required
- fewer PE shelves and cards are required
- system call-carrying capacity is more easily achieved and maintained
- customers are distributed evenly over the loops
- load balancing is more easily accomplished by being done on a system basis rather than for each customer

Network loop assigning

When assigning the loop number in systems equipped with two Network UEMs, the load should be distributed evenly across both UEMs. Loops should be assigned in the order shown in Table 2- 1. Record the loops used in Worksheet L provided at the end of this document.

The total number of Peripheral Equipment UEMs should be distributed over the total number of voice and data loops. Normally, one PE UEM is assigned to a superloop. However, one PE UEM can be assigned from one half-superloop to as many as four superloops, depending on the concentration of Terminal Numbers to Timeslot ratio. See Table 2-l for details on loop number assignments.

Total number of loops = 4 x No. of Superloop Network Cards + 2 x No. of Enhanced Network Cards

Table 2-1
Loop number assignment

Number of groups	Number of loops
1	28
2	56
3	84
4	112
5	140

Note: The assignments shown may vary depending on system configuration and size. Conference (CONF) and Tone and Digit Switch (TDS) may be assigned any even loop number. Do not assign the odd loop number associated with CONF or TDS loop.

PE card distribution

Using Worksheet M (provided at the end of this document), determine the total **number** of each type of PE cards (500, **SL1,** TRK, DTR, etc.) per PE UEM.

Using Worksheets N and 0 (also provided at the end of this document), determine the number of Multiple Appearance Groups (MAG) assigned to each loop. (Also refer to Worksheet S for a Multiple Appearance Group Record sheet). Multiple appearance groups should be balanced over all the loops.

Multiple appearance groups that call each other frequently should not be assigned to the same loop, but should be assigned to the same network group to reduce inter-group calls in multiple network group systems. Large multiple appearance groups of more than 10 **TNs** should be avoided, if possible.

Users within a multiple network group system that call each other frequently should be assigned to the same network group. Similarly, **trunk** groups that are used primarily by certain groups of users should be assigned within the same network group as the users.

Intelligent Peripheral Equipment (IPE) card slot assigning

Card slot priority

Input messages from card slots 1 and 0 in each IPE module (card slot 0 in each EPE shelf) are directed to a high priority input buffer.. The input messages from the remaining slots on each IPE module are directed to a priority input buffer. The system processes the low priority input buffer only when the high priority buffer and the SL-1 and 500 output buffers are empty, thereby minimizing input buffer delay on signals from devices in high priority card slots. This mechanism is important for certain types of trunks that require critical timing. It is relatively unimportant for other devices.

Class of service priority

Class of service priority is completely unrelated to card slot priority. Selected sets and trunks can be assigned a high priority (HPR) class of service Requests for dial tone from high priority sets and trunks are processed before sets and trunks assigned a low priority (LPR) class of service The fewer the sets and trunks assigned as high priority, the better the service received during heavy load conditions.

Trunks

Incoming Delay Dial, Wink Start, and similar trunks have a timing --- advantage at seizure time when assigned to card slots 1 and 0 in the IPE module. TIE/DID trunks with DTMF pulsing (incoming) used on the high priority card slots (1 and 0) have a better chance of attaching a DTR before the first digit arrives. Trunks using 10 or 20 pps (incoming) should not be assigned to high priority slots to minimize the number of high priority input messages during pulsing.

The recommended card slot assignments for trunks is as follows:

- AIOD type trunks must always be assigned to card slots 1 and 0.
- Delay Dial, Wink Start and DTMF type trunks should be assigned to a high priority card slot if possible.
- Trunks using 10 or 20 pps (incoming) should not be assigned to a high priority card slot if possible
- Other types of trunks may be assigned to high priority card slots to avoid glare, but can also be assigned card slot 2 through 10.

Attendant consoles

Attendant consoles should never be assigned to a high priority card slot. Too many high priority messages from attendant consoles assigned to these card slots can result in delays in output messages to attendant consoles, sets and trunks. Attendant consoles should always be assigned to card slots 2 through 10. A large number of attendant consoles should not be assigned to the same network loop since buffer overflow may result (ERR030 and ERR040 messages on the TTY).

Telephone sets

SL-l-, 500-, and 2500-type sets can be assigned to any card slot. However, there is no service or user advantage gained by assigning sets to high priority card slots. One disadvantage of assigning a 500-type set to high priority card slots is the possibility of input messages during pulsing delaying output buffer processing.

Card slot assignment

Use Worksheet P (provided at the end of this document) to assign cards to the UEM slots. Calculate the average load after all packs of a particular type have been assigned. Total the load and keep a running total. If this method is followed, cards need not be interchanged at the end of the process because of load imbalance.

Assigning cards

Procedure 2-1
Order for assigning cards

1 Assign cards requiring a card slot 1 assignment (high priority slot).

2 Assign cards for high-usage trunks, such as CO trunks.

3 Assign cards for low-usage trunks, such as paging and dictation.

4 Assign cards for attendant consoles.

Note: For the PE UEM (NT8D13AA/DC), card slot 1 is reserved for high priority signaling. For the IPE UEM (NT8D37AA/DC), both card slots 0 and 1 are reserved for high priority signaling.

5 Assign Digitone receiver cards.

6 Assign cards for sets associated with multiple appearance groups.

7 Assign remaining cards. On a system which has a high density of Digitone sets, assign the least number of 500 line cards to loops which have Digitone receivers assigned.

Note: Loops and Conference/Tone and Digit Switch Cards (Conf/TDS) should be evenly distributed across Network UEMs and groups.

8 Calculate the total load per UEM.

9 Calculate the total load per loop.

10 If required, rearrange card assignments to balance the load.

Terminal number assigning

Once the cards are assigned to the PE UEMs, the individual units on each card can be assigned. Use Worksheet Q (at the end of this document) to record the Terminal Number (TN) assignments. TN 0000 cannot be used on superloop 0. Therefore, use loop 0 for Enhanced Network or Conference/IDS Card to avoid wasting a port.

Ongoing assignment plan

Use the initial assignment records to complete an SL-1 System assignment plan for each equipped network loop in the system. (See Worksheet R at the end of this document). From this system loop profile, an assignment plan can be developed for each loop. Assignments for future trunks, multiple appearance group stations, consoles, and Digitone receiver requirements can be developed for each loop according to the profile.

Cutover study

Once the system has been placed in service, a cutover study should be undertaken. The results of this study are used to update the loop profiles and create a new assignment plan. Ongoing assignments should follow the new assignment plan until the first customer busy-season trunking study. At that time loop threshold measurements are set so that at least one of the predominant busy hours would produce a CCS load output.

Threshold study

From the threshold study printout the loop profile should be updated, and a new assignment plan should be developed. At this time, it may be advisable to estimate the system capacity for future growth. If the growth capacity is sufficient to last beyond the next annual threshold study, assignments can continue in accordance with the assignment plan. If the growth capacity is not sufficient, plans should be made to establish a tentative date when new equipment (loops or shelves) must be ordered and installed. This date generally should be controlled by physical capacity and tracked by total working physical terminations.

Equipment relief

When additional equipment is installed, assignments should be concentrated into the new loop or shelves until the **first** threshold study. At that time, the loop profile would be updated and a new loading plan developed. At any time when a loop exceeds 500 CCS (based on 85% traffic level), that loop should be suspended from future assignments. If any loop should encounter service problems, that loop should be suspended and sufficient load removed to reduce service levels to an acceptable level.

Assignment records

The following printouts are available from the system and should be used in addition to worksheets to assist in maintaining assignment records:

- list of trunk route members
- list of TN blocks
- list of unused card positions
- list of unused units
- DN to TN matrix

Refer to *X11 Features and services* (553-3001-305) for information on how to obtain and manipulate data in the SL-1.

Provisioning guidelines

Procedure 3-1
Provisioning guidelines

Note: To determine the equipment requirements, follow the provisioning guidelines in the order shown below. Worksheets and Tables are all provided at the end of this document.

Step 1	Define and forecast growth.
Step 2	Estimate ccs per terminal.
Step 3	Calculate number of trunks required.
Step 4	Calculate line, trunk, and console load.
Step 5	Calculate DTR requirements.
Step 6	Calculate total system load.
Step 7	Calculate number of superloops required.
Step 8	Calculate number of Network groups required.
Step 9	Calculate number of PE cards required.

Step 10 Calculate number of PE UEMs required.

Step 11 Provision TDS/Conference loops.

Step 12 Calculate memory requirements.

Step 13 Assign the equipment/prepare equipment summary.

Note: The provisioning methods described in this document are based on a non-partitioned system using the figures provided. The figures are intended as a guide only.

The details of each step are given below in the following steps:

Step 1: Define and forecast growth

The first step in provisioning an initial SL-1 is to forecast the growth of the system at the 2-year and 5-year interval in terms of telephone stations.

The number of telephones required when the system is placed in service (cutover) is determined by the customer. If the customer is unable to provide a 2-year and 5-year station growth forecast, then a customer estimate of annual growth of personnel in percent is used to estimate the number of stations required at the 2-year and 5-year interval.

Example

A customer has 500 employees and requires 275 telephones to meet the system cutover. The customer projects an annual increase of 5% of employees based on future business expansion. The employee growth forecast is:

- 500 employees x 0.05 (% growth) = 25
- 525 employees x 0.05 = 27 additional employees at 1 year
- 552 employees x 0.05 = 28 additional employees at 2 years
- 580 employees x 0.05 = 29 additional employees at 3 years
- 609 employees x 0.05 = 31 additional employees at 4 years
- 640 employees x 0.05 = 32 additional employees at 5 years

The ratio of telephones to employees is 275/500 = 0.55.

To determine the number of telephones required from cutover through a 5-year interval, the number of employees required at cutover 1, 2, 3, 4, and 5 years is multiplied by the ratio of telephones to employee.

— 500 (employees) x 0.55 (ratio) = 275 telephones required at cutover

— 525 (employees) x 0.55 (ratio) = 289 telephones requiredat 1 year

— 552 (employees) x 0.55 (ratio) = 304 telephones required at 2 years

— 580 (employees) x 0.55 (ratio) = 319 telephones required at 3 years

— 609 (employees) x 0.55 (ratio) = 335 telephones required at 4 years

— 640 (employees) x 0.55 (ratio) = 352 telephones required at 5 years

This customer requires 275 telephones at cutover, 304 telephones at 2 years, and 352 telephones at 5 years.

Every Directory Number (DN) assigned to an NE-500 or NE-2500 set requires a Terminal Number (TN). Each SL-1 set requires a TN.

Determine the number of NE-500, NE-2500, and SL-1 TN required for each customer, and enter this information on Worksheet A (provided at the end of this document). Perform this calculation for the cutover, 2-year, and 5-year interval.

Step 2: Estimate ccs per terminal

CCS per terminal

The station and trunk CCS per terminal (CCS/T) for an initial installation of an SL- 1 can be estimated using any one of the following methods.

- Comparative method
- Manual calculation
- Default method

Comparative method

Three existing systems are selected which have an historical record of traffic study data. The criteria for choosing comparative systems is as follows:

- similar line size (± 25%)
- similar business (bank, hospital, insurance, manufacturing, etc.)
- similar locality (urban or rural)

Once the similar customers have been selected, their station, trunk, and intra CCS/T are averaged. These average figures are then applied to calculate trunk requirements for the SL- 1 being provisioned. Table 3- 1 gives an example.

Table 3-1
Example of station, trunk, and intra ccs/t averaging

	Customer A	Customer B	Customer C	Total	Average
Line size	200	250	150	600	200
Line CCS/T	4.35	4.75	3.5	12.6	4.2
Trunk CCS/T	2.6	3.0	2.0	7.6	2.5
Intra CCS/T	1.7	1.75	1.5	4.95	1.65

If only the trunk CCS/T is available, then multiply the trunk CCS/T by 0.5 to determine the intra CCS/T (assumes a normal traffic pattern of 33% incoming calls, 33% outgoing calls, and 33% intra-system calls). The trunk CCS/T and intra CCS/T are then added to arrive at the line CCS/T. Table 3-2 gives an example when only trunk CCS/T are known:.

Table 3-2
Example of ccs/t averaging when only trunk ccs/t are known

Trunk Type	No. of Trunks	Grade of service	Load in CCS	No. of Terms	CCS/T
DID	16	P.01	-294	234	1.2
CO	14	P.02	267	234	1.14
TIE	07	P.05	116	215	0.54
Paging	02	10 ccs/trunk	20	207	0.09
Out WATS	04	30 ccs/trunk	120	216	0.54
FX	02	30 ccs/trunk	60	216	0.27
Private Line	04	20 ccs/trunk	60	04	20
		TOTAL	959 ccs		23.79

Mote: The indivuidual ccs/t per trunk group are not added to form the trunk ccs/t. The trunk ccs/t is the total trunk load divided by the total number of lines at cutover.

Manual calculation of ccs/t

Normally, the customer can estimate the number of trunks required at cutover and specify the grade of service to be maintained at the 2-year and 5-year period. (If not, the comparative method can be used).

The number of trunks can be read from the appropriate trunking table to select the estimated usage on the trunk group. The number of lines at cutover that are accessing the group are divided into the estimated usage. The result is the CCS/T which can be used to estimate trunk requirements.

Manual calculation example:

— Line CCS/T = 6.2

— Trunk CCS/T = 4.1

— 2 Console = 30 CCS

Cutover	Line ccs = 275 x 6.2 = 1705
	Trunk ccs = 275 x 4.1 = 1128
	Subtotal = 2833
	Console ccs = 30
	Total system load = 2663
2 **Years**	Line ccs = 304 x 6.2 = 1885
	Trunk ccs = 304 x 4.1 = 1247
	Subtotal = 3132
	Console ccs = 30
	Total **system load = 3162**
5 Years	Line ccs = 352 x 6.2 = 2183
	Trunk ccs = 352 x 4.1 = 1444
	Subtotal = 3627
	Console ccs = 30
	Total system load = 3657

This method is used for each trunk group in the system, with the exception of small special services trunk groups (Tie Trunks, Wats, FX). Normally, the customer will tolerate a lesser grade of service on these trunk groups. Table 3-3 has been developed which lists the estimated usage on special services trunks.

Table 3-3
Estimated load per trunk (ccs)

Tie Trunks	30 ccs
Foreign Exchange	30 ccs
Out WATS	30 ccs
In WATS	30 ccs
Paging	10 ccs
Dial Dictation	10 ccs
Individual Bus Lines	20 ccs

Default method

Studies have been conducted which estimate the average line CCS/T to never be greater than 5.5 in 90 percent of all businesses. If attempts to calculate the CCS/T using the comparative method or the manual calculation have not been successful, the default-of 5.5 line CCS/T can be used.

The network line usage is determined by multiplying the number of lines by 5.5 CCS/T. The total is then multiplied by 2 to incorporate the trunk CCS/T. Unfortunately, when this method is used, the intra CCS/T is added twice to the equation, and the result could be over provisioning if the intra CCS/T is high.

Another difficulty experienced with this method is the inability to forecast individual trunk groups. The trunk and intra CCS/T is forecasted as a sum group total. Examples of the Default method and the Manual calculation method are shown in Table 3-4 for comparison.

Default method example:

— 275 Stations at Cutover

— 304 Stations at 2 years

— 352 Stations at 5 years

Cutover 275 x 5.5 (CCS/T) x 2 = 3025 CCS Total System Load

2 Year 304 x 5.5 (CCS/T) x 2 = 3344 CCS Total System Load

5 Year 352 x 5.5 (CCS/T) x 2 = 3872 CCS Total System Load

Table 3-4
Defautt Method and Manual Calculations analysis

	Default Method	Manual Calculations	Difference
Cutover	3025	2863CCS	162 CCS
2 Years	3344	3162 CCS	182 CCS
5 Year5	3872	3657 CCS	215 CCS

Step 3: Calculate number of trunks required

Trunks required

The values obtained through any of the three previous methods should now be entered on Worksheet A (provided at the end of this document). Add your calculations to the worksheet. Once the trunk CCS/T is known, and a grade of service has been specified by the customer, the number of trunks required per trunk group to meet the cutover, 2-year and 5-year requirements of a customer can be determined as follows:

Example

The customer requires a Poisson 1% blocking grade of service (see Table 3-A at the end of this document). The estimated trunk CCS/T is 1.14 for a DID trunk group. With the cutover, 2-year and 5-year number of lines, the total trunk CCS is determined by multiplying the number of lines by the trunk CCS/T:

Cutover 275 (lines) x 1.14 (trunk CCS/T) = 313.5 CCS

2 year 304 (lines) x 1.14 (trunk CCS/T) = 346.5 CCS

5 year 352 (lines) x 1.14 (trunk CCS/T) = 401.28 CCS

Use Table 6- 1 to determine the quantity of trunks required to meet the trunk CCS at cutover, 2-year and 5-year interval. In this case:

- 17 DID trunks are required at cutover
- 18 DID trunks are required at 2 years
- 21 DID trunk are required at 5 yearrs

Note: For trunk traffic greater than 4427 ccs, allow 29.5 ccs/trunk.

Step 4: Calculate line, trunk, and console load

Line, trunk, and console load

Once the quantity of trunks required has been estimated, enter the quantities on Worksheet A (in Step 1) for the cutover, 2-year and 5-year interval. This calculation must be performed for each trunk group to be equipped. The total trunk CCS/T is the sum of each individual trunk group CCS/T. This value is also entered on Worksheet A. (See Worksheet A at the end of this document.)

Line load

The line load is calculated by multiplying the total number of 500 and SL-1 line Terminal Numbers (TN) by the line CCS/T. The number of TN is determined as follows:

- one TN for every Directory Number (DN) assigned to one or more 500 or 2500-type set
- one TN for every SL-1 set.
- one Tn for every digital set M2xxx or M3xxx without data option.
- two TNs for every M2xxx or M3xxx set with data option.

Trunk load

The trunk load is calculated by multiplying the total number of digital sets, 500, and SL-1 line TN having access to the trunk route by the CCS/T per trunk route.

Console load

The console load is determined by multiplying the number of consoles by 30 CCS per console.

Step 5:
Calculate DTR requirements

Once station and trunk requirements have been determined for the complete system, the Digitone Receiver (DTR) requirements can be calculated. DTR are shared by all customers in the system and should be distributed equally over all the network loops.

Tables 6-3 through 6-6 (at the end of this document) are based on models of PBX traffic environments and can be applied to determine DTR needs in most cases. When the system being provisioned does not fall within the bounds of these models or is equipped with any special features, the detailed calculations must be performed for each feature and the number of Digitone receivers must accomodate the highest result.

Some special features are:

— Centralized Attendant Service (CAS)

— Direct Inward System Access (DISA)

— Authorization Code

— Charge Account for Call Detail Recording (CDR)

— Integrated Message Service (IMS)

Note: Refer to the section "Feature calculations" for more information on the above features.

From the appropriate table (See Table 6-3 to Table 6-6 at the end of this document) determine the number of DTR required and the DTR load for cutover, two-year, and five-year interval. Record this information on Worksheet B (located at the end of this document).

The following models are based on some common PBX traffic measurements:

Model 1

Table 6-3 is based on the following factors:

- 33% intra-office calls, 33% incoming calls, and 33% outgoing calls
- 1.5% dial tone delay grade of service
- no Digitone DID trunks or incoming Digitone tie trunks

Model 2

Table 64 is based on the following factors:

- assumes same traffic pattern as model 1
- the system has Digitone DID trunks or incoming Digitone tie trunks
- Poisson 0.1% blockage grade of service

Model 3

Table 6-5 is based on the following factors:

- 15% intra-office calls, 28% incoming calls, and 56% outgoing calls
- 1.5% dial tone delay grade of service
- no Digitone DID trunks or incoming Digitone tie trunks

Model 4

Table 6-6 is based on the following factors:

- assumes same traffic pattern as model 3
- the system has Digitone DID trunks or incoming Digitone tie trunks
- Poisson 0.1% blockage grade of service

Detailed calculation: method 1

This method can be used when there are no incoming Digitone DID trunks and the following is assumed:

— Receiver traffic is assumed to be inflated by 30% to cover unsuccessful dialing attempts.

— Call holding times used in Irma-office and Outgoing Call calculations can be assumed to be 135 seconds if unknown.

— Receiver holding times assumed to be 6.2 and 14.1 seconds for intra and outgoing calls respectively.

— Factor (1-R)/2 in (1) Outgoing, assumes that Incoming calls and Outgoing calls are equal. R is the intra-office ratio.

Procedure 3-2
Detailed calculation method 1

1 Calculate Digitone calls:

$$\text{Intra-office traffic} = \frac{100 \times \text{Diaitone station traffic (ccs)}}{\text{call holding time in seconds}} \times \frac{R}{2}$$

$$\text{Outgoing traffic} = \frac{100 \times \text{Digitone station traffic}}{\text{call holding time in seconds}} \times \frac{(1-R)}{2}$$

2 Calculate total receiver traffic:

$$\text{Total receiver traffic} = 1.3 \times \frac{[(6.2 \times \text{Intra}) + (14.1 \times \text{outgoing})]}{100}$$

3 Calculate average holding time:.

$$\text{Average holding time} = \frac{(6.2 \times \text{Intra}) + (14.1 \times \text{outgoing})}{\text{Intra calls} + \text{outgoing calls}}$$

4 Refer to Table 6-7 or Table 6-8 (at the end of this document) and use answers from (2) and (3) above to determine the number of receivers required.

Detailed calculation: method 2

This method can be used when incoming Digitone trunks are included in the system. This method uses the same assumptions as method 1, with the receiver holding time assumed to be 2.5 seconds for a DID call.

Procedure 3-2
Detailed calculation method 1

1 Calcualte Intra-office and Outgoing Digitone calls as shown in Method 1 (1):

$$\text{DID calls} = \frac{100 \times \text{Dinitone station traffic (in ccs)}}{\text{call holding time in seconds}}$$

2 Calculate total receiver traffic:

Total receiver traffic =

$$\frac{1.3 \times 6.2 \times \text{Intra} + (1.3 \times 14.1 \times \text{outgoing}) + (2.5 \times \text{DID calls}).}{100}$$

3 Refer to Table 6-9 (at the end of this document) and use the answer from (2) above to determine the number of digitone receivers required.

Step 6: Calculate total system load

Total the line, trunk, console, and Digitone receiver load for each customer to arrive at a total load figure for each customer for the cutover, 2-year, and 5-year interval. Enter this figure on Worksheets B and C (at the end of this document).

Step 7: Calculate number of superloops required

The system network loop requirement is the total of all individual customer loops and superloops required. The number of network loops and superloops required is calculated for each customer for the cutover, IL-year, and 5-year interval. Network loops and superloops are provisioned at cutover on the basis of the 2-year loop requirement figure.

To determine the number of superloops required, first separate the traffic supported by Enhanced Network Cards (QPC414). Enhanced Networks support the traffic carried by Data Line Cards (QPC3 11, QPC430, QPC432), RPE, and DTI/PRI. Remaining traffic including DTR traffic should be engineered for superloops.

Number of Superloop Network Cards or Number of superloops =

$$\frac{\text{Traffic to be handled by Superloon Network}}{2975}$$

These figures are based on an 85% utilization level. The value obtained should be rounded to the next higher number. For Option 21, exclude the traffic carried by 10 Intelligent Peripheral Equipment (IPE) Cards in the first module before computing the number of Superloop Network Cards.

Non-blocking configuration with Superloop Network

For non-blocking applications (or non-blocking part of the system), provide one superloop per 120 Terminal Numbers (TNs). Each line or trunk is one TN except that an integrated voice and data line is two TNs (assuming dam port is configured).

Blocking configuration with Superloop Network

For applications where blocking is allowed, one superloop can serve up to 512 lines (1024 TNs). The actual number of lines will depend on the traffic requirement of the lines.

Enhanced Network Cards (QPC414)

The traffic carried by Enhanced Network Cards includes the data traffic, RPE traffic, and DTI/PRI traffic (which includes both the data and voice traffic).

Provide separate loops for RPE and DTI/PRI traffic. Based on 85% utilization, the number of loops required is calculated as follows:

$$\text{Number of loops} = \frac{\text{Traffic reauired to be carried by Enhanced Network Cards}}{560}$$

$$\text{Number of Enhanced Network Cards} = \frac{\text{Number of loops}}{2}$$

The value obtained should be rounded to the next higher number.

DTI/PRI cards

Digital Trunk Interface Cards (DTIs) provide the interface between the SL-1 switch and the T-1/DS 1 Digital transmission trunks. Digital trunks are offered in the group of 24 trunks. The number of DTI Cards required can be found from Table 3-5 when the DTI/PRI traffic is known.

Note: The number of DTI/PRI loops = number of DTI/PRI cards

Table 3-5
Number of DTI cards required when DTI/PRI traffic is known

DTI/PRI traffic (CCS)	Number of DTI cards
1 - 507	1
508 - 1201	2
1202 - 1935	3
1936 - 2689	4
2690 - 3456	5
3457 - 4231	6
4232 - 5006	7
5007 - 5781	8
over 5781	provide 8+ one DTI for each 774 ccs in excess of 5781 ccs.

Note: In a Network module, if two network slots are available but not contiguous, the Superloop Network Card or Enhanced Network Card can be moved to create a 2" slot for DTI/PRI. The Superloop Network Card can be plugged into the left or right half of the "superslot" to achieve this purpose.

For non-blocking applications, the Ring Again feature must be provided since blocking may occur at the far end of the trunk.

Since the DTI/PRI Card physically occupies two network slots, therefore, the number of DTI/PRI Cards should be multiplied by 2 to obtain the required number of network slots.

DTI/PRI Cards can be plugged into a Network module, a Common/Peripheral Equipment module, a Common Equipment module, a CPU module, or Remote Peripheral Equipment modules. After all essential cards are configured in these UEMs, estimate the available slots for DTI/PRI. If enough slots are not available for all DTI/PRIs required, a special DTI/PRI-only Network module can be added to the system.

Step 8: Calculate number of Network groups required

Compute the number of Network groups based on the total. number of loops required (excluding conference and tone loops). The following equation should be used: (Also refer to Table 3-6.)

Total number of loops = 4 x no. of Superloop Network Cards + 2 x no. of Enhanced Networks

Table 3-6
Number of groups based on the total number of loops required

Number of groups	Number of loops
1	28
2	56
3	84
4	112
5	140

Note: Use Worksheet C (at the end of this document) if no superloop is required. If the total number of loops required exceeds 22, then a multiple group system should be installed.

Based on the above criteria, installing a multiple group system at the start is more cost-effective than converting to a multiple group system (from a single gropu system) between the 2-year and 5-year interval.

Step 9: Calculate number of PE cards required

Enter the number of Digitone receivers required (from Worksheet B) at the cutover, 2-year, and 5-year interval on Worksheet D. Use a separate worksheet for the cutover, 2-year, and 5-year intervals.

Using the information on Worksheet A, enter the number of M2xxx TNs, M3xxx TNs, NE-500/2500 TN, SL-1 TN, and trunk TN required at the cutover, 2-year, and 5-year interval (for all customers).

Divide each entry by the number of terminal number assignments per card, round up to the next highest figure, and total the number of cards required.

Calculate the number of new cards and old cards separately.

> ***Note:*** Worksheets are provided at the end of this document.

Step 10: Calculate number of PE UEMs required

The number of PE UEMs provided at cutover is based on the 2-year estimate of PE cards required and an 85% utilization level. The maximum capacity of an Intelligent Peripheral Equipment (IPE) Module is 256 Integrated Voice and Data (IVD) or analog lines; however, a typical configuration should include a combination of line, trunk, and digitone receivers which provides up to 160 lines with appropriate trunks.

Divide the number of PE cards required at 2-years by 8.5, round to the next higher figure, and enter this value on Worksheet D (at the end of this document).

To compute the number of Peripheral Equipment (PE) UEMs, total the number of line cards, trunk cards, and Digitone receiver cards required at 2 years by 13.6 and round to the next higher integer figure. Enter this value into Worksheet D (located at the end of this document).

Calculate the number of IPE UEMs and PE UEMs required.

Step 11: Provision TDS/Conference loops

Tone and Digit Switch (TDS) and Conference (CONF) loops are provisioned according to the two-year figure for the number of network loops required. All systems should be equipped with a minimum of two TDS and two CONF loops.

Refer to Table 6- 10 (at the end of this document) to determine TDS and CONF loop requirements for systems other than SL-1 S. Enter these figures on Worksheet F (at the end of this document).

Step 12: Calculate memory requirements

Refer to the end of this document and use Worksheets G through I to calculate memory needs. The two-year figure for sets, consoles, trunks, for example, should be used when calculating. Once the total memory needs are determined, add an additional 10% to the total.

Step 13: Assign the equipment / prepare equipment summary

Equipment summary

Use Worksheet J (at the end of this document) to record the equipment requirements for the complete system at cutover. Proceed to assign the equipment. The equipment summary may have to be updated as a result of assigning procedures. The equipment summary, once finalized, may be used to order the equipment for the system.

Feature calculations

Calculations with Authorization Code

With authorization code, the receiver holding times are changed from 6.2 seconds to 19.6 seconds for intra-office calls, and from 14.1 seconds to 27.5 seconds for outgoing calls.

Use these figures in (2) and (3) of Detailed calculation Method 1, and (2) of Detailed calculation Method 2 when calculating the DTR requirements for a system with the authorization code option.

The following is assumed.

- All Digitone intra-office and outgoing calls require authorization.
- The average number of Special Services Prefix (SSP) digits is 2 (the maximum is 4).
- The average number of authorization code digits is 10 (range is 1 to 14 digits).
- The average receiver holding time is 13.4 seconds.

  Note: *See* Table 6-7 at the end of this document.

Calculations with Centralized Attendant Service (CAS)

This method is used to determine the DTR requirements for the main location of a system equipped with the CAS option. The following is assumed:

- All attendant calls presented through Release Link Trunks' (RLT) from a remote PBX require Digitone Receivers.
- The average number of digits dialed is 4.
- Average receiver holding time is 6.2 seconds.

Procedure 4-1
Calculations with CAS

1 Calculate the attendant calls from the remote PBX:

$$\text{attendant call} = \frac{100 \times \text{attendant traffic from the remote (CCS)}}{\text{attendant work time (in seconds)}}$$

2 Add the attendant calls to the intra-office calls calculated in (1) of Method 1, and proceed with the remaining calculations of Method 1.

Calculations with Charge Account for CDR

The receiver holding time for outgoing calls changes from 14.1 seconds to 20.8 seconds.

Apply this change to (2) and (3) in Method 1 and (3) in Method 2 to determine DTR requirements for a system with the charge account for CDR option.

The following is assumed:

- 50% of the Digitone outgoing calls require charge account.
- The average number of SSP digits is 2 (maximum is 4).
- The average number of digits in the account number is 10 (range is 2 to 23 digits).
- The average receiver holding time is 13.4 seconds. See Table 6-7.

Calculations with Direct Inward System Access (DISA)

This method is used when a system is equipped with DISA. The following is assumed:

- The DISA calls come through DISA trunks or DID trunks.'
- 75% of DISA calls require security code.
- The average number of digits in the security code is 4 (range is 1 to 8).
- The DISA receiver holding time is 6.2 seconds.

Procedure 4-2
Calculations with DISA

1 Calculate the number of DISA calls.

$$\text{DISA calls} = \frac{100 \times \text{DISA traffic}}{\text{call holding time}}$$

2 Calculate the DISA receiver traffic.

$$\text{DISA receiver traffic} = \frac{6.2 \times \text{DISA calls}}{100}$$

3 Add this traffic to (2) in Method 2 and proceed with the remainder of Method 2 calculations.

Calculations with Integrated Message Service (IMS)

This method is used when a system is equipped with IMS. The following is assumed:

- Only messaging calls from 2500 sets require Digitone Receiver service
- 50-50 split of originating and terminating calls and 135 seconds average call holding time were assumed in Step (a).
- 50% of calls from 2500 sets were intra-PBX calls Step (b).
- In general, a caller will not wait until the completion of Recorded Announcement to act (press message button or transfer to attendant). The average time is listening to an announcement is four seconds, (Step d).
- If the actual number of 2500 sets is not known, assume it to be 60% of total lines.

Procedure 4-3
Calculations with IMS

1 Calculate originating calls from 2500 sets of the PBX.

Calls from 2500 sets = CCS/line x 100 x Qty 2500 sets/(2x135) = A

2 Calculate intra-PBX calls from 2500 sets.

Irma-PBX 2500-set calls = A x 0.5 = B

3 Calculate calls requiring service of DTR.

Calls to DTR = B x 0.5 = C where 0.5 is the fraction of B which goes to the messaging service.

4 Calculate traffic (CCS) to DTR.
Messaging CCS to DTR = C x 4/100
Messaging CCS should be added to the total DTR traffic to determine the overall DTR requirements.

Worksheets

Worksheet A
Growth forecast

One sheet for each customer, one sheet for the system as a whole.

Customer: ____________________ Date: ______________

	Cutover	2-year	5-year	CCS/T
Stations				
M2xxx sets				
M2xxx TNs				
M3xxx sets				
M3xxx TNs				
SL-1 Sets				
SL-1 TNs				
500 Sets				
2500 Sets				
2500 TNs				
Trunks				
2-Way				
1-Way In				
1-Way Out				
DID				
TIE				
CCSA				
INWATS				
OUTWATS				
FX				
Private Line				
Dial Dictation				
Paging				
RAN				
AIOD				
DTI				
E&M 2W				
E&M 4W				
c o				

Worksheet A continued
Growth forecast

Customer: ____________________ **Date:** ______________

Line CCS/T ____________

Total Trunk CCS/T ____________

Intra CCS/T ____________

Worksheet B

One sheet for each customer for cutover, 2-year, and 5-year intervals. One for the system cutover, 2-year, and 5-year intervals.

Customer: ____________________ Year: _______

Address: ____________________

____

Line usage

M2xxx	TN_______	x	_______ccs/T	=	_______	ccs
M3xxx	TN_______	x	_______ccs/T	=	_______	ccs
SL-1	TN_______	x	_______ccs/T	=	_______	ccs
500	TN_______	x	_______ccs/T	=	_______	ccs
2500	TN_______	x	_______ccs/T	=	_______	ccs
	TOTAL LINE LOAD			=	_______	ccs

Trunk usage

Trunk Route	No of TNs Accessing Route		CCS/T Per Trunk Route		Total CCS Load Per Trunk Route
_______	_______	x	_______	=	_______ ccs
_______	_______	x	_______	=	_______ ccs
_______	_______	x	_______	=	_______ ccs
_______	_______	x	_______	=	_______ ccs
_______	_______	x	_______	=	_______ ccs
_______	_______	x	_______	=	_______ ccs

Worksheet B continued

TOTAL TRUNK LOAD = ___________ccs

Console usage
No. of
Consoles ____________ x 3occcs = __________ Total Console Load

Digital Receivers
Table ____________ **# of DTR** __________ Total DTR Load
__________ccs

Total Load
__________ccs

Worksheet C

One sheet for each customer.
One sheet for the complete system.

Customer: ____________________ Year: ______

Address: ____________________

____

Network loop calculation

	Total load (CCS)	CCS /Loop		No. of loops	Round to next highest figure
Cutover	______	______	=	______	______
2-year	______	______	=	______	______
5-year	______	______	=	______	______

Number of Network Loops Required at 2 Years = ______

Number of Network Groups Required at 2 Years = ______
(Use Table C- 1 Below)

Worksheet C continued

Table C-l
Network groups required at 2 years

No. of Network Groups	Maximum No. of Voice Loops	No DGT Trunks in CCS/Loop 560	500	With DGT Trunks in CCS/Loop 540	485
1	24	13440	12000	12960	11640
2	48	26880	24000	25920	23280
3	72	40320	36000	38880	34920
4	96	53760	48000	51840	46560
5	120	67200	60000	64800	58200

Note: The maximum CCS/loop for any SL-1 is 600 CCS/loop when no Digitone Trunks are used or 580 CCS/loop when Digitone Trunks are used.

Worksheet D

One for the complete system at cutover, 2-year, and 5-year intervals.

Customer: ______________________ **Year:** ______

Address: ______________________

____

Table D-l

PE card calculations	**CUT**	**2-YR**	**5-YR**
No. of ISDgtl C =			
No. of DTR =			
No. of 500 TN / 4 =			
No. of SL-1 TN / 4 =			
No. of Consoles =			
No. of CO/FX/ Wats/Private Link Trunks / 2 =			
No. of 2-Wire E&M/DX/Paging Trunks / 2 =			

Worksheet D continued

Table D-l continued

PE card calculations	**CUT**	**2-YR**	**5-YR**
No. of Loop Signaling/DID Trunks / 2			
No. of Dictation Trunks / 2			
No. of Recorded Announcement Trunks / 4			
No. of AIOD Trunks			
No. of 4-Wire E&M/DX Trunks / 2			
TOTAL CARDS			

PE UEM calculations

Use the total cards required at 2 years to determine the number of PE UEMs to be provisioned at cutover.

PE UEMs required = $\frac{\text{Total cards}}{8.5}$ (Round to next highest number)

Number of PE UEMs required at cutover ________________

Table D-l continued

PE card calculations	CUT	2-YR	5-YR
No. of Dgtl LC = Number of digital ports in service + number of TCM consoles x 6			
No. of Anlg LCs = Number of analog ports in service / 16			
No. of Anlg M/W LCs = Number of analog ports with Message Waiting feature in service / 16			
No. of XUT = Total number of CO/DID/RAN/PAGE trunks / 8			
No. of XEMs = Total number of E&M/PAGE/Dictation trunks / 4			
TOTAL CARDS			

Notes: Do not configure more than one TCM console on one Dgtl LC for higher reliability. Try to spread Dgtl LCs supporting consoles over different XPE UEMs and different superloops for even higher reliability. Use paging trunks on XUT or XEM depending on what combination minimizes the total number of trunk cards required.

Worksheet E

One sheet for the complete system.

Customer: ____________________ Date: ______

Address: ____________________

____

UEM provisioning

(1) Single network group system	CPU UEM	1
	PE UEM	______
(2) Multiple network group system	CPU UEM	______
	Network UEM	______
	PE UEM	______

Worksheet F

One sheet for the complete system.

Customer: ____________________ Date: ______

Address: ____________________

____

Conference loop requirements

Conference loops are provisioned according to the 2-year network loop requirements.

Conference Loop Required = __________

Tone and Digit loop requirements

Tone and Digit loops are provisioned according to the 2-year network loop requirements.

Tone and Digit Loops Required = __________

Estimated real time usage calculation

$$ERTU = \frac{\text{Total Line Load} \times 100 \times T}{150} / 2100$$

= Percent Utilization of CPU Real Time

Worksheet F continued

Where:

Total Line Load is the 2-year figure

T = the average processing time for a call in seconds;

use 0.6 for a single network group system, or
0.24 for a multiple network group system

150 = the average holding time

2100 = the maximum useable real time of the CPU in seconds

Worksheet G

One sheet for the complete system.

Customer: ______________________ Date:

	Items	Words	Total
Fixed Amount of Storage Required			
500 + 2500 TN			
SL-1 TN			
Add-On Modules			
Network Groups			
Trunk Circuits			
Consoles			
Customer Groups			
Trunk Routes			
Network Loops (Excluding Conference)			
RPE Loops			

Total ___________ **(Include total from second worksheet)**

Total words ___________ **(Include total words from second worksheet)**

Worksheet G continued

	Items	Words	Total
InterGroup Pairs			
Peripheral Signaling Cards			
Serial Data Interface Cards			
Tone and Digit Switch			
MF Senders			
Conference Card			
Digitone Receivers			
Call Registers			
Low Priority Input Buffers			
High priority Input Buffers			
500-Type Output Buffers			
SL-1 Type Output Buffer			

Total ____________ **(Add to first page total)**

Total words ____________ **(Add to first page total words)**

Worksheet G continued

Memory Card Code OPC/NT - ____________

Capacity ____ k words (1k = 1024 Words)

Unprotected Memory Cards Required ____________

Memory Card Addresses Required ____________

Worksheet H

One sheet for the complete system.

Customer: ____________________ Date: ______________

Table H-l
Protected memory calculations

	Items	Words	Total
Fixed Amount of Storage Required	1		
500 + 2500 TN			
SL-1 TN			
Add-On Modules			
Network Groups			
Trunk Circuits			
Consoles			
Customer Groups			
Trunk Routes			
Code Restricted Trunk Routes			
Network Loops (Excluding Conference)			
Digitone Receivers			

Worksheet H continued

Total __________ **(Include total from third page)**

Add 10% __________

Total words __________ **(Include total words from third page)**

Memory Card Code	QPC/NT __________
Capacity	__k words__ (lk = 1024 Words)
Protected Memory Cards Required	__________
Memory Card Addresses Required	__________

Worksheet H continued

One sheet for the complete system.

Customer: ____________________ Date: ______________

Table H-l continued
Protected memory calculations

	Items	Words	Total
Speed Call Head Table			
Speed Call Lists (10 Numbers)			
Speed Call Lists (50 Numbers)			
Tone and Digit Switch			
Conference Card			
History File			

Total __________ **(Add to first page total)**

Add 10% __________

Total words __________ **(Add to first page total words)**

Worksheet I

One sheet for the complete system.

Customer: ____________________ Date: _______________

Program store calculations

Program Name	**Storage in k (lk = 1024 words)**
Basic	
Overlay Area	
Read Only Memory	

Total = __________ k

Total x 1024 = __________ **words**

Worksheet I continued

Memory Card Code	OPC/NT
Capacity	k words (1 k = 1024 Words)
Program Store Cards Required	
Memory Card Addresses Required	

Worksheet J
Equipment summary

One sheet for the complete system.

Customer: ____________________ Date: ______________

Table J-l
Equipment summary

Equipment summary	Quantity	Based on figure
Line and Trunk Cards		Cutover
Digitone Receivers		2 Year
Unprotected Memory Cards		2 Year
Protected Memory Cards		2 Year
Conference Loops		2 Year
Tone and Digit Loops		2Year
Call Registers		2 Year
High Priority Input Buffers		Cutover

Worksheet J continued

One sheet for the complete system.

Customer: ____________________ Date: ____________

Table J-1 continued
Equipment summarv

Equipment summary	Quantity	Based on figure
Low Priority Input Buffers		Cutover
500-Type Output Buffers		Cutover
SL-1-Type Output Buffers		Cutover
Central Processing Units		Cutover
Peripheral UEMs		2 Year
Network Loops (Less Conf and TDS)		2 Year
Network Groups		2 Year

Worksheet K

One sheet for the complete system.

Customer: ____________________ Date: _______________

Table K-l
Balancing network loops over network groups

Customer	Network Group 0	Network Group 1	Network Group 2	Network Group 3	Network Group 4

Worksheet L

One sheet for the complete system.

Customer: ____________________ Date: ______________

Load balancing

Total system load = __________ ccs

Voice loops required = __________

PE UEMs required = __________

Average CCS per UEM = $\frac{\text{Total system load CCS}}{\text{PE UEMs required}}$ = __________ ccs

Average CCS per Loop = $\frac{\text{Total system load CCS}}{\text{Voice loops required}}$ = __________ ccs

Table L-l
Load balancing

Loop number	UEMs assigned	CCS per loop	CCS per UEM

Worksheet L continued

One sheet for the complete system.

Customer: ____________________ Date: ______________

Table L-l
Load balancing

Loop number	UEMs assigned	CCS per loop	CCS per UEM

Worksheet M

One sheet for the complete system.

Customer: ____________________ Date: ______________

Card distribution

Divide the total number of a card type by the total number of BE UEMs to arrive at a cards-per-UEM figure:

Table M-1
Card distribution

Pack type	Quantity	Total PE UEMs	Packs per UEM

Worksheet N

One sheet for the complete system.

Customer: ____________ Date: ____________

Table N-l
Multiple Appearance Group (MAG) assignments

Loop number	Loop number	Loop number	Loop number
MAG No. SL-1 TN 500 TN	MAG No. SL-1 TN 500 TN	MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 5ooTN
MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 500 TN	MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 500 TN
MAG No. SL-1 TN 500 TN	MAG No. SL-1 TN 500 TN	MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 5ooTN
MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 5ooTN	MAG No. SL-1 TN 5ooTN	MAG No. SL-I TN 5ooTN
SL-1 Packs ____ 500 Packs	SL-1 Packs 500 Packs	SL-1 Packs 500 Packs	SL-1 Packs 500 Packs

-Worksheet 0

One sheet for the complete system.

Customer: ____________ Date: ____________

Station load balancing

Total SL-1 TN to be assigned ____

Less number of SL-1 TN assigned to MAG - ____

Equals number of SL-1 TN not in MAG = ____

TOTAL PE UEMs = ____________ Number of 500 TN not in

SL-1 TN not in MAG MAG assigned per UEM

TOTAL 500 TN to be assigned ____

Less number of 500 TN assigned to MAG - ____

Equals number of 500 TN not in MAG = ____

TOTAL PE UEMs = ____________ Number of 500 TN not in

500 TN not in MAG MAG assigned per UEM

Worksheet O continued

Total 2500 TN to be assigned ______

Less number of 2500 TN assigned to MAG - ______

Equals number of 2500 TN not in MAG = ______

TOTAL PE UEMs = __________ Number of 2500 TN not in MAG assigned per UEM

2500 **TN not in MAG**

-Worksheet P

Customer: ____________________ Date: ______________

Table P-l
Card to UEM assignment

	Type		Type	Total packs	CCS load
Position 1		Position 6			
Position 2		Position 7			
Position 3		Position 8			
Position 4		Position 9			
Position 5		Position 10			

Loop number ________ UEM number ________

Table P-2
Card to UEM assignment

	Type		Type	Total packs	CCS load
Position 1		Position 6			
Position 2		Position 7			
Position 3		Position 8			
Position 4		Position 9			
Position 5		Position 10			

Loop number ________ UEM number ________

Worksheet P continued

Customer: ____________________ Date: ______________

Table P-3
Card to UEM assignment

	Type		Type	Total packs	CCS load
Position 1		Position 6			
Position 2		Position 7			
Position 3		Position 8			
Position 4		Position 9			
Position 5		Position 10			

Loop number ________ UEM number ________

Table P-4
Card to UEM assignment

	Type		Type	Total packs	c c s load
Position 1		Position 6			
Position 2		Position 7			
Position 3		Position 8			
Position 4		Position 9			
Position 5		Position 10			

Loop number ________ UEM number ________

-Worksheet Q

One sheet for each PE UEM in the system.

Date: ________________

DN = Directory Number
RTMB = Route Member Number

Loop number ________ **UEM number** ________ **Group number** ________

Table Q-1
TN assignment record

Pack pos	Pack type	Pack CKT	DN	RTMB	CUST
1		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
2		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
3		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			

Worksheet Q continued

Date: ______________

DN = Directory Number
RTMB = Route Member Number

Loop number ________ **UEM number** ________ **Group number** ________

Table Q-1 continued
TN assignment record

Pack pos	Pack type	Pack CKT	DN	RTMB	CUST
4		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
5		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
6		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			

Worksheet Q continued

Table Q-1 continued
TN assignment record

Loop # ____ UEM # Grp # ____

Pack pos	Pack type	Pack CKT	DN	RTMB	CUST
7		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
8		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
9		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			
10		0			
		1			
		2			
		3			
		4			
		5			
		6			
		7			

Worksheet R
SL-1 system assignment plan

Prepared by: ____________________ Date: ______

System: ____________________

Customer: ____________________

One sheet for each equipped voice loop.

Loop number ________ **Group number** ________

UEMs equipped __________

Trunks working __________

Trunks equipped __________

Consoles __________

Digitone receivers __________

2500 TN __________

500 TN __________

SL-1 TN __________

MAG assigned __________

Load capacity __________

Recommended assignment plan __________________

Worksheet S
Multiple appearance group record

Prepared by: ____________________ Date: ____

System: ____________________

Customer: ____________________

Table S-l
Multiple appearance group record

MAG number	LP. number	EXT. number	stat. designator	Set type	Department

Tables

Tables 6-1

Table 6-1
Trunk traffic (Poisson 1% blocking)

TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS
1	0.4	31	703	61	1595	91	2530	121	3488
2	5.4	32	732	62	1626	92	2563	122	3520
3	15.7	33	760	63	1657	93	2594	123	3552
4	29.6	34	789	64	1687	94	2625	124	3594
5	46.1	35	818	65	1718	95	2657	125	3616
6	64	36	847	66	1749	96	2689	126	3648
7	84	37	876	67	1780	97	2721	127	3681
8	105	38	905	68	1811	98	2752	128	3713
9	126	39	935	69	1842	99	2784	129	3746
10	149	40	964	70	1873	100	2816	130	3778
11	172	41	993	71	1904	101	2847	131	3810
12	195	42	1023	72	1935	102	2879	132	3843
13	220	43	1052	73	1966	103	2910	133	3875
14	244	44	1082	74	1997	104	2942	134	3907
15	269	45	1112	75	2028	105	2974	135	3939
16	294	46	1142	76	2059	106	3006	136	3972
17	320	47	1171	77	2091	107	3038	137	4004
18	346	48	1201	78	2122	108	3070	138	4037
19	373	49	1231	79	2153	109	3102	139	4070
20	399	50	1261	80	2184	110	3135	140	4102
21	426	51	1291	81	2215	111	3166	141	4134
22	453	52	1322	82	2247	112	3198	142	4167
23	480	53	1352	83	2278	113	3230	143	4199
24	507	54	1382	84	2310	114	3262	144	4231
25	535	55	1412	85	2341	115	3294	145	4264
26	562	56	1443	86	2373	116	3326	146	4297
27	590	57	1473	87	2404	117	3359	147	4329
28	618	58	1504	88	2436	118	3391	148	4362
29	647	59	1534	89	2467	119	3424	149	4395
30	675	60	1565	90	2499	120	3456	150	4427

Note: For trunk traffic greater than 4427 ccs, allow 29.5 ccs/trunk.

Table 6-2
Trunk traffic (Poisson 2% blocking)

TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS
1	4	31	744	61	1659	91	2611	121	3581
2	7.9	32	773	62	1690	92	2643	122	3614
3	20.9	33	803	63	1722	93	2674	123	3647
4	36.7	34	832	64	1752	94	2706	124	3679
5	55.8	35	862	65	1784	95	2739	125	3712
6	76.0	36	892	66	1816	96	2771	126	3745
7	96.8	37	922	67	1817	97	2803	127	3777
8	119	38	952	68	1878	98	2838	128	3810
9	142	39	982	69	1910	99	2868	129	3843
10	166	40	1012	70	1941	100	2900	130	3875
11	191	41	1042	71	1973	101	2931	131	3810
12	216	42	1072	72	2004	102	2964	132	2941
13	241	43	1103	73	2036	103	2996	133	2974
14	267	44	1133	74	2067	104	3029	134	4007
15	293	45	1164	75	2099	105	3651	135	4039

—continued—

Table 6-2 continued
Trunk traffic (Poisson 2% blocking)

TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS	TRKS	CCS
16	320	46	1194	76	2130	106	3094	136	4072
17	347	47	1125	77	2162	107	3126	137	4105
18	374	48	1255	78	2194	108	3158	138	4138
19	401	49	1286	79	2226	109	3190	139	4171
20	429	50	1317	80	2258	110	3223	140	4204
21	458	51	1348	81	2290	111	3255	141	4237
22	486	52	1374	82	2322	112	3288	142	4209
23	514	53	1352	83	2354	113	3321	143	4302
24	542	54	1441	84	2386	114	3353	144	4335
25	571	55	1472	85	2418	115	3386	145	4368
26	562	56	1503	86	2450	116	3418	146	4401
27	627	57	1534	87	2482	117	3451	147	4434
28	656	58	1565	88	2514	118	3483	148	4467
29	685	59	1596	89	3546	119	3516	149	4500
30	715	60	1627	90	2578	120	3548	150	4533

Note: For trunk traffic greater than 4533 ccs, allow 30.2 ccs/trunk.

Table 6-3
Digitone receiver requirements

Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS)	Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS)
2	7	2	17	1181	319
3	33	9	18	1244	336
4	69	19	19	1348	364
5	120	33	20	1455	393
6	179	49	21	1555	420
7	249	68	22	1662	449
8	332	88	23	1774	479
9	399	109	24	1885	509
10	479	131	25	1988	537
11	564	154	26	2100	567
12	659	178	27	2211	597
13	751	203	28	2325	628
14	848	229	29	2440	659
15	944	255	30	2555	690
16	1044	282			

Nok: Refer to Section 3-15 for the Model assumptions for this table.

Table 6-4
Digitone receiver requirements

Number of digitone receivers	Maximum number of digitone line!	Digitone receiver load (CCS)	Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS)
2	2	2	17	843	253
3	21	7	18	920	276
4	52	15	19	996	299
5	90	27	20	1076	323
6	134	40	21	1153	346
7	183	55	22	1233	370
8	235	71	23	1316	395
9	293	88	24	13%	419
10	353	107	25	1480	444
11	416	126	26	1563	469
12	483	145	27	1650	495
13	553	166	28	1733	520
14	623	187	29	1816	545
15	693	208	30	1903	571
16	770	231			

Note: Refer to Section 3 5 for the Mod assumptions for this table.

Table 6-5
Digitone receiver requirements

Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS)	Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS
2	5	2	17	862	319
3	22	9	18	908	336
4	50	19	19	983	364
5	87	33	20	1062	393
6	132	49	21	1135	420
7	180	68	22	1213	449
8	234	88	23	1294	479
9	291	109	24	1375	509
10	353	131	25	1451	537
11	415	154	26	1532	567
12	481	178	27	1613	597
13	548	203	28	1697	628
14	618	229	29	1781	659
15	689	255	30	1864	690
16	762	282			

Note: Refer to Section 3-15 for the Model assumptions for this table.

Table 6-6
Digitone receiver requirements

Number of digitone receivers	Maximum number of digitone lines	Digitone receiver load (CCS)	Number of digitone receivers	Maximum number of digitone lines	Digitone receiver 'load (CCS)
2	4	2	17	683	253
3	18	7	18	745	276
4	41	15	19	808	299
5	72	27	20	872	323
6	109	40	21	935	346
7	148	55	22	1000	370
8	193	71	23	1067	395
9	240	88	24	1132	419
10	291	107	25	1200	444
11	340	126	26	1267	469
12	391	145	27	1337	495
13	448	166	28	1405	520
14	505	187	29	1472	545
15	562	208	30	1543	571
16	624	231			

Note: **Refer to Section 3-15 for the Model assumptions for this table.**

Table 6-7
Digitone receiver load capacity in CCS

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number of **digitone** receivers										
1	0	0	0	0	0	0	0	0	0	0
2	3	2	2	2	2	2	2	2	2	2
3	11	10	10	9	9	9	9	8	8	8
4	24	23	22	21	20	19	19	19	18	18
5	41	39	37	36	35	34	33	33	32	32
6	61	57	55	53	52	50	49	49	48	47
7	83	78	75	73	71	69	68	67	66	65
8	106	101	91	94	91	89	88	86	65	84
9	131	125	120	116	113	111	109	107	106	104
10	157	150	144	140	136	133	131	129	127	126
11	185	176	170	165	161	157	154	152	150	148
12	212	203	196	190	185	182	178	176	173	171
13	241	231	223	216	211	207	203	200	198	196
14	270	259	250	243	237	233	229	225	223	220
15	300	288	278	271	264	259	255	251	248	245
16	339	317	397	298	292	286	282	278	274	271
17	361	346	335	327	310	313	319	306	392	298
18	391	377	365	356	348	342	336	331	327	324
19	422	409	396	386	378	371	364	359	355	351
20	454	438	425	414	405	398	393	388	383	379

—continued—

Table 6-7 continued
Digitone receiver load capacity in CCS

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number Of digitone receivers										
	0	0	0	0	0	0	0	0	0	0
21	487	469	455	444	435	427	420	415	410	406
22	517	501	487	475	466	456	449	443	438	434
23	550	531	516	504	494	487	479	472	467	562
24	583	563	547	535	524	515	509	502	497	491
25	615	595	579	566	555	545	537	532	526	521
26	647	628	612	598	586	576	567	560	554	548
27	680	659	642	628	618	607	597	589	583	577
28	714	691	674	659	647	638	628	620	613	607
29	746	724	706	690	678	667	659	651	644	637
30	779	758	738	723	709	698	690	682	674	668
31	813	792	771	755	742	729	719	710	703	696
32	847	822	805	788	774	761	750	741	733	726
33	882	855	835	818	804	793	781	772	763	756
34	913	889	868	850	836	825	812	803	795	787
35	947	923	900	883	867	855	844	835	826	818
36	981	957	934	916	900	886	876	866	857	850
37	1016	989	967	949	933	919	909	898	889	881
38	1051	1022	1001	982	966	951	938	928	918	912
39	1083	1055	1035	1015	999	984	970	959	949	941
40	1117	1089	1066	1046	1029	1017	1002	990	981	972

Table 6-8
Digitone receiver load capacity in CCS

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number Of **digitone** receivers	0	0	0	0	0	0	0	0	0	0
1										
2	2	2	2	2	2	2	2	2	2	2
3	8	8	8	8	8	8	8	8	8	8
4	18	18	18	18	18	17	17	17	17	17
5	31	31	31	30	30	30	30	30	30	[illegible]
6	47	46	46	45	45	45	45	44	44	44
7	64	63	63	62	62	62	61	61	61	[illegible]
8	83	82	82	81	80	80	79	79	79	[illegible]
9	103	102	101	100	100	99	99	98	98	97
10	125	123	122	121	121	120	119	119	118	[illegible]
11	147	145	144	143	142	141	140	140	139	[illegible]
12	170	168	167	166	165	164	163	162	161	[illegible]
13	193	192	190	189	188	186	185	184	184	[illegible]
14	218	216	214	213	211	210	209	208	207	206
15	243	241	239	237	236	234	233	232	231	[illegible]
16	268	266	264	262	260	259	257	256	255	254
17	294	292	290	288	286	284	283	281	280	[illegible]
18	322	319	317	314	312	311	309	308	306	[illegible]
19	347	344	342	339	337	335	334	332	331	[illegible]
20	374	371	368	366	364	361	360	358	356	[illegible]

Table 6-8 continued
Digitone receiver load capacity in CCS

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number of digitone receivers	0	0	0	0	0	0	0	0	0	0
21	402	399	396	393	391	388	386	385	383	381
22	431	427	424	421	419	416	414	412	410	409
23	458	454	451	448	445	442	440	438	436	434
24	486	482	478	475	472	470	467	465	463	461
25	514	510	506	503	500	497	495	492	490	488
26	544	539	535	532	529	526	523	521	518	516
27	573	569	565	561	558	555	552	549	547	545
28	603	598	594	590	587	584	581	578	576	573
29	631	626	622	618	614	611	608	605	602	600
30	660	655	651	646	643	639	636	633	631	628
31	690	685	680	676	672	668	665	662	659	656
32	720	715	710	705	701	698	694	691	688	686
33	751	745	740	735	731	727	724	721	718	715
34	782	776	771	766	761	757	754	750	747	744
35	813	807	801	7%	792	788	784	780	777	774
36	341	835	829	824	820	818	814	810	807	804
37	872	865	859	854	849	845	841	837	834	831
38	902	896	890	884	879	875	871	867	863	860
39	934	927	921	914	909	905	901	897	893	890
40	965	952	952	945	940	936	931	927	923	920

Table 6-9
Digitone receiver requirements
(Poisson 0.1% blocking)

Number of digitone receivers	Digitone receiver load (CCS)	Number of digitone receivers	Digitone receiver load (CCS)
1	0	26	469
2	2	27	495
3	7	28	520
4	15	29	545
5	27	30	571
6	40	31	597
7	55	32	624
8	71	33	650
9	88	34	676
10	107	35	703
11	126	36	729
12	145	37	756
13	166	38	783
14	187	39	810
15	208	40	837
16	231	41	865
17	253	42	892
18	276	43	919
19	299	44	947
20	323	45	975
21	346	46	1003
22	370	47	1030
23	395	48	1058
24	419	49	1086
25	444	50	1115

Table 6-10
Network group capacities

Number of network groups	Maximum number of voice loops	No figitonetrunks 744 / 560 / 500 CCS per loop	Digitone trunks 720 / 540 / 485 CCS per loop
1	24	17850 / 13440 / 12000	17280 / 12960 / 11640
2	48	35700 / 26880 / 24000	34560 / 25920 / 23280
3	72	53550 / 40320 / 36000	51840 / 38880 / 34920
4	96	71400 / 53760 / 48000	69120 / 51840 / 46560
5	120	89250 / 67200 / 60000	86400 / 64800 / 58200

Note: This table is based on an 85% utilization level. The 17850 CCS limit used above is based on CCS/Loop figures of 744 CCS/Loop with no Digitone trunks and 720 CCS/Loop with Digitone trunks. This constitutes an 85% utilization level of the maximum CCS/Loop of the current system which is 875 CCS/Loop with no Digitone trunks and 848 CCS/Loop with Digitone trunks and with the use of a Superloop Network Card.

Table 6-10
TDS and CONF loop requirements

Network loops required at 2 years	Tone and Digit Switch loops required	Conference loops required
1-12	1	1
13-24	2	2
25-36	3	3
37-48	4	4
49-60	5	5
61-72	6	6
73-84	7	7
85-96	8	8
97-108	9	9
m-120	10	10

Table 6-11
Digitone receiver provisioning
(assumes 1 l-second holding time)

DTR CCS	DTR ports	DTR CCS	DTR ports
1-2	2	730-761	32
3-9	3	762-793	33
10-19	4	794-825	34
20-34	5	826-856	35
35-50	6	857-887	36
51-69	7	888-919	37
70-89	8	920-951	38
90-111	9	952-984	39
112-133	10	985-1017	40
134-157	11	1018-1050	41
158-182	12	1051-1084	42
183-207	13	1085-1118	43
208-233	14	1119-1153	44
234-259	15	1154-1188	45
260-286	16	1189-1223	46
287-313	17	1224-1258	47
314-342	18	1259-1293	48
343-371	19	1294-1329	49
372-398	20	1330-1365	50
399-427	21	1366-1400	51
428-456	22	1401-1435	52
457-487	23	1436-1470	53
488-515	24	1471-1505	54
516-545	25	1506-1540	55
546-576	26	1541-1575	56
577-607	27	1576-1610	57
608-638	28	1611-1645	58
639-667	29	1646-1680	59
668-698	30	1681-1715	60
699-729	31	1716-1750	61

—continued—

Table 6-11 continued
Digitone receiver provisioning
(assumes 11-second holding time)

DTR CCS	DTR ports	DTR CCS	DTR ports
1751-1785	62	2871-2905	94
1786-1820	63	2906-2940	95
1821-1855	64	294 l-2975	96
1856-1890	65	2976-3010	97
1891-1925	66	3011-3045	98
1926- 1960	67	3046-3080	99
1961-1995	68	3081-3115	100
1996-2030	69	3116-3465	101
2031-2065	70		
2066-2100	71		
2101-2135	72		
2136-2170	73		
2171-2205	74		
2206-2240	75		
2241-2275	76		
2276-2310	77		
2311-2345	78		
2346-2380	79		
2381-2415	80		
2416-2450	81		
2451-2485	82		
2486-2520	83		
2521-2555	84		
2556-2590	85		
2591-2625	86		
2626-2660	87		
2661-2695	88		
2696-2730	89		
2731-2765	90		
2766-2800	91		
2801-2835	92		
2X36-2870	93		

SL-1

System options 21, 51,61, 71

System engineering

Information subject to change without notice.
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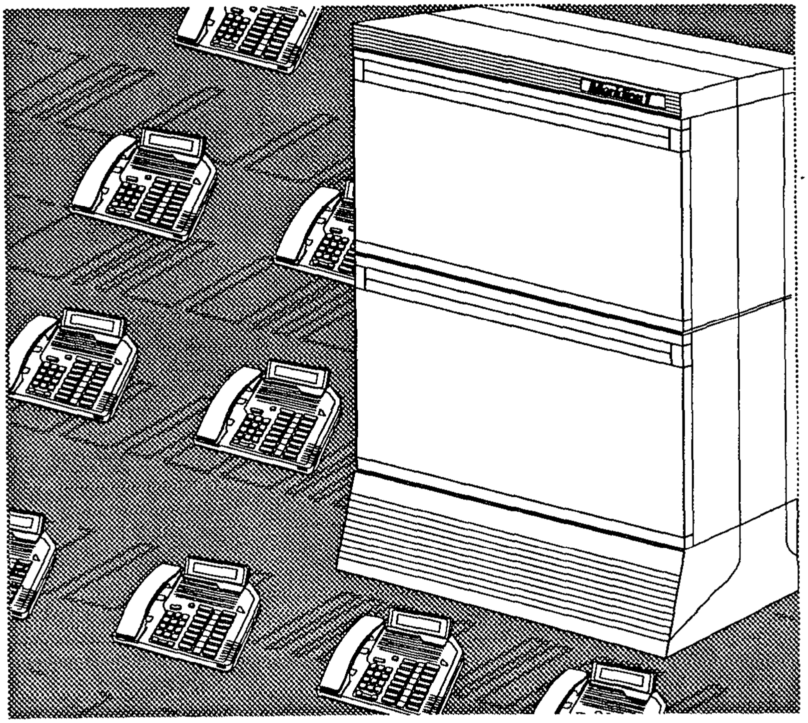
553-2201-151 Appendix 1

SL-1

Generic Xl 1

Memory calculations

Standard, release 15



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Meridian 1
Communication Systems

SL-1

Generic Xl 1

Memory calculations

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Contents

General

This Appendix provides memory information relating to the SL-1 Integrated Services Network (ISN).

Engineering and assigning of equipment (553-2201-151) provides provisioning information and the associated data worksheets for a complete system. For Generic Xl 1, ***Engineering and assigning of equipment (553-*** 2201-151) directs the user to this Appendix for specific memory calculation information. Apply this information in worksheets G, H, I of that document for the machine types in Table 1.

Use these numbers to identify machine types in the following tables.

> Note : The memory calculations for the RT (13 11) are the same as-for NT(1lll).

Table 1
Machine type designators

Machine type		Code number	System option
MS/S	=	711	
N	=	811	
XN	=	911	
ST	=	1011	21
NT	=	1111	51/61
XT	=	1211	71
RT	=	1311	

Memory description

Software and office data are stored in a read/write Random Access Memory (RAM). The RAM is organized into modules of 128K, 192K, 256K, 512K or 768K by 16-bit words, or 24-bit words for NT, RT, and XT machines in Release 12 and later. Memory size depends on the features programmed into the machine and the number and type of stations served. The memory module pack(s) are mounted in the CE shelf. The following table shows the valid hardware configuration for the various SL-1 systems.

Release 15 introduces other System Options, whose memory calculations coincide with the following current machine types:

- System option 21 has the same memory capacity as the 1011 machine (ST) type
- System options 51, and 61 have the same memory capacity as the 1111 machine (NT) type
- System option 71 has the same memory capacity as the 1211 machine (XT) type

Table 2
QPC memory module packs per system-

Memory size	MS/S	N	XN	NT/RT	XT	ST
128K	1 - 478		l-479		1 - 479	
192K	1 - 423		l-426		1 - 426	
256K	2 - 478 OR 1 - 674		2-479		2-479	
320K		l-426 + 1 - 479	1 - 478 + 1- 479			
384K		2-426	2-426			
512K		1 - 672	1 - 672			1 - 673
576K			3-426			
768K			4 - 426	1 - 583	1 - 583	
1536K				1 - 583	2 - 583	
2304K						3 - 583

Note : 1K = 1024 words. Storage capacity of the:

— QPC423 memory circuit pack is 192 x 1024 or 196,608 words

— QPC426 memory circuit pack is 192 x 1024 or 196,608 words

— QPC478 memory circuit pack is 128 x 1024 or 131,072 words

— QPC479 memory circuit pack is 128 x 1024 or 13 1,072 words

— QPC583 memory circuit pack is 768 x 1024 or 786,432 words, with 25-bit words for NT and XT machines

— QPC672 memory circuit pack is 512 x 1024 or 524,288 words

— QPC673 memory circuit pack is 512 x 1024 or 524,288 words

— QPC674 memory circuit pack is 256 x 1024 or 262,144 words

Memory Generic 711 (S and MS)

The memory requirements for a Generic 7 11 system consists of a Read Only Memory (ROM) circuit pack and RAM circuit pack(s). The memory system is divided into pages.

The unprotected and protected data stores are usually assigned to pages 0 and 1.

The bottom 8K words of page 2 are replaced with the QPC486 ROM pack. The remaining top words of page 2 are assigned to program store.

Page 3 (Input/Output memory) is not assigned to a QPC478 module and page 4 is not used.

Additional pages of program store are provided as required, by RAM pack addition or rearrangement.

Configuration Overlay LD 17 is used to assign the RAM type or' combination of types for data and program store to a system (see 553-3001-400).

Memory Generics 811 and 911 (N and XN)

Software and office data for Generics 8 11 and 9 11 are stored in a RAM (as for Generic 7 11) except that QPC426 and/or QPC479 modules (or a QPC672) are used.

The ROM for Generic 8 11 is contained in a QPC486 pack while the ROM for Generic 9 11 is part of the QPC443 Control and Timing pack.

Memory Generics 1011 (ST)

Software and office data for Generic 1011 system are stored in a RAM (as for Generic 7 11) except that QPC673 (with error correction) is used.

The ROM for Generic 1011 is contained in QPC717 ROM pack which connects to the QPC687 CPU pack.

Memory Generics 1111, 1211, and 1311 (NT, XT, and RT)

Software and office data for Generic 1111, 1211, and 13 11 systems are stored in a RAM (as for Generic 711) except that QPC583 modules, with 24-bit addressing, are used.

The ROM for Generic 1111; 1211, and 13 11 is contained in a QPC579 CPU Function Unit.

Templates

A template is a map of the pattern of keys/features assigned to a telephone, The protected data structure for the SL- 1 NE-500/2500 and digital telephones is based on the concept of shared templates. For example, if two or more telephones have identical key/feature layouts, then the data regarding this layout is contained in a single template, thereby reducing the storage required for data description.

The operation of the template mechanism is internal and is transparent to the user. Templates are created automatically either by service change programs or by the sysload program at system startup. The data print program (Overlay 20) of 553-3001-400 has been extended to assist in optimizing template usage. The program can print:

— individual templates or all templates in the system.

— the number of telephones using a particular template.

— the Terminal Numbers (TNs) using a template.

— the total number of templates defined and the number of templates used by at least one telephone.

> ***Note :*** A large number of telephones clustered around a relative small number of templates indicates efficient use of templates.

When data is entered into the system, use the following guidelines to maximize the protected memory savings provided by the template mechanisms.

(a) If two or more telephones have the same functions defined, they should, if possible, have the same key/feature layout assigned. This ensures that all such telephones and add-on modules share the same template.

(b) For telephones that have the same functions defined but their auto-dial and/or call-forward features have different number sizes, it is less expensive (in terms of memory) to make the sizes of the numbers equal rather than assign the telephones to different templates. The rule to be used is that a new template requires at least 12 words of protected data for SL-1 telephone sets and four words for 500/2500 telephones, whereas four extra digits use only 1 word.

(c) Use Overlay 20 of 553-3001-400 to maintain a current list of all templates defined in the system. Consult this list whenever service change of telephones is to be performed.

Memory calculations

The memory requirement for Xl 1 Generic must be calculated individually using the following tables:

Table	Storage
3	Software Program
4	Unprotected Data
5	Protected Data

Record the memory requirements on worksheets G, H and I and add this data to the other completed main practice worksheets to compile the total provisioning data for the SL- 1 system.

Note: The memory requirement figures shown in the tables are based on the following software releases:

711	Releases 4 through 13
811	Releases 4 through 14
911	Releases 4 through 14
1011	Releases 9 through 15
1111/1211	Releases 8 through 15
1311	Releases 12 through 15

Note 1: 711, 811 and 911 Release 6 information is included in Release 7.

Note 2: The memory calculations for the RT (1311) machine are the same as for the NT (1111) machine type.

The absence of Generic release indicator R4, R5, or R7 in **the Version** column indicates the storage words for the associated program applies to all Generic releases.

Package dependencies

Each Generic contains a basic feature group (always provided) to which optional features can be added. For a complete list of the packages available and their related package dependencies, refer *to Equipment identification and ordering (U.S.)* (553-2201-153).

Table 3
Software program storage requirements

Program (1K = 1024 words)	Version	Storage in Ks	Comments
Resident (Basic)	711 R4	73.88	
	711 R5	77.04	
	711 R7	85.59	
	711 R8	87.61	
	711 R9	90.24	
	711 R10	96.70	
	711 R12	112.74	
	711 R13	122.62	
	811 R4	77.15	
	811 R5	81.96	
	811 R7	89.67	
	811 R8	91.10	
	811/1011 R9	95.31	
	811/1011 R10	102.02	
	811/1011 R12	116.75	
	811/1011 R13	126.90	
	811/1011 R14	136.36	
	911 R4	75.76	
	911 R5	81.65	
	911 R7	89.30	
	911 R8	90.62	
	911 R9	92.51	
	911 R10	73.53	
	911 R12	111.03	
	911 R13	121.59	
	911 R14	136.06	
	1011 R15	158.77	
	1111/1211 R8	68.46	
	1111/1211 R9	70.02	
	1111/1211 R10	73.53	
	1111/1211 R12	84.23	
	1111/1211 R13	87.84	
	1111/1211 R14	94.62	
	1111/1211 R15	122.20	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
Read/Write Firmware	711 R4-10	0.74	(Note 1)
	711 R12-13	0.36	
	811 R4	0.34	
	811 R5	0.35	
	811 R7-8	0.35	
	811/1011 R9-10	0.39	
	811/1011 R12-15	0.55	
	911 R4	0.40	
	911 R5	0.77	
	911 R7-10	0.77	
	911 R12-14	Note 1	
	1111/1211 R8-10	0.96	
	1111/1211 R12-15	Note 1	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
Overlay Area	711 R4	10.58	
	711 R5	15.74	
	711 R7	16.46	
	711 R8	16.92	
	711 R9	16.96	
	711 R10	17.12	
	711 R12	18.07	
	711 R13	10.75	
	811 R4	11.00	
	811 R5	15.58	
	811 R7	16.46	
	811 R8	16.94	
	811/1011 R9	17.42	
	811/1011 R10	17.43	
	811/1011 R12	18.07	
	811/1011 R13	10.75	
	811/1011 R14-15	20.51	
	911 R4	11.00	
	911 R5	15.58	
	911 R7	16.46	
	911 R8	16.94	
	911 R9	17.42	
	911 R10	17.43	
	911 R12	18.07	
	911 R13	25.41	
	911 R14	20.51	
	1111/1211 R8	16.46	
	1111/1211 R9	17.42	
	1111/1211 R10	26.14	
	1111/1211 R12	27.10	
	1111/1211 R13	10.60	
	1111/1211 R14-15	30.76	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
OPTF	711, 811, 911, 1011, 1111, 1211	0	All Releases
	1011 R15	17.67	
	1111/1211	12.58	
CUST	711, 811, 911, 1011, 1111, 1211	0	All Releases
	1011 R15	9.19	
	1111/1211 R15	6.38	
AIOD	711 R4-12	0.88	
	711 R13	0.91	
	811 R4-8	0.88	
	811/1011 R9-12	0.88	
	811/1011 R13-15	0.91	
	911 R4-5, 8-12	0.87	
	911 R7	0.86	
	911 R13-14	0.90	
	1111/1211 R8-12	0.65	
	1111/1211 R13-15	0.66	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CDR	711 R4	1.77	
	711 R5	1.80	
	711 R7	1.94	
	711 R8	1.99	
	711 R9	2.05	
	711 R10	2.20	
	711 R12	2.38	
	711 R13	2.47	
	811 R4	1.77	
	811 R5	1.79	
	811 R7	1.94	
	811 R8	1.98	
	811/1011 R9	2.05	
	811/1011 R10	2.20	
	811/1011 R12	2.38	
	811/1011 R13-14	2.47	
	911 R4	1.74	
	911 R5	1.77	
	911 R7	1.91	
	911 R8	1.95	
	911 R9	2.02	
	911 R10	2.17	
	911 R12	2.35	
	911 R13-14	2.45	
	1011 R15	2.48	
	1111/1211 R8	1.50	
	1111/1211 R9	1.55	
	1111/1211 R10	1.67	
	111 1/121 1 R12	1.80	
	111 1/121 1 R13-14	1.75	
	1111/1211 R15	1.76	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CDR TTY	711 R4	0.56	
	711 R5	0.57	
	711 R7	0.59	
	711 R8	0.71	
	711 R9	0.72	
	711 R10	0.99	
	711 R12	1.07	
	711 R13	1.16	
	811 R4, 5	0.56	
	811 R7	0.59	
	811 R8	0.71	
	811 R9	0.72	
	811 R10	0.99	
	811/1011 R12	1.07	
	811/1011 R13-15	1.16	
	911 R4, 5	0.56	
	911 R7	0.59	
	911 R8	0.70	
	911 R9	0.72	
	911 R10	0.98	
	911 R12	1.06	
	911 R13-14	1.14	
	1111/1211 R8	0.54	
	1111/1211 R9	0.55	
	1111/1211 R10	0.76	
	1111/1211 R12	0.82	
	1111/1211 R13-15	0.83	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CDR CLNK	711 R4-5	0.56	
	711 R7-9	0.59	
	711 R10	0.66	
	711 R12	0.69	
	711 R13	0.81	
	811 R4-5	0.56	
	811 R7-8	0.59	
	811/1011 R9	0.59	
	811/1011 R10	0.66	
	811/1011 R12	0.69	
	811/1011 R13	0.81	
	811/1011 R14-15	0.89	
	911 R4	0.56	
	911 R5	0.57	
	911 R7-9	0.59	
	911 R10	0.66	
	911 R12	0.70	
	911 R13	0.82	
	911 R14	0.90	
	1111/1211 R8-9	0.46	
	1111/1211 R10	0.51	
	1111/1211 R12	0.53	
	1111/1211 R13	0.58	
	1111/1211 R14-15	0.64	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage iu Ks	Comments
RAN	711 R4	1.34	
	711 R5	1.34	
	711 R7-8	1.36	
	711 R9	1.41	
	711 R10-12	1.49	
	711 R13	1.55	
	811 R4	1.33	
	811 R5	1.34	
	811 R7-8	1.36	
	811/1011 R9	1.40	
	81 1/101 1 R10-12	1.49	
	811/1011 R13	1.55	
	811/1011 R14	1.54	
	911 R4-5	1.31	
	911 R7	1.36	
	911 R8	1.34	
	911 R9	1.38	
	911 R10	1.46	
	911 R12	1.47	
	911 R13-14	1.53	
	1011 R15	1.60	
	1111/1211 R8	1.03	
	1111/1211 R9	1.07	
	1111/1211 R10	1.12	
	1111/1211 R11	1.13	
	1111/1211 R13-14	1.11	
	1111/1211 R14	1.15	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
TAD	711 R4-5	0.71	
	711 R7-12	0.72	
	711 R13	0.76	
	811 R4-5	0.71	
	811 R7-8	0.72	
	811/1011 R9-12	0.72	
	81 1/1011 R13-15	0.76	
	911 R4-5	0.72	
	911 R7-12	0.73	
	911 R13-14	0.77	
	1111/1211 R8-12	0.54	
	1111/1211 R13-15	0.56	
DNDI	711 R4-9	0.39	
	711 R10	0.40	
	711 R12	0.42	
	711 R13	0.40	
	811 R4-8	0.39	
	811/1011 R9	0.39	
	811/1011 R10	0.40	
	81 1/101 1 R12	0.42	
	811/1011 R13	0.40	
	81 1/101 1 R14	0.42	
	911 R4-9	0.38	
	911 R10	0.39	
	911 R12	0.41	
	911 R13	0.39	
	911 R14	0.41	
	1011 R15	0.43	
	111 1/121 1 R8-10	0.29	
	1111/1211 R12	0.30	
	1111/1211 R13	0.28	
	1111/1211 R14	0.30	
	1111/1211 R15	0.30	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
EES	711 R4	0.60	
	711 R5	0.79	
	711 R7	0.76	
	711 R8	0.75	
	711 R9	0.79	
	711 R10	0.81	
	711 R12	0.83	
	711 R13	0.87	
	811 R4	0.60	
	811 R5	0.79	
	811 R7-8	0.76	
	811/1011 R9	0.81	
	811/1011 R10	0.83	
	811/1011 R12	0.85	
	811/1011 R13	0.89	
	811/1011 R14	0.91	
	911 R4	0.60	
	911 R5	0.78	
	911 R7-8	0.75	
	911 R9	0.80	
	911 R10	0.82	
	911 R12	0.84	
	911 R13	0.88	
	911 R14	0.90	
	1011 R15	1.00	
	1111/1211 R8	0.54	
	1111/1211 R9	0.58	
	1111/1211 R10	0.59	
	1111/1211 R12-13	0.61	
	1111/1211 R14	0.63	
	1111/1211 R15	0.69	
INTR	711, 811, 911, 1011, 1111, 1211	0	All Releases.

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ANI	711 R4-9	1.54	
	711 R10	1.56	
	711 R12	1.59	
	711 R13	1.65	
	811 R4-8	1.53	
	811/1011 R9	1.53	
	811/1011 R10	1.55	
	811/1011 R12	1.58	
	811/1011 R13	1.64	
	811/1011 R14	1.66	
	911 R4	1.52	
	911 R5	1.52	
	911 R7-9	1.51	
	911 R10	1.53	
	911 R12	1.57	
	911 R13	1.62	
	911 R14	1.64	
	1011 R15	1.74	
	1111/1211 R8-9	1.17	---
	1111/1211 R10	1.19	
	1111/1211 R12	1.21	
	1111/1211 R13	1.19	
	1111/1211 R14	1.21	
	1111/1211 R15	1.26	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ANIR	711 R4-12	0.20	
	711 R13	0.22	
	811 R4-8	0.20	
	811/1011 R9-12	0.20	
	811/1011 R13-15	0.22	
	911 R4-12	0.19	
	911 R13-14	0.22	
	1111/1211 R8-12	0.16	
	1111/1211 R13	0.17	
	1111/1211 R15	0.18	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
BRTE	711 R4	4.95	
	711 R5	5.48	
	711 R7	5.61	
	711 R8	5.68	
	711 R9	5.74	
	711 R10	5.86	
	711 R12	6.81	
	711 R13	7.00	
	811 R4	4.95	
	811 R5	5.47	
	811 R7	5.61	
	811 R8	5.68	
	811/1011 R9	5.74	
	811/1011 R10	5.86	
	811/1011 R12	6.81	
	81 1/101 1 R13	7.00	
	81 1/101 1 R14	7.19	
	911 R4	4.87	
	911 R5	5.39	
	911 R7	5.52	
	911 R8	5.59	
	911 R9	5.65	
	911 R10	5.77	
	911 R12	6.71	
	911 R13	6.93	
	911 R14	7.12	
	1011 R15	7.86	
	1111/1211 R8	6.34	
	1111/1211 R9	4.46	
	1111/1211 R10	4.55	
	1111/1211 R12	5.30	
	1111/1211 R13	5.01	
	1111/1211 R14	5.15	
	1111/1211 R15	5.63	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
RPE	711 R4-9	0.99	
	711 R10-12	1.00	
	711 R13	1.02	
	811 R4-8	1.00	
	811/1011 R9	1.00	
	811/1011 R10-12	1.01	
	811/1011 R13	1.03	
	811/1011 R14-15	1.02	
	911 R4-9	0.98	
	911 R10-12	1.00	
	911 R13-14	1.01	
	1111/1211 R8-9	0.77	
	1111/1211 R10-12	0.78	
	1111/1211 R13-156	0.74	
DNDG	711 R4-12	0.47	
	711 R13	0.49	
	811 R4-8	0.47	
	811/1011 R9-12	0.47	
	811/1011 R13-15	0.49	
	911 R4-12	0.46	
	911 R13	0.36	
	911 R14	0.49	
	1111/1211 R8-12	0.36	
	1111/1211 R13-15	0.35	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
MSB	711 R4-5	0.08	
	711 R7-12	0.10	
	711 R13	0.13	
	811 R4-5	0.08	
	811 R7-8	0.10	
	811/1011 R9-12	0.10	
	811/1011 R13	0.13	
	811/1011 R14	0.19	
	911 R4-5	0.08	
	911 R7-9	0.09	
	911 R10-12	0.10	
	911 R13	0.13	
	911 R14	0.19	
	1011 R15	0.21	
	1111/1211 R8-12	0.07	
	1111/1211 R13	0.09	
	1111/1211 R14	0.13	
	1111/1211 R15	0.15	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ss25	711 R8	0.61	
	711 R9-10	0.62	
	711 R12	0.64	
	711 R13	0.67	
	811 R8	0.61	
	811/1011 R9-10	0.62	
	811/1011 R12	0.64	
	811/1011 R13	0.67	
	811/1011 R14	0.72	
	911 R4-5, 8-10	0.61	
	911 R7	0.60	
	911 R12	0.63	
	911 R13	0.66	
	911 R14	0.71	
	1011 R15	0.96	
	1111/1211 R8-10	0.49	
	1111/1211 R12	0.50	
	1111/1211 R13	0.49	
	1111/1211 R14	0.53	
	1111/1211 R15	0.71	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DDSP	711 R4	1.81	
	711 R5	1.82	
	711 R7	2.10	
	711 R8	2.11	
	711 R9	2.47	
	711 R10	2.98	
	711 R12-13	3.37	
	811 R4	1.81	
	811 R5	1.82	
	811 R7	2.10	
	811 R8	2.11	
	811/1011 R9	2.47	
	811/1011 R10	2.98	
	811/1011 R12	3.36	
	811/1011 R13	3.67	
	811/1011 R14	3.98	
	911 R4	1.79	
	911 R5	1.79	
	911 R7	2.07	
	911 R8	2.08	
	911 R9	2.43	
	911 R10	2.93	
	911 R12	3.32	
	911 R13	3.63	
	911 R14	3.94	
	1011 R15	4.63	
	1111/1211 R8	1.60	
	1111/1211 R9	1.87	
	1111/1211 R10	2.27	
	1111/1211 R12	2.58	
	1111/1211 R13	2.66	
	1111/1211 R14	2.88	
	1111/1211 R15	3.35	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ODAS	711, 811/1011, 911	1.12	
	711, 811/1011, 911 R9	1.22	
	711, 811/1011, 911 R10-12	1.21	
	711, 811/1011 R13	1.22	
	811/1011 R14	1.22	
	911 R13-14	1.20	
	1011 R15	0.72	
	1111/1211 R8	0.88	
	1111/1211 R9	0.96	
	1111/1211 R10-12	0.94	
	1111/1211 R13-15	0.88	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DI	711 R4-5	0.58	
	711 R7	0.61'	
	711 R8-9	0.63	
	711 R10	0.65	
	711 R12	0.68	
	711 R13	0.67	
	811 R4-5	0.58	
	811 R7	0.61	
	811 R8	0.63	
	811/1011 R9	0.63	
	811/1011 R10-12	0.65	
	811/1011 R13	0.67	
	811/1011 R14	0.70	
	911 R4-5	0.57	
	911 R7	0.59	
	911 R8-9	0.62	
	911 R10	0.62	
	911 R12-13	0.67	
	911 R14	0.69	---
	1011 R15	0.74	
	1111/1211 R8-9	0.46	
	1111/1211 R10	0.47	
	1111/1211 R12	0.50	
	1111/1211 R13	0.49	
	1111/1211 R14	0.50	
	1111/1211 R15	0.54	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DISA	711 R4-5	0.28	
	711 R7	0.29	
	711 R8-10	0.30	
	711 R12-13	0.32	
	811 R4-5	0.28	
	811 R7	0.29	
	811 R8	0.30	
	811/1011 R9-10	0.30	
	811/1011 R12-13	0.32	
	811/1011 R14	0.34	
	911 R4	0.27	
	911 R5	0.28	
	911 R7-8	0.29	
	911 R9-10	0.30	
	911 R12	0.34	
	911 R13	0.32	
	911 R14	0.34	
	1011 R15	0.35	
	1111/1211 R8-10	0.22	
	1111/1211 R12	0.26	
	1111/1211 R13	0.23	
	1111/1211 R14-15	0.25	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CHG	711 R4-5	0.24	
	711 R7	0.29	
	711 R8	0.34	
	711 R9-12	0.35	
	711 R13	0.37	
	811 R4-5	0.24	
	811 R7	0.29	
	811 R8	0.34	
	811/1011 R9-12	0.35	
	811/1011 R13	0.37	
	811/1011 R14-15	0.38	
	911 R4-5	0.24	
	911 R7	0.28	
	911 R8	0.33	
	911 R9-12	0.34	
	911 R13	0.37	
	911 R14	0.38	
	1111/1211 R8-10	0.25	
	1111/1211 R12	0.26	
	1111/1211 R13	0.27	
	1111/1211 R14-15	0.28	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CAB	711 R4	1.11	
	711 R5-9	1.12	
	711 R10-12	1.14	
	711 R13	1.24	
	811 R4	1.11	
	811 R5-8	1.12	
	811/1011 R9	1.12	
	811/1011 R10-12	1.14	
	811/1011 R13	1.24	
	811/1011 R14	1.26	
	911 R4	1.10	
	911 R5-7	1.11	
	911 R8-9	1.12	
	911 R10-12	1.13	
	911 R13	1.23	
	911 R14	1.25	
	1011R15	1.28	
	1111/1211 R8-9	0.84	
	1111/1211 R10-12	0.85	
	1111/1211 R13	0.88	
	1111/1211 R14	0.90	
	1111/1211 R15	0.91	
BAUT	711 R4-12	0.30	
	711 R13	0.31	
	811 R4-8	0.30	
	811 R9	0.30	
	811/1011 R10-12	0.30	
	811/1011 R13-15	0.31	
	911 R4-12	0.29	
	911 R13	0.30	
	911 R14	0.31	
	1111/1211 R8-12	0.22	
	1111/1211 R13-15	0.21	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CASM	711 R4-5	0.14	
	711 R7-10	0.15	
	711 R12	0.16	
	711 R13	0.19	
	811 R4-5	0.14	
	811 R7-8	0.15	
	811/1011 R9-10	0.15	
	811/1011 R12	0.17	
	811/1011 R13	0.19	
	811/1011 R14	0.22	
	911 R4-5	0.13	
	911 R7-10	0.15	
	911 R12	0.17	
	911 R13	0.19	
	911 R14	0.22	
	1011 R15	0.23	
	1111/1211 R8-10	0.11	
	1111/1211 R12	0.13	
	1111/1211 R13	0.14	---
	1111/1211 R14	0.16	
	1111/1211 R15	0.17	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CASR	711 R4	6.05	
	711 R5	6.08	
	711 R7	6.53	
	711 R8	6.54	
	711 R9	6.60	
	711 R10	6.64	
	711 R12	6.81	
	711 R13	6.92	
	811 R4	6.06	
	811 R5	6.12	
	811 R7	6.57	
	811 R8	6.59	
	811/1011 R9	6.65	
	811/1011 R10	6.69	
	811/1011 R12	6.86	
	811/1011 R13	6.97	
	811/1011 R14	7.49	
	911 R4	5.97	
	911 R5	6.02	
	911 R7	6.52	
	911 R8	6.53	
	911 R9	6.60	
	911 R10	6.64	
	911 R12	6.80	
	911 R13	6.92	
	911 R14	7.44	
	1011 R15	7.85	
	1111/1211 R8	5.14	
	1111/1211 R9	5.19	
	1111/1211 R10	5.22	
	1111/1211 R12	5.34	
	1111/1211 R13	4.95	
	1111/1211 R14	5.33	
	1111/1211 R15	5.56	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
BQUE	711 R4	2.05	
	711 R5	2.15	
	711 R7	2.27	
	711 R8	2.29	
	711 R9	2.33	
	711 R10	2.42	
	711 R11	2.46	
	711 R12	2.47	
	711 R13	2.55	
	811 R4	2.06	
	811 R5	2.16	
	811 R7	2.27	
	811 R8	2.29	
	811/1011 R9	2.33	
	811/1011 R10	2.43	
	811/1011 R12	2.56	
	811/1011 R13	2.47	
	811/1011 R14	2.52	
	911 R4	2.03	
	911 R5	2.12	
	911 R7	2.24	
	911 R8	2.25	
	911 R9	2.29	
	911 R10	2.39	
	911 R12	2.53	
	911 R13	2.43	
	911 R14	2.59	
	1011 R15	2.70	
	1111/1211 R8	1.76	
	1111/1211 R9	1.79	
	1111/1211 R10	1.86	
	1111/1211 R12	1.89	
	1111/1211 R13	1.83	
	1111/1211 R14	1.87	
	1111/1211 R15	1.93	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NTRF	711 R4-13	0.54	
	811 R4-8	0.54	
	811/1011 R9-15	0.54	
	911 R4-8	0.52	
	911 R9-14	0.53	
	1111/1211 R8	0.44	
	1111/1211 R9-10	0.45	
	1111/1211 R12	0.45	
	1111/1211 R13-15	0.38	
CMAC	711 R4-5	0.82	
	711 R7-12	0.83	
	711 R13	1.00	
	811 R4-5	0.82	
	811 R7-8	0.83	
	811/1011 R9-12	0.83	
	811/1011 R13-15	1.00	
	911 R4-5	0.81	
	911 R7-12	0.83	
	911 R13	0.97	
	911 R14-15	1.00	
	1111/1211 R8-15	0.70	
IMCDR	711 R4-12	1.20	
	711 R13	1.31	
	811 R4	1.20	
	811 R5-8		Note 5
	811/1011 R9-13		Note 5
	811/1011 R14-15	1.31	
	911 R4	1.19	
	911 R5-13		Note 5
	911 R14-15	1.29	
	1111/1211 R8-13		Note 5
	1111/1211 R14-15	0.91	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NCOS	711, 811, 911, 1011	0.10	
	711, 811, 911, 1011 R13	0.08'	
	811, 911, 1011 R14-15	0.08	
	1011 R15	0.08	
	1111/1211 R8-12	0.08	
	1111/1211 R13-15	0.06	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CPRK	711 R4-5	3.41	
	711 R7	3.51	
	711 R8	3.53	
	711 R9	3.54	
	711 R10	3.58	
	711 R12	3.76	
	711 R13	3.98	
	811 R4-5	3.41	
	811 R7	3.51	
	811 R8	3.53	
	811/1011 R9	3.53	
	811/1011 R10	3.58	
	811/1011 R12	3.76	
	811/1011 R13	3.98	
	811/1011 R14	4.12	
	911 R4	3.35	
	911 R5	3.36	
	911 R7	3.45	
	911 R8-9	3.47	
	911 R10	3.52	
	911 R12	3.70	
	911 R13	3.95	
	911 R14	4.09	
	1011 R15	4.23	
	1111/1211 R8-9	2.60	
	1111/1211 R10	2.62	
	1111/1211 R12	2.76	
	1111/1211 R13	2.80	
	1111/1211 R14	2.90	
	1111/1211 R15	2.97	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
SSC	711, 811, 911, 1011	0.10	
	811, 911, 1011 R14-15	0.10	
	1111/1211 R8-15	0.08	
IMS (UST, UMG)	711 R4	7.47	
	711 R5	7.49	
	711 R7	7.59	
	711 R8	7.63	
	711 R9	7.70	
	711 R10	2.80	
	711 R12	2.83	
	711 R13	3.00	
	811 R4	7.47	
	811 R5	7.49	
	811 R7	7.59	
	811 R8	7.63	
	811/1011 R9	7.70	
	811/1011 R10	2.80	
	811/1011 R12	2.83	
	811/1011 R13	3.00	
	811/1011 R14-15	3.02	
	911 R4	7.36	
	911 R5	7.38	
	911 R7	7.47	
	911 R8	7.51	
	911 R9	7.58	
	911 R10	2.75	
	911 R12	2.79	
	911 R13	2.97	
	911 R14	2.98	
	1111/1211 R8	5.97	
	1111/1211 R9	6.03	
	1111/1211 R10	2.12	
	1111/1211 R12	2.14	
	1111/1211 R13	2.16	
	1111/1211 R14-15	2.17	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ROA	711	0.36	
	711 R10	0.36	
	711 R12	0.38	
	711 R13	0.40	
	811/1011	0.38	
	811/1011 R10	0.38	
	811/1011 R12	0.38	
	811/1011 R13	0.40	
	811/1011 R14	0.42	
	911 R4-7	0.36	
	911 R8	0.10	
	911 R10	0.27	
	911 R12	0.10	
	911 R13-14	0.11	
	1011 R15	0.43	
	1111/1211 R8-9	0.08	
	1111/1211 R10-14	0.08	
	1111/1211 R15	0.31	

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Table 3
Software program storage requirements (continued)'

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NSIG	711 R4	2.03	
	711 R5-7	2.30	
	711 R8-10	2.32	
	711 R12-13	2.63	
	811 R4	2.03	
	811 R5-7	2.30	
	811 R8	2.32	
	811/1011 R9-10	2.32	
	811/1011 R12-13	2.63	
	811/1011 R14	2.68	
	911 R4	1.99	
	911 R5-7	2.26	
	911 R8-10	2.27	
	911 R12	2.65	
	911 R13	2.59	
	911 R14	2.64	
	1011 R15	2.69	
	1111/1211 R8-10	1.83	
	1111/1211 R12	2.09	
	1111/1211 R13	1.97	
	1111/1211 R14-15	2.01	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
MCBQ	711 R4	2.53	
	711 R5	2.56	
	711 R7	2.66	
	711 R8	2.67	
	711 R10-12	2.68	
	711 R13	2.76	
	811 R4	2.54	
	811 R5	2.57	
	811 R7	2.68	
	811 R8	2.67	
	811/1011 R9	2.69	
	811/1011 R10-12	2.70	
	811/1011 R13	2.78	
	811/1011 R14	2.81	
	911 R4	2.50	
	911 R5	2.52	
	911 R7-8	2.63	
	911 R9	2.64	
	911 R10-12	2.65	
	911 R13	2.74	
	911 R14	2.78	
	1011 R15	2.86	
	1111/1211 R8	2.07	
	1111/1211 R9	2.08	
	1111/1211 R10-12	2.09	
	1111/1211 R13	1.95	
	1111/1211 R14	1.98	
	111/1211 R15	2.01	
NSC	711, 811, 911, 1011, 1111, 1211	0	All Releases

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
BACD	711 R4	8.98	
	711 R5	9.01'	
	711 R7	10.68	
	711 R8	10.91	
	711 R9	11.64	
	711 R10	12.79	
	711 R12	15.02	
	711 R13	15.66	
	811 R4	8.99	
	811 R5	9.01	
	811 R7	10.86	
	811 R8	10.92	
	811/1011 R9	11.67	
	811/1011 R10	12.83	
	811/1011 R12	15.05	
	811/1011 R13	15.69	
	811 R14	16.13	
	911 R4	8.85	
	911 R5	8.87	---
	911 R7	10.69	
	911 R8	10.75	
	911 R9	11.84	
	911 R10	12.97	
	911 R12	15.17	
	911 Ri3	15.90	
	911 R14	16.35	
	1011 R15	17.63	
	1111/1211 R8	8.50	
	1111/1211 R9	9.35	
	1111/1211 R10	10.24	
	1111/1211 R12	11.97	
	1111/1211 R13	11.36	
	1111/1211 R14	11.68	
	1111/1211 R15	12.78	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ACDB	711	0.05	
	711 R12	0.09	
	711 R13	0.12	
	811 R4-7	0.05	
	811 R8	0.04	
	811/1011 R9-10	0.05	
	811/1011 R12	0.09	
	811/1011 R13-14	0.12	
	911	0.05	
	911 R12	0.09	
	911 R13-14	0.12	
	1011 R15	0.13	
	1111/1211 R8-10	0.04	
	1111/1211 R12	0.09	
	1111/1211 R13-14	0.08	
	1111/1211 R15	0.09	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ACDC	711 R4	13.54	
	711 R5	13.49 .	
	711 R7	14.16	
	711 R8	14.19	
	711 R9	14.75	
	711 R10	15.77	
	711 R12	16.97	
	711 R13	17.99	
	811 R4	13.54	
	811 R5	13.49	
	811 R7	14.16	
	811 R8	14.19	
	811/1011 R9	14.75	
	811/1011 R10	15.77	
	811/1011 R12	16.97	
	811/1011 R13	17.99	
	81 1/101 1 R14	17.98	
	911 R4	13.39	
	911 R5	13.34	
	911 R7	14.01	
	911 R8	14.04	
	911 R9	14.60	
	911 R10	15.61	
	911 R12	16.62	
	911 R13-14	17.83	
	1011 R15	20.87	
	1111/1211 R8	11.25	
	1111/1211 R9	11.67	
	111 1/121 1 R10	12.46	
	1111/1211 R12	13.26	
	1111/1211 R13-14	12.77	
	1111/1211 R15	14.80	
LMAN	711, 811, 911, 1011, 1111, 1211	0	All Releases

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
MUS	711 R4-5	1.03	
	711 R7-9	1.04	.
	711 R10	1.05	
	711 R12	1.28	
	711 R13	1.29	
	811 R4	1.03	
	811 R5-7	1.04	
	811/1011 R8-10	1.05	
	811/1011 R12	1.06	
	811/1011 R13-14	1.29	
	911 R4-5	1.28	
	911 R7-9	1.01	
	911 R10	1.02	
	911 R12	1.03	
	911 R13	1.26	
	911 R14	1.27	
	1011 R15	1.39	
	1111/1211 R8-9	1.25	
	1111/1211 R10	0.81	
	1111/1211 R12	0.99	
	1111/1211 R13-14	0.91	
	1111/1211 R15	0.97	
ACDA	711, 811, 911, 1011, 1111, 1211	0	All Releases

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Table 3
Software program storage requirements **(continued)**

Program (1K = 1024 words)	Version	Storage in Ks	Comments
MWC	711 R4-5	1.19	
	711 R7-8	1.24	
	711 R9	1.26	
	711 R10	1.29	
	711 R12	1.38	
	711 R13	1.42	
	811 R4-5	1.19	
	811 R7-8	1.24	
	811/1011 R9	1.26	
	811/1011 R10	1.29	
	811/1011 R12	1.38	
	811/1011 R13	1.42	
	811/1011 R14	1.43	
	911 R4-5	1.16	
	911 R7	1.20	
	911 R8	1.21	
	911 R9	1.23	
	911 R10	1.26	
	911 R12	1.35	
	911 R13	1.40	
	911 R14	1.41	
	1011 R15	2.80	
	1111/1211 R8	0.92	
	1111/1211 R9	0.93	
	1111/1211 R10	0.96	
	1111/1211 R12	1.02	
	1111/1211 R13-14	1.01	
	1111/1211 R15	2.03	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
AAB	711 R4-5	0.07	
	711 R7-13	0.11	
	811 R4-5	0.07	
	811/1011 R7-14	0.11	
	911 R4-5	0.07	
	911 R7-14	0.11	
	1011 R15	0.12	
	1111/1211 R8	0.08	
	1111/1211 R9-13	0.09	
	1111/1211 R14-15	0.08	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
GRP	711 R4	2.19	
	711 R5	2.17	
	711 R7	2.20	
	711 R8-9	2.22	
	711 R10	2.26	
	711 R11	2.25	
	711 R12	2.29	
	711 R13	2.13	
	811 R4	2.18	
	811 R5	2.17	
	811 R7	2.19	
	811/1011 R8-9	2.21	
	811/1011 R10	2.25	
	811/1011 R12	2.28	
	811/1011 R13	2.13	
	811/1011 R14	2.32	
	911 R4	2.15	
	911 R5	2.13	
	911 R7	2.16	
	911 R8-9	2.18	
	911 R10	2.22	
	911 R12	2.24	
	911 R13	1.65	
	911 R14	2.30	
	1011 R15	2.35	
	1111/1211 R8-9	2.11	
	1111/1211 R10	1.68	
	1111/1211 R12	1.70	
	1111/1211 R13	1.49	
	1111/1211 R14	1.63	
	1111/1211 R15	1.65	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
INFCR	7 11 (before R9)	0.29	
	711 R9	0.38	
	711 R10	0.44	
	711 R12	0.46	
	711 R13	0.50	
	8 11 (before R9)	0.29	
	811/1011 R9	0.38	
	811/1011 R10	0.44	
	811/1011 R12	0.46	
	811/1011 R13-15	0.50	
	9 11 (before R9)	0.29	
	911 R9	0.38	
	911 R10	0.43	
	911 R12	0.45	
	911 R13-14	0.49	
	1111/1211 R8	0.23	
	1111/1211 R9	0.30	
	1111/1211 R10	0.33	
	1111/1211 R12-15	0.35	
ILNK	711, 811, 911	0.15	
	711, 811/1011 R13	3.46	
	811/1011 R14	3.46	
	911 R13-14	3.43	
	1011 R15	4.37	
	1011, 1111/1211	0.12	
	111/1211 R13-14	2.45	
	111/1211 R15	3.08	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ACDD	711 R4-5	2.22	
	711 R7-9	2.23	
	711 R10	2.50	
	711 R12	2.83	
	711 R13	1.50	
	811 R4-5	2.22	
	811/1011 R7-9	2.23	
	811/1011 R10	2.53	
	811/1011 R12	2.83	
	811/1011 R13-15	1.50	
	911 R4-5	2.19	
	911 R7	2.20	
	911 R8-9	2.21	
	911 R10	2.50	
	911 R12	2.80	
	911 R13-14	1.50	
	1111/1211 R8-9	1.85	
	1111/1211 R10	2.07	
	1111/1211 R12	2.33	
	1111/1211 R13-15	1.03	
FCA	711, 811, 911, 1011, 1111, 1211	0	All Releases

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
SR	711 R4-5	4.13	
	711 R7	4.36	
	711 R8	4.51	
	711 R9	4.87	
	711 R10	5.48	
	711 R12	5.97	
	711 R13	6.19	
	811 R4-5	4.13	
	811 R7	4.36	
	811 R8	4.51	
	811/1011 R9	4.87	
	81 1/1011 R10	5.48	
	811/1011 R12	5.97	
	811/1011 R13	6.19	
	811/1011 R14	6.50	
	911 R4-5	4.06	
	911 R7	4.29	
	911 R8	4.44	
	911 R9	4.80	
	911 R10	5.41	
	911 R12	5.89	
	911 R13	6.13	
	911 R14	6.44	
	1011 R15	6.56	
	1111/1211 R8	3.52	
	1111/1211 R9	3.73	
	1111/1211 R10	4.20	
	1111/1211 R12	4.56	
	1111/1211 R13	4.35	
	1111/1211 R14	4.57	
	1111/1211 R15	4.61	

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Table 3
Software program storage requirements (continued)'

Program (1K = 1024 words)	Version	Storage in Ks	Comments
AA	711 R4-5	0.58	
	711 R7	0.59	
	711 R8-12	0.65	
	711 R13	0.64	
	811 R4-5	0.58	
	811 R7	0.59	
	811/1011 R8-14	0.65	
	911 R4-5	0.57	
	911 R7	0.58	
	911 R8-14	0.64	
	1011 R15	1.00	
	1111/1211 R8-14	0.47	
	1111/1211 R15	0.73	
HIST	711, 811, 911, 1011	0.04	
	811, 911, 1011 R14-15	0.04	
	1111/1211 R8-15	0.03	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
AOP	711 R4-5	0.42	
	711 R7	0.54	
	711 R8	0.62	
	711 R9-12	0.63	
	711 R13	0.65	
	811 R4-5	0.42	
	811 R7	0.54	
	811 R8	0.62	
	811/1011 R9-12	0.63	
	811/1011 R13	0.65	
	811/1011 R14	0.64	
	911 R4-5	0.42	
	911 R7	0.52	
	911 R8	0.60	
	911 R10-12	0.61	
	911 R13-14	0.63	
	1011 R15	0.80	
	1111/1211 R8-9	0.44	
	1111/1211 R10-14	0.45	
	1111/1211 R15	0.56	

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Table 3
Software program storage requirements (continued)'

Program (1K = 1024 words)	Version	Storage in Ks	Comments
BARS	711, 811, 911, 1011, 1111/1211	0	All, Releases
NARS	711, 811, 911, 1011, 1111/1211	0	All Releases
CDP	711, 811, 911, 1011	0.07	
	711, 811/1011 R13	0.08	
	811/1011 R14-15	0.08	
	911 R13	0.09	
	911 R14	0.07	
	1111/1211 R14-15	0.05	
PQUE	711, 811, 911, 1011, 1111/1211	0	All Releases
FCBQ	711, 811, 911, 1011	0.02	All Releases
	1111/1211	0.02	
	1111/1211 R13-15	0.01	
OHQ	711 R4, 5, 7	0.11	
	711 R8-13	0.12	
	811 R4-7	0.11	
	811 R8-9	0.12	
	811/1011 R10-15	0.12	
	911	0.11	
	911 R13-14	0.12	
	1111/1211 R8-12	0.09	
	1111/1211 R13-15	0.08	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NAUT	711 R4-5	0.49	
	711 R7-12	0.50	
	711 R13	0.51	
	811 R4-5	0.49	
	811 R7	0.50	
	811/1011 R8-12	0.50	
	811/1011 R13	0.51	
	811/1011 R14	0.55	
	911 R4-5	0.48	
	911 R7-12	0.49	
	911 R13	0.50	
	911 R14	0.54	
	1011 R15	0.57	
	1111/1211 R8-10	0.38	
	1111/1211 R12	0.37	
	1111/1211 R13	0.36	
	1111/1211 R14	0.40	
	1111/1211 R15	0.41	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
SNR	711 R4-5	0.76	
	711 R7	0.78	
	711 R8-12	0.84	
	711 R13	0.85	
	811 R4-5	0.76	
	811 R7	0.78	
	811/1011 R8-12	0.84	
	811/1011 R13	0.85	
	811/1011 R14	0.93	
	911 R4-5	0.75	
	911 R7	0.77	
	911 R8-12	0.83	
	911 R13	0.85	
	911 R14	0.92	
	1011 R15	0.96	
	1111/1211 R8-12	0.59	
	1111/1211 R13	0.60	
	1111/1211 R14	0.65	
	1111/1211 R15	0.68	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
TDET	711 R4	0.36	
	711 R5-12	0.39	
	711 R13	0.42	
	811 R4	0.36	
	811 R5-7	0.38	
	811/1011 R8-12	0.38	
	811/1011 R13-14	0.42	
	911 R4	0.35	
	911 R5-12	0.38	
	911 R13-14	0.41	
	1011 R15	0.45	
	1111/1211 R8-14	0.30	
	1111/1211 R15	0.32	
SCC	711, 811, 911, 1011, 1111, 1211	0	All Releases
NXFR	711 R4-5	0.51	
	711 R7-9	0.62	
	711 R10-12	0.65	
	711 R13	0.71	
	811 R4-5	0.51	
	811 R7	0.62	
	811/1011 R8-9	0.62	
	811/1011 R10-12	0.65	
	811/1011 R13-14	0.71	
	911 R4-5	0.51	
	911 R7-9	0.61	
	911 R10-12	0.64	
	911 R13	0.70	
	911 R14	0.71	
	1011 R15	0.72	
	1111/1211 R8-9	0.51	
	1111/1211 R10-12	0.53	
	1111/1211 R13-15	0.50	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ATVN	711 R4	4.99	
	711 R5-7	5.00	
	711 R8	5.02	
	711 R9	5.03	
	711 R10	5.12	
	711 R12	5.18	
	711 R13	5.25	
	811 R4	4.97	
	811 R5-7	4.98	
	811 R8	5.00	
	811/1011 R9	5.01	
	811/1011 R10	5.10	
	811/1011 R12	5.17	
	811/1011 R13	5.24	
	811/1011 R14	5.29	
	911 R4	4.92	
	911 R5-7	4.93	
	911 R8-9	4.95	
	911 R10	5.04	
	911 R12	5.11	
	911 R13	5.20	
	911 R14	5.25	
	1011 R15	5.52	
	1111/1211 R8	3.92	
	1111/1211 R9	3.93	
	1111/1211 R10	4.00	
	1111/1211 R12	4.05	
	1111/1211 R13	3.80	
	1111/1211 R14	3.84	
	1111/1211 R15	3.99	
ACDR	711, 811, 911, 1011, 1111/1211	0	All Releases

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
HOT	711 (before R10)	0	
	711 R10-12	0.24	
	711 R13	0.26	
	811/1011 (before R10)	0	
	811/1011 R10-12	0.24	
	811/1011 R13	0.25	
	811/1011 R14-15	0.26	
	911 (before R10)	0	
	911 R10-12	0.24	
	911 R13	0.25	
	911 R14	0.26	
	1111/1211 (before R10)	0	
	1111/1211 R10	0.24	
	1111/1211 R12-13	0.18	
	1111/1211 R14-15	0.19	
DHLD	711, 811/1011	0.58	
	711, 811/1011 R12	0.59	
	711, 811/1011 R13-15	0.61	
	911	0.57	
	911 R12	0.59	
	911 R13-14	0.60	
	1111/1211 R8-10	0.46	
	1111/1211 R12	0.47	
	1111/1211 R13-15	0.44	
LSEL	711, 811/1011	0.17	All Releases
	911 R4-5	0.16	
	911 R7-14	0.17	
	1111/1211 R8-15	0.12	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
SS5	711, 811, 911, 1011, 1111/1211	0.01	All Releases
DRNG	711 R4-5, 7	0.41	
	711 R8	0.49	
	711 R9	0.48	
	711 R10	0.68	
	711 R12	0.70	
	711 R13	0.58	
	811 R4-5, 7	0.41	
	811 R8	0.49	
	811/1011 R9	0.48	
	811/1011 R10-12	0.70	
	811/1011 R13	0.60	
	811/1011 R14-15	0.58	
	911 R4-5, 7	0.40	
	911 R8-9	0.48	
	911 R10-12	0.69	
	911 R13-14	0.57	
	1111/1211 R8	0.39	
	1111/1211 R9	0.38	
	1111/1211 R10-12	0.55	
	1111/1211 R13-15	0.42	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
PBXI	711 R5	2.84	
	711 R7	4.28	
	711 R8	4.70	
	711 R9-10	4.82	
	711 R12	6.26	
	711 R13	6.24	
	811 R5	3.27	
	811 R7	4.72	
	811 R8	4.76	
	811/1011 R9-10	4.89	
	811/1011 R12	6.33	
	811/1011 R13	6.31	
	811/1011 R14	7.14	
	911 R5	3.23	
	911 R7	4.66	
	911 R8	4.70	
	911 R9	4.82	
	911 R10	4.83	
	911 R12	6.25	
	911 R13	6.24	
	911 R14	7.04	
	1011 R15	7.26	
	1111/1211 R8	3.71	
	1111/1211 R9	3.83	
	1111/1211 R10	3.84	
	111 1/121 1 R12	4.94	
	1111/1211 R13	4.57	
	1111/1211 R14	5.18	
	1111/1211 R15	5.26	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DLDN	711 R5-13	0.09.	
	811 R5-7	0.09	
	811/1011 R8-15	0.09	
	911 R5-15	0.09	
	1111/1211 R8-13	0.06	
	1111/1211 R15	0.07	
AMP	711 R5	1.37	
	711 R7-8	1.44	
	711 R9	1.46	
	711 R10-12	1.47	
	711 R13	1.57	
	811 R5	1.37	
	811 R7-8	1.44	
	811/1011 R9	1.46	
	811/1011 R10-12	1.47	
	811/1011 R13	1.57	
	811/1011 R14	1.61	---
	911 R5	1.36	
	911 R7	1.44	
	911 R8	1.43	
	911 R9	1.45	
	911 R10-12	1.46	
	911 R13	1.57	
	911 R14	1.61	
	1011 R15	1.62	
	1111/1211 R8	1.09	
	1111/1211 R9	1.11	
	1111/1211 R10-13	1.12	
	1111/1211 R14	1.15	
	1111/1211 R15	1.16	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CSL	711 R7	13.96	
	711 R8	14.68	
	711 R9	15.10	
	711 R10	15.08	
	711 R12	17.04	
	711 R13	17.65	
	811 R7	13.96	
	811 R8	14.68	
	811 R9	15.10	
	811/1011 R10	15.08	
	811/1011 R12	17.04	
	811/1011 R13	17.64	
	811/1011 R14	17.65	
	911 R7	13.55	
	911 R8	14.26	
	911 R9	14.69	
	911 R10	14.67	
	911 R12	16.61	
	911 R13-14	17.24	
	1011 R15	17.80	
	1111/1211 R8	11.23	
	1111/1211 R9	11.51	
	1111/1211 R10	11.49	
	1111/1211 R12	12.99	
	1111/1211 R13-14	12.45	
	1111/1211 R15	12.54	
OOD	711, 811, 911, 1011, 1111/1211	0	All Releases
SCI	711 R7-13	0	
	811/1011 R7-15	0	
	911 R7-14	0	
	1111/1211 R8-15	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage iu Ks	Comments
CCOS	711 R7-8	0.22	
	711 R9	0.24	
	711 R10-13	0.25	
	811 R7	0.22	
	811 R8	0.21	
	811/1011 R9	0.24	
	811/1011 R10-14	0.25	
	911 R7-8	0.21	
	911 R9	0.23	
	911 R10-12	0.24	
	911 R13-14	0.25	
	1111/1211 R8	0.17	
	1111/1211 R9	0.18	
	1111/1211 R10-14	0.19	
RESDB	811/1011 R14	4.30	
	911 R14	4.47	
	1111/1211 R14	7.46	
CDRQ	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	
ATM	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	

— continued —

Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
CSLA	711	0	. All Releases
	811/1011	0	
	911	0	
	1111/1211	0	
TENANT	711 R7	0.38	
	711 R8	0.43	
	711 R9-12	0.44	
	711 R13	0.43	
	811 R7	0.38	
	81 1/1011 R8	0.43	
	811/1011 R9	0.44	
	811/1011 R10-12	0.44	
	811/1011 R13	0.43	
	811/1011 R14	0.48	
	911 R7	0.38	
	911 R8	0.43	
	911 R9-12	0.44	
	911 R13	0.43	
	911 1 R14	0.47	
	1011 R15	0.51	
	1111/1211 R8	0.33	
	1111/1211 R9-12	0.34	
	1111/1211 R13	0.32	
	1111/1211 R14	0.35	
	1111/1211 R15	0.38	
FTDS	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DSET	711 R12	8.70	
	711 R13	8.75	
	811/1011 R12	8.69	
	81 1/1011 R13	8.74	
	811/1011 R14	9.67	
	911 R12	8.57	
	911 R13	8.66	
	911 R14	9.57	
	1011 R15	12.53	
	111 1/121 1 R12	6.66	
	1111/1211 R13	6.34	
	1111/1211 R14	6.99	
	1111/1211 R15	9.12	
TSET	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	
LNR	711 R8	0.24	
	711 R9	0.26	
	711 R10-12	0.28	
	711 R13	0.30	
	811 R8	0.24	
	811/1011 R9	0.26	
	81 1/1011 R10-12	0.28	
	811/1011 R13-15	0.30	
	911 R8	0.24	
	911 R9	0.26	
	911 R10-12	0.28	
	911 R13-14	0.30	
	1111/1211 R8	0.19	
	1111/1211 R9	0.20	
	1111/1211 R10-15	0.22	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
DLT 2	711 R9-13	0	
	811/1011 R9-14	0	
	911 R9-14	0	
	1111/1211 R9-14	0	
PRETRANS	711 R8	0.33	
	711 R9	0.34	
	711 R10-13	0.35	
	811 R8	0.33	
	811/1011 R9	0.34	
	811/1011 R10-13	0.35	
	811/1011 R14-15	0.37	
	911 R8	0.33	
	911 R10-13	0.34	
	911 R14	0.36	
	1111/1211 R8	0.24	
	1111/1211 R9-13	0.25	
	1111/1211 R14-15	0.26	
SUPV	711 R8	0.77	
	711 R9-12	0.66	
	711 R13	0.68	
	811 R8	0.78	
	811/1011 R9-12	0.67	
	811/1011 R13-14	0.69	
	911 R8	0.77	
	911 R9-12	0.65	
	911 R13	0.67	
	911 R14	0.68	
	1011 R15	0.72	
	1111/1211 R8	0.56	
	1111/1211 R9-14	0.48	
	1111/1211 R15	0.50	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ITDS	711 R8-13	0	
	811/1011 R8-14	0	
	911 R8-14	0	
	1111/1211 R8-14	0	
CPND	711 R10-12	0.88	
	711 R13	0.90	
	811/1011 R10-12	0.88	
	811/1011 R13-15	0.90	
	911 R10-12	0.86	
	911 R13-14	0.88	
	1111/1211 R10-12	0.71	
	1111/1211 R13-15	0.64	
SLST	711	0	A Releases
	811/1011	0	
	911	0	
	1111/1211	0	
JPN	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	
DNIS	711	0	All Releases
	811/1011	0	
	911	0	
	1111/1211	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
3GD	711 R10	11.21	
	711 R12	11.51	
	711 R13	11.32	
	811/1011 R10	11.21	
	811/1011 R12	11.51	
	811/1011 R13	11.32	
	811/1011 R14	11.33	
	911 R10	11.09	
	911 R12	11.35	
	911 R13-14	11.22	
	1011 R15	11.54	
	1111/1211 R10	8.90	
	1111/1211 R12	9.13	
	1111/1211 R13-14	8.26	
	1111/1211 R15	8.40	
RMS	711 R10	1.55	
	711 R12	1.58	
	711 R13	1.60	
	811/1011 R10	1.55	
	811/1011 R12	1.58	
	811/1011 R13-14	1.60	
	911 R10	1.53	
	911 R12	1.55	
	911 R13-14	1.58	
	1011 R15	1.67	
	1111/1111 R10	1.20	
	1111/1111 R12	1.22	
	1111/1211 R13-14	1.18	
	1111/1211 R15	1.25	

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Table 3
Software program storage requirements (continued)

Program UK = 1024 words)	Version	Storage in Ks	Comments
MR	711 R10	0.85	
	711 R12	0.85	
	711 R13	0.89	
	811/1011 R10	0.85	
	811/1011 R12	0.85	
	811/1011 R13-15	0.89	
	911 R10	0.83	
	911 R12	0.84	
	911 R13-14	0.88	
	1111/1111 R10-15	0.64	
AWU	711 R10	4.49	
	711 R12	4.57	
	711 R13	4.62	
	811/1011 R10	4.48	
	811/1011 R12	4.58	
	811/1011 R13	4.61	
	811/1011 R14	4.62	
	911 R10	4.43	
	911 R12	4.51	
	911 R13-14	4.58	
	1011 R15	4.34	
	1111/1211 R10	3.35	
	1111/1211 R12	3.40	
	1111/1211 R13-14	3.27	
	1111/1211 R15	3.06	
?MSI	711 R10-13	0.05	
	811/1011 R10-15	0.05	
	911 R10-14	0.05	
	1111/1211 R10-15	0.04	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
OPAO	711 R10-13	0.05	
	811/1011 R10-15	0.05	
	911 R10-14	0.05	
	1111/1211 R10-15	0.04	
LLC	711 R10-13	0.08	
	811/1011 R10-15	0.08	
	911 R10-14	0.08	
	1111/1211 R10-15	0.06	
SLP	711 R10	1.11	
	711 R12	1.17	
	711 R13	1.23	
	811/1011 R10	1.10	
	811/1011 R12	1.17	
	811/1011 R13	1.22	
	811/1011 R14-15	1.23	
	911 R10	1.09	
	911 R12	1.16	
	911 R13	1.21	
	911 R14	1.22	
	1111/1211 R10	0.87	
	1111/1211 R12	0.92	
	1111/1211 R13-15	0.89	
MCT	711 R10-13	0.34	
	811/1011 R10-15	0.34	
	911 R10-14	0.34	
	1111/1211 R10	0.29	
	1111/1211 R12	0.28	
	1111/1211 R13	0.27	
	1111/1211 R14-15	0.24	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ICDR	711 R10-13	0	
	811/1011 R10-15	0	
	911 R10-14	0	
	1111/1211 R10-15	0	
APL-AUX	711 R10	4.76	
	711 R12	4.77	
	711 R13	5.06	
	811/1011 R10	4.77	
	81 1/1011 R12	4.77	
	811/1011 R13	5.06	
	811/1011 R14-15	5.07	
	911 R10	4.69	
	911 R12	4.70	
	911 R13	5.00	
	911 R14	5.01	
	1111/1211 R10-12	3.80	
	111 1/1211 R10-13	3.70	
	1111/1211 R14-15	3.71	
TVS	711 R12-13	0	
	811/1011 R12-15	0	
	911 R12-14	0	
	1111/1211 R12-15	0	
TOF	711 R12-13	0	
	811/1011 R12-15	0	
	911 R12-14	0	
	1111/1211 R12-15	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NKL	81 1/1011 R12-15	0	.
	911 R12-14	0	
	1111/1211 R12-15	0	
ISA ISDN PRA	711 R12-13	0	Note 7 for R13
	81 1/101 1 R12-14	0	
	911 R12-14	0	
	1111/1211 R12-14	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
IDC	711 R12	0.37	
	711 R13	0.39	
	811/1011 R12	0.38	
	811/1011 R13	0.39	
	811/1011 R14-15	0.44	
	911 R12	0.37	
	911 R13	0.38	
	911 R14	0.43	
	1111/1211 R12	0.20	
	1111/1211 R13	0.28	
	1111/1211 R14-15	0.31	
AUX ACD-D	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
DCP	711 R13	0.18	
	811/1011 R13	0.18	---
	811/1011 R14-15	0.19	
	911 R13-14	0.19	
	1111/1211 R13-15	0.14	
ACD Priority Agent	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
EMUS	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
FTC	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
DT12	811/1011 R14	8.55	
	911 R14	8.43	
	1011 R15	8.57	
	1111/1211 R14	6.11	
	1111/1211 R15	6.12	
JDMI	811/1011 R14-15	0	
	911 R14	0	
	1111/1211 R14-15	0	
ISDN	711 R13	Note 7	
	811/1011 R13	20.26	
	811/1011 R14	23.34	
	911 R13	20.00	
	911 R14	23.02	
	1011 R15	35.28	
	1111/1211 R13	14.75	
	1111/1211 R14	16.95	
	1111/1211 R15	26.06	
PRA	811/1011 R14-15	0	
	911 R14	0	
	1111/1211 R14-15	0	
ISL	711 R13		Note 7
	811/1011 R13-15	0.02	
	911 R13-14	0.01	
	1111/1211 R13-15	0.01	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
NTWK SRVC	711 R13	Note 7	
	811/1011 R13	3.57	
	811/1011 R14	3.97	
	911 R13	3.51	
	911 R14	3.91	
	1011 R15	5.42	
	1111/1211 R13	2.56	
	1111/1211 R14	2.85	
	1111/1211 R15	3.89	
DNXP	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
CDRE	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
ISDN AP	711 R13	0	
	811/1011 R13-15	0	
	911 R13-14	0	
	1111/1211 R13-15	0	
PR12	811/1011 R14	4.11	
	911 R14	4.03	
	1011 R15	4.19	
	1111/1211 R14	2.91	
	1111/1211 R15	2.97	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ACNT	811/1011 R14	0.61	
	911 R14	0.60	
	1011 R15	0.62	
	1111/1211 R14	0.43	
	1111/1211 R15	0.44	
ACD Account Package	711 R13	0.61	
	811/1011 R13-14	0.61	
	911 R13-14	0.60	
	1111/1211 R13-14	0.43	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
Total (base = resident + overlay area + firmware)			
	711 R4	84.82	
	711 R5	87.96	
	711 R7	100.67	
	711 R8	104.41	
	711 R9	107.50	
	711 R10	114.00	
	711 R12	130.22	
	711 R13	141.05	
	811 R4	88.24	
	811 R5	93.31	
	811 R7	105.64	
	811 R8	107.95	
	811/1011 R9	134.73	
	811/1011 R10	119.84	
	811/1011 R12	122.81	
	811/1011 R13	145.52	
	811/1011 R14	165.42	
	911 R4	87.26	
	911 R5	93.42	
	911 R7	105.84	
	911 R8	108.04	
	911 R9	110.41	
	911 R10	115.42	
	911 R12	128.46	
	911 R13	139.66	
	911 R14	164.57	
	1011 R15	188.92	
	1111/1211 R8	85.66	
	1111/1211 R9	96.17	
	1111/1211 R10	100.42	
	1111/1211 R12	110.37	
	1111/1211 R13	114.94	
	1111/1211 R14	133.38	
	1111/1211 R15	164.57	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
	No. of R/W Modules (base) (Note 2)		
	711	1 (56k)	
	811/1011	1 (56k)	
	911	1 (56k)	
	1111/1211	1 (56k)	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
	Overflow (base) (Note 3)		
	711 R4	28.82	
	711 R5	31.96	
	711 R7	44.67	
	711 R8	48.41	
	711 R9	51.50	
	711 R10	58.00	
	711 R12	74.22	
	711 R13	85.05	
	811 R4	32.94	
	811 R5	37.3 1	
	811 R7	49.64	
	811 R8	51.95	
	811/1011 R9	56.65	
	811/1011 R10	63.84	
	811/1011 R12	78.73	
	811/1011 R13	89.52	
	911 R4	31.26	
	911 R5	37.42	
	911 R7	49.84	
	911 R8	52.04	
	911 R9	54.41	
	911 R10	59.42	
	911 R12	72.46	
	911 R13	83.66	
	1111/1211 R8	29.66	
	1111/1211 R9	40.16	
	1111/1211 R10	44.42	
	1111/1211 R12	54.37	
	1111/1211 R13	58.94	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
	Total of All Optional Packages (Note 4)		
	711 R4	93.81	
	711 R5	100.26	
	711 R7	128.01	
	711 R8	142.29	
	711 R9	136.06	
	711 R10	162.92	
	711 R12	174.29	
	711 R13	186.74	
	811 R4	93.92	
	811 R5	100.80	
	811 R7	127.37	
	811 R8	144.01	
	811/1011 R9	135.12	
	811/1011 R10	161.20	
	811/1011 R12	194.96	
	81 1/1011 R13	209.93	
	811/1011 R14	232.04	
	911 R4	92.77	
	911 R5	99.68	
	911 R7	121.58	
	911 R8	142.39	
	911 R9	133.69	
	911 R10	159.96	
	911 R12	192.49	
	911 R13	207.76	
	911 R14	229.67	
	1011 R15	275.69	
	1111/1211 R8	112.29	
	1111/1211 R9	106.13	
	1111/1211 R10	126.92	
	1111/1211 R12	155.19	
	1111/1211 R13	154.70	
	1111/1211 R14	170.68	
	1111/1211 R1	207.69	

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Table 3
Software program storage requirements (continued).

Program (1K = 1024 words)	Version	Storage in Ks	Comments
Overflow (base + all optional packages). (Note 4)			
	711 R4	122.63	
	711 R5	132.22	
	711 R7	172.68	
	711 R8	190.70	
	711 R9	187.56	
	711 R10	220.92	
	711 R12	248.51	
	711 R13	271.79	
	811 R4	126.16	
	811 R5	138.11	
	811 R7	177.01	
	811 R8	195.98	
	811/1011 R9	191.77	
	811/1011 R10	225.04	
	811/1011 R12	273.69	
	811/1011 R13	299.45	
	811/1011 R14	397.46	
	911 R4	124.03	---
	911 R5	137.10	
	911 R7	171.42	
	911 R8	194.43	
	911 R9	188.10	
	911 R10	219.38	
	911 R12	264.95	
	911 R13	291.42	
	911 R14	394.25	
	1011 R15	464.61	
	1111/1211 R8	141.95	
	1111/1211 R9	146.30	
	1111/1211 R10	171.34	
	1111/1211 R12	209.56	
	1111/1211 R13	213.64	
	1111/1211 R14	304.06	
	1111/1211 R15	372.26	

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Table 3
Software program storage requirements (continued)

Program (1K = 1024 words)	Version	Storage in Ks	Comments
ROM	711	8.0	
	811/1011	8.0	
	911	8.0	
	1111/1211	8.0	

Note 1: On XL and XN systems, Read/Write fiiware is represented by the set of High-Level intrinsics.

Note 2 :Only 56K of the first program store is available.

Note 3 :Overflow into protected data store or page 6, 5 and then 1.

Note 4 :Program is first loaded into page 2, then overflow into the pages (if equipped) in the following sequences: page 6, 5, 1 (for non-enhanced systems); or page 8, 9, 10, 12, 13, 14, 6, 5, 1 (for enhanced systems).

Note 5 :MCDR (Mini CDR) is only available for SL-1M.

Note 6 :Resident Programs include packages 0, 1 and 2.

Note 7 :ISDN features are not available on 711 version.

Note 8: TSET can only be used when DSET is available and uses the same memory.

Note 9: 1011 software must have “SLST” package turned ON.

Table 4
Unprotected data storage requirements

Feature	Version	Storage in Words	Comments
	Fixed amount of storage required for system operation. .		
	711 R4	3748	1 item only
	711 R5	3983	1 item only
	711 R7	4386	1 item only
	711 R8-14	4397	1 item only
	811 R4	3751	1 item only
	811 R5	3986	1 item only
	811 R7	4386	1 item only
	811 R8	3398	1 item only
	811/1011 R9-15	4400	1 item only
	911 R4	5632	1 item only
	911 R5	5867	1 item only
	911 R7	6267	1 item only
	911 R8	6279	1 item only
	911 R9-14	6281	1 item only
	1111/1211 R8-15	7487	1 item only
	For EACH of the following:		
500 and 2500 Sets	711 R4-7	3.5	
	711 R8-10	4.5	
	811 R4-7	3.5	
	811/1011 R8-10	4.5	
	911 R4-7	3.5	
	911 R8-10	4.5	
	1111/1211 R8-10	4.5	
500 sets	711 R12-14	4.5	
	811/1011 R12-15	4.5	
	911 R12-14	4.5	
	1111/1211 R12-15	4.5	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
2500 sets	711 R12-14	5.5	
	811/1011 R12-15	5.5	
	911 R12-14	5.5	
	1111/1211 R12-15	5.5	
2500 Sets (CFW)	711 R4-7	4.5	
	711 R8-12	5.5	
	811 R4-7	4.5	
	811/1011 R8-12	5.5	
	911 R4-7	4.5	
	911 R8-12	5.5	
	111 1/121 1 R8-12	5.5	
SL-1 Sets (NDD)	711	14.25	
	711 R13-14	16.25	
	811/1011	14.25	
	811/1011 R13-15	16.25	
	911 R4-8	14.25	
	911 R9-12	15.25	
	911 R13-14	16.25	
	1111/1211 R8	14.25	
	111 1/121 1 R9-12	15.25	
	1111/1211 R13-15	16.25	
SL-1 Sets (ADD)	711	15.25	
	711 R13-14	18.25	
	811/1011	15.25	
	811/1011 R13-15	18.25	
	911 R4-8	15.25	
	911 R9-12	16.25	
	911 R13-14	18.25	
	1111/1211 R8	15.25	
	1111/1211 R9-12	16.25	
	1111/1211 R13-15	18.25	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Add-on K/L Strips	711	10	
	811/1011	-10	
	911	10	
	1111/1211	10	
Data Service Access TNs VMS Access TNs	711 R8-13		(Note 15)
	811/1011 R8-15		
	911 R8-14		
	1111/1211 R8-15		
Trunks	711		(Note 1)
	811/1011		
	911		
	1111/1211 R8-14		
Attendants	711 R4-7	89	
	711 R8-9	92	
	711 R10-12	93	
	711 R13-14	97	
	811 R4-7	95	
	811/1011 R8-9	98	
	811/1011 R10-12	99	
	811/1011 R13-14	103	
	911 R4-7	95	
	911 R8-9	98	
	911 R10-12	99	
	911 R13-14	103	
	1011 R15	107	
	1111/1211 R8-9	98	
	1111/1211 R10-12	99	
	1111/1211 R13-14	103	
	1111/1211 R15	107	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Customers	711 R4-7	137	
	711 R8-12	152	
	711 R13	142	
	711 R14	144	
	811 R4-7	137	
	811/1011 R8-12	152	
	811/1011 R13	142	
	811/1011 R14-15	144	
	911 R4-7	137	
	911 R8-12	152	
	911 R13	142	
	911 R14	192	
	1111/1211 R8-12	152	
	1111/1211 R13	142	
	1111/1211 R14-15	192	
Trunk Routes	711		(Note 2)
	811/1011		
	911		
	1111/1211		
Network-Local	711 R4-14	63	
	811 R4	65	
	811 R5-7	66	
	811/1011 R8-15	66	
	911 R4	65	
	911 R5-14	66	
	1111/1211 R8--15	66	
Network-RPE	711 R4-13	80	
	811 R4	82	
	811 R5-7	83	
	811/1011 R8-15	83	
	911 R4	82	
	911 R5-14	83	
	1111/1211 R8-15	83	

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Table 4
Unprotected data storage **requirements (continued)**

Feature	Version	Storage in Words	Comments
Junctor Group Pairs	711 R4-14	0	
(Note 3)	811 R4-7	0	
	811/1011 R8-15	0	
	911 R4-14	74	
	1111/1211 R8-15	74	
Peripheral Signaling	711 R4-14	36	
	811 R4-7	52	
	811/1011 R8-15	52	
	911 R4-14	52	
	1111/1211 R8-15	52	
Secondary Tape	711	539/541	
	811/1011	539/541	
	911	5391541	
	1111/1211	539/541	
TTY	711 R4-5		(Note 4)
	711 R7-14		
	811 R4-7		
	811/1011 R8-15		
	911 R4-5		
	911 R7-14		
	1111/1211 R8--15		
Tone & Digit Switch	711	57	
	811/1011	59	
	911	59	
	1111/1211	59	
MF Sender	711	57	
	811/1011	59	
	911	59	
	1111/1211	59	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Conference	711 R4-9	141	
	711 R10-14	145	
	811 R4-7	143	
	811/1011 R8-9	143	
	811/1011 R10-15	147	
	911 R4-9	143	
	911 R10--14	147	
	1111/1211 R8-9	143	
	1111/1211 R10--15	147	
Digitone Receiver	711	6	
	811/1011	6	
	911	6	
	1111/1211	6	
LPIB	711	4x LPIB	1 item
	811/1011	4x LPIB	Note 5)
	911	4x LPIB	
	1111/1211	4x LPIB	
HPIB	711	4x HPIB	1 item
	811/1011	4 x HPIB	(Note 5)
	911	4x HPIB	
	1111/1211	4x HPIB	
PBXOB	711	4 x PBXOB	x # Periph. Signals
	811/1011	4 x PBXOB	(Note 5)
	911	4 x PBXOB	
	1111/1211	4 x PBXOB	
BCSOB	711	4 x BCSOB	x # Periph. Signals
	811/1011	4 x BCSOB	(Note 5)
	911	4 x BCSOB	
	1111/1211	4 x BCSOB	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
ACD	711		(Note 6)
	811/1011		
	911		
	1111/1211		
ACD Enhancement	711		(Note 11)
	811/1011		
	911		
	1111/1211		
Extended Agent Observe	711	1	1 per ACD POS
	811/1011	1	
	911	1	
	1111/1211	1	
CMAC	711	534	1 item
	811/1011	534	
	911	534	
	1111/1211	534	
NARS/BARS/CDP	711		(Note 7)
	811/1011		
	911		
	1111/1211		

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Call Register	711 R4	40	(Note 8)
	711 R5	41	
	711 R7	44	
	711 R8-9	45	
	711 R10-12	48	
	711 R13-14	61	
	811 R4	41	
	811 R5	42	
	811 R7	45	
	811/1011 R8-9	46	
	811/1011 R10-12	49	
	811/1011 R13-14	62	
	911 R4	41	
	911 R5	42	
	911 R7	45	
	911 R8-9	46	
	911 R10-12	49	
	911 R13-14	62	
	1011 R15	64	
	1111/1211 R8-9	46	
	1111/1211 R10-12	49	
	1111/1211 R13-14	62	
	1111/1211 R15	64	
CPRK	711		(Note 9)
	811/1011		
	911		
	1111/1211		
IMS	711	28	1 per list
	811/1011	28	(Note 10)
	911	28	
	1011 R15	16	
	1111/1211	28	
	1111/1211 R15	16	

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Table 4
Unprotected data storage requirements(continued)

Feature	Version	Storage in Words	Comments
APL	711	179	1 per APL Link
	811/1011	179	
	911	179	
	1111/1211	179	
TDET	711	10	
	811 R4-5	10	
	811 R7	11	
	811/1011 R8-15	11	
	911 R4-5	10	
	911 R7-14	11	
	1111/1211 R8--15	11	
DTI	711		(Note 12)
	811/1011		
	911		
	1111/1211		
ATM - Schedule Blk	711		(Note 13)
	811/1011		
	911		
	1111/1211		
ATM - Data Blk	711		(Note 13)
	811/1011		
	911		
	1111/1211		
Digital Sets	711		(Note 14)
	811/1011		
	911		
	1111/1211		

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Multi-Tenant	711	32	
	811/1011	32	
	911	32	
	1111/1211	32	
CSL	711		(Note 16)
	811/1011		
	911		
	1111/1211		

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
DTI/DLI Loops	711		(Note 17)
	811/1011		
	911		
	1111/1211		
CUST	711	13	
	811/1011	13	
	911	13	
	1111/1211	13	
BGD	711	60	
	711 R13-14	66	
	811/1011	60	
	811/1011 R13-15	66	
	911	60	
	911 R13-14	66	
	1111/1211	60	
	1111/1211 R13-15	66	
BGD Disp	711	6x DNIS	1 item
	711 R13-14	9x DNIS	(Note 18)
	811/1011	6x DNIS	
	811/1011 R13-15	9x DNIS	
	911	6x DNIS	
	911 R13-14	9x DNIS	
	1111/1211	6x DNIS	
	1111/1211 R13-15	9x DNIS	
BGD/AWU Loop	711	100	1 item
	811/1011	100	
	911	100	
	1111/1211	100	

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Table 4
Unprotected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
ISDN PRA	711 R12-14 811/1011 R12--15 911 R12-14 1111/1211 R12-14		# of DCHIs (Note 19)
Overlay Data Space	711 R12-14 811/1011 R12-15 911 R12-14 1111/1211 R12-15	260 260 260 260	
ISL	711 R13-14 811/1011 R13-15 911 R13-14 1111/1211 R13-15		# of DCHIs (Note 19)
ISDN Utility	711 811/1011 911 1111/1211		(Note 21)
ISDN PR12	711 811/1011 911 1111/1211		(Note 19)
JDMI/DTI2	711 811/1011 911 1111/1211 R13		Note 22
EBLF	1011 R15 1111/1211 R15		Note 23
EOVF	1011 R15 1111/1211 R14		Note 24

Note I : The size of the trunk block is calculated from:

CT + X (words),

where:

CT = 7 words (3 average card block + 4 trunk timing block)

X = (see the following table).

Trunk Types	Value of X	
	N or XN	Other
RLA	15	14
AUTOVON	8	8
ADM	14	13
Others	5	5
	10 (Note)	10 (Note)

Note: These numbers are for Release 12.

For Release 13 through 14, the size of the trunk block is calculated from:

CT + X (words) + Y

where:

CT = 9 words (5 average card block + 4 trunk timing block)

X = (see the following table)

Y = 0 if the trunk belongs to a route which does not have CDR or which has CDR with dialed digits.

= 9 if the trunk belongs to a route which has CDR with outpulsed digits.

Trunk Types	Value of X MS	Value of X Other
RAN	5	5
RLA	14	15
AUTOVON	8	8
ADM	15	15
Others (includes ISA)	10	10

Note 2 : The size of the route block is calculated from:

24 + ceiling (number of members/16) (words).

Releases 12 and 13

27 + ceiling (number of members/16) (words).

Releases 14 through 15

43 + ceiling (number of members/16) (words)

Note 3 : The number of Junctor Group Pairs is (N x (N-1)/2 in a system with N network groups.

Note 4 : The size of the TTY blocks is calculated from:

For Releases 4 and 5:

141 + x (words),

where: x = 8 for CDR TTYs; 128 otherwise.

For Releases 7 through 15:

t + x (words),

where:

t = 16 (size (TTYIOBLOCK) + 128 (TTY output buffer) = 144

and x = the following table

	Input Buffer	Data	Output Q
CDR link:	128		
HS link:	128 +	15	
APL link:	128 +	(179 +	4)
PMS Link:	20 +	2	
other:	8		

Note 5 : The size of the Input/Output buffers is specified in "messages". Each message uses 4 words of unprotected data store. The recommended size for I/O buffers is:

LPIB	(Low Priority Input Buffers)	= 96 messages
HPIB	(High Priority Input Buffers)	= M, LE:16 messages S, MS: 16 messages N, VLE: 32 messages XL:16 x # of groups XN:32 x # of groups
PBXOB	(Non SL1 Output Buffers)	= 160 messages
BCSOB	(SL1 Output Buffers)	= 160 messages

Note 6 : For ACD features the following additional storage is required (total for system):

(K0 x [(K1 x CROUT) + (K2 x CPID) + (K3 x CDN) + CTM + (K4 x CRT)]) + (K5 x CCUST) + (K6 x DN) + (K7 x PID)

where the multiplication constants (Ki) are:

KO=O	if ACD-C package is not equipped,
K0 = 1	if ACD-C package is equipped.
K1 = 32	size (U_ACD_RTE_EXTN) (=20) + word offset (TRUNK-SEIZE-TIME) (=12)
K1 = 32 (R12)	size (U_ACD_BLOCK_EXTN) (=78)
K1 = 46 (R13-15)	size (U_ACD_RTE_EXTN) (=28) + word offset (TRUNK-SEIZE-TIME) (=18)
	if long report is selected.
K2 = 11	size (U_ACD_POS_BASIC) (= 11)
K2 = 11 (R12)	size (U_ACD_POS_BASIC) (= 13)
K2 = 14 (R13-15)	size (U_ACD_POS_BASIC) (= 14)
	if short report is selected
K2 = 22	size (U_ACD_POS_EXTN) (= 22)
K2 = 22 (R12)	size (U_ACD_POS_EXTN) (= 39)
K2 = 42 (R13-14)	size (U_ACD_POS_EXTN) (= 42)
K3 = 50 (R4-5)	size (U_ACD_BLOCK_EXTN) (=50)
K3 = 66 (R7-9)	size (U_ACD_BLOCK_EXTN) (=66)

K3 =74	size (U_ACD_BLOCK_EXTN) (=74) for R10
K3 =78 (R12-15)	size (U_ACD_BLOCK_EXTN) (=78)
K4 = 25	size (U_ACD_IOAREA) (=25)
K5 = 71 (R4-5)	size (U_ACD_PRINT) (=15) + size (U_ACD_RTE_SYS) (=13) + size (U_ACD_SYS_Q_POS) (=43)
K5 = 79 (R7-10)	size (U_ACD_PRINT) (=15) + size (U_ACD_RTE_SYS) (=13) + size (U_ACD_SYS_Q_POS) (=51)
K5 = 79 (R12)	size (U_ACD_PRINT) (= 19) + size (U_ACD_RTE_SYS) (= 34) + size (U_ACD_SYS_Q_POS) (= 57)
K5 = 114 (R13-15)	size (U_ACD_PRINT) (= 20) + size (U_ACD_RTE_SYS) (= 34) + size (U_ACD_SYS_Q_POS) (= 60)
K6 = 90 (R4-5)	size (U-ACD-BLOCK) (=90)
K6 = 100 (R7-8)	size (U-ACD-BLOCK) (=100)
K6 = 117 (R10)	size (U_ACD_BLOCK) (=117)
K6 = 118 (R12)	size (U-ACD-BLOCK) (=123)
K6 = 123 (R13-14)	size (U-ACD-BLOCK) (=123)
K6 = 128 (R15)	size (U-ACD-BLOCK) (=128)
K7 = 24	size (U_ACD_POS) (=24)

K7 = 29 (R13-15)	size **(U_ACD_POS)** (= 29) + 2 for DN Expansion + 1 for **ACD_ACNT_CODE**
K8 = 48 (R13)	for NT, RT, and XT systems
K8 = 48 (R14-15)	for XT, and NT
K8 = 32 (R13-15)	for XN, and ST systems

and the variables are represented by:

CCUST = total no. of customers with ACD-C package
CDN = total no. of ACD **DNs** for ACD-C customers
CPID = total no. of AGENT POSITIONS for ACD-C customers
CROUT = total no. of ACD routes in ACD-C customers
CTM = total no. of TRUNK members in CROUT
DN = total no. of ACD **DNs** (for the system)
PID = total no. of AGENT POSITIONS (for the system)
CRT = total no. of ACD CRTs.

Note 7 : The unprotected data store requirements (on a per-customer basis) for NARS/BARS/CDP:

2 x (8 x RL + 6 x NCOS) Release 4

2 x (12 x RL + 6 x NCOS) Releases 5-8

2 x (16 x RL + 6 x NCOS) Releases 9-12

If FCBQ & OHQ is equipped:

2 x (11 x RL + 10 x NCOS) Release 4

2 x (17 x RL + 10 x NCOS) Releases 5-8

2 x (21 x RL + 10 x NCOS) Releases 9-12

Releases 13 through 15

If OHQ or MCBQ is equipped:

RLSIZE + NCOSIZE + QROUTSIZE

Otherwise:

RLSIZE + NCOSIZE

where:

RL	= number of route lists
RLSIZE	= 2 x (45 x RL) (FCBQ & OHQ equipped) = 2 x (40 x RL) (otherwise)
NCOS	= number of NCOS defined
NCOSIZE	= 2 x (1045 x NCOS) (RLBQ & OHQ equipped) = 2 x (6 x NCOS) (otherwise)
QROUTE	= number of routes with either CBQ or OHQ
QROUTESIZE	= 2 x (7 x QROUTE)

Note 8 : N, the recommended number of Call Registers is:

$N = (T + 815)/33.8 + M$

where:

$T = A/2 \times C \times 1.42 - B.$
M = the number of ACD incoming trunks.
A = the total voice loop traffic in CCS.
B = M x 1 (1 is average CCS per ACD trunk).
C = the total call register traffic factor

The Total Call Register Traffic Factor is equal to 1 + any of the following factors:

0.037 if CDR Charge Account
0.074 if Authorization Code
0.037 if Parallel CDR Ports Per Customer
0.150 if NARS/BARS/CDP
0.150 if FCBQ and OHQ
0.033 if ACD RAN
0.019 if Telset Messaging
0.140 if IMS
0.083 if Ring Again
0.033 if Music Trunk
0.067 if CPRK
0.003 if NFCR
0.039 if ESN Signalling
0.0 if Stored Number Redial (negligible impact)
0.184 if IVMS (with R4-5)
0.044 if individual hold (with R4-5)

Assumptions:

(1) The peak day traffic = 1.42 x ABSBH traffic for business offices.

(2) All outgoing calls require authorization (worst case assumption).

(3) An additional call register is required for 20 s to hold the authorization code.

(4) 50% of outgoing calls use the charge account feature (worst case assumption).

(5) An additional call register is required for 20 s to hold the charge account.

(6) The additional holding time of the call register for CDR purposes is 5 seconds.

(7) The average number of ports used in the multiple CDR ports feature is 2.

(8) A call register is required for each incoming ACD trunk.

(9) The intra-office ration R = 0 (worst case assumption).

(10) The number of originating calls = the number of terminating calls.

(11) The blocking peak of the day traffic is P0.01.

(12) The average NARS/BARS call takes 20 s to dial and 20 s to complete outpulsing and delay for answer.

(13) The average holding time of a RAN is 15 s.

(14) The average Telset Message takes 6 s to dial and 20 s to complete outpulsing and delay for answer.

(15) The average IMS call takes 8 s to dial, 15 seconds ringing and 40 s with message attendant. During the busy hour, 60% of tenninating calls are unanswered, of which 50% require IMS.

(16) A call register is required for active Ring Again call.

(17) Music Trunk holding time is 30 s.

(18) Average Call Park holding time is 1 min.

(19) Average holding time for New Flexible Code Restriction is 4 s.

(20) ESN Signalling Feature holding time is 15 s and 35% of calls need signalling feature.

(21) The average IVMS call takes 8 s to dial, 15 s ringing, 10 s listening to greeting and 50 seconds leaving message. During the busy hour, 60% of terminating calls are unanswered, of which 50% require IVMS (R4-5).

(22) Individual Hold call holding time is 30 s (R4-5).

Note 9 : Size per item for Call Park

k + ceiling (s/16), for UCALL_PARK_BLOCK

where:

s = number of System Park DNs per customer

k = 2	UCPRKBLOCKLENGTH (1.O)
	FREE_DN_INDEX (0.5)
	NUM_SYS_PRK_USED (0.5)

Note *10* : IMS Unprotected Memory **Requirements**

Release 4:

LINK Q TBL HDR = 1 word

LINK OQ TBL = 16 words

APL REQ TO SENDS = 1 word

APL RDY TO SENDS = 1 word

APL MONITOR S = 10 words

APL **MAINTENENCE** S = 1 word

APL PRINT MODE S = 1 word

APL PRT MSG S = 1 word

APL PRT PACK S = 1 word

MSG MONITOR S = 1 word

PACK MONITOR S = 1 word

APL INTERCEPT S = 1 word

APL I LINK SEL S = 1 word

APL LINK DATA = 179 words x N

QUEUE DATA BLOCK = 4 words x N

N = # of APL links defined in CFN Block

Total Unprotected 12 + (182 x N)) words or (0.117 + 0.178 x N) K
N = # of APL links defined in CFN Block

Releases 5 and 7:

LINK OQ TBL = 16 words

APL LINK DATA = 178 words x N

QUEUE DATA BLOCK = 4 words x N

N = # of APL links defined in CFN Block

Releases 8 through 15:

LINK OQ TBL = 16 words

APL LINK DATA = 179 words x N

QUEUE DATA BLOCK = 4 words x N
N = # of APL links defined in CFN Block

Total Unprotected (Releases 5 through 14)
(16 + (182 x N)) words or (0.016 + 0.178 x N) K words
N = # of APL links defined in CFN Block.

Total Unprotected (Releases15)
(16 + (183 x N)) words or (0.016 + 0.178 x N) K words
N = # of APL links defined in CFN Block.

Note *11* : For Releases 4 and 5: ACD Enhancement — For each customer with historical reports active add:

62 words for the customer (U ACD PRINT)

24 words per ACD Group (U ACD BLOCK)

11 words per Route that auto
terminates on an ACD group (U ACD RTE BLK)

2 words per ACD position (U ACD POS)
plus 11 words per ACD position if short reports are active on the customer.

For Releases 7 through 14: ACD Enhancement — AN ACD — C customer **(see Note 6).**

Note 12 : DTI unprotected memory requirement:

Releases 4 and 5

13 + 9 x number of DTI loops.

Releases 7 through 15 (per DTI loop)

local network loop data + DTI data

= 66 (for 811 and 911 machines) + 9 = 75 ‘words

= 63 (for all other machines) + 9 = 72 words.

Note 13 : In Releases 7 through 15, there is no unprotected data store impact.

Note 14 : Unprotected data store for digital set voice port:
Releases 7 and 8

	N/XN (words)	Others (words)
M2009	25.25	24.25
M2018	35.25	34.25
M2112	25.25	24.25
M2317	36.25	35.25
M3000	46.25	45.25

Unprotected data store for digital set data port with Digit Display Class Of Service (COS). Note that data ports without digital COS require one word less than those with Digit Display.

	N/XN (words)	Others (words)
M2009	26.25	25.25
M2018	36.25	35.25
M2112	26.25	25.25
M2317	16.25	15.25
M3000	16.25	15.25

Releases 9 through 12

	N/XN (words)	Others (words)
M2009	18.25	17.25
M2018	29.25	-28.25
M2112	20.25	19.25
M2317	36.25	35.25
M3000	46.25	45.25

Unprotected data store for digital set data ports. Note that data ports without digit class of service require one word less than those with digit display.

Releases 13 through 15

	With Digit Display (size in words)	Without Digit Display (size in words)
M2009	21.25	19.25
M2018	32.25	30.25
M2112	23.25	21.25
M2317	38.25	36.25
M3000	48.25	46.25

Note 15 : The additional unprotected data store for a virtual terminal (DS access TN or VMS access TN) is dependent on the shelf/card to which the terminal is assigned. For all machine types, the increments (in words) are as follows:

Releases 8 through 12

DS/VMS Access TN	Preallocated Card	14
	Otherwise	15.25

Releases 13 through 15

DS/VMS Access TN	**Preallocated** Card	15
	Otherwise	16.25

Where a preallocated card is one of the following shelf/cards:

O/l - 0/7, l/l - 1/8, 2/1 - 2/8, or 3/8 on a DLI loop.
See Note 17.

Note 16 : CSL Unprotected Data is comprised of:
Per system (with CSL package, Release 8):

CSL IQ HDRTBL + Queues	*= 3 + (3 x 4)* words
CSL OQ HDRTBL	= 16 words
CSL MONITOR BLK	= 112 words
Total	= 143 words.

Per system (with CSL package, Releases 9 through 15):

CSL IQ HDRTBL + Queues	*= 3 + (3 x 4)* words
CSL OQ HDRTBL	= 16 words
Total	= 31 words.

Per CSL Link (Releases 8 through 15):

U CSL DATA BLK	= 123 words
CSL I ARRAY BLK	= 128 words
CSL 0 ARRAY BLK	= 128 words
QUEUE DATA BLOCK	*= 4* words
Total	*= 383* words.

Note 17 : DLI unprotected memory requirements (per DLI loop):

= DTI requirements (Note 12) + DLI data + preallocated card data

= 75 (811 and 911 machines) + 18 + 120 words.= 213 words

= 72 (all other machines) + 18 + 120 =210 words.

Note 18 : NDIS is the number of display messages defined in Overlay 17 for the Background Terminal.

Note 19 : Each DCHI consists of the following unprotected data blocks:

1. DCH U BLOCK = 43 words
   44 for R13 and R14
   47 for R15
2. Output request buffers = 5 x # of OTBFs
3. Output buffer = 261 words
4. Input buffer = 261 words
5. Unprotected call reference table = 2 + M
6. Unprotected message link table = - 1 + M

M is computed as follows:

(a) If PRI 111 nn is defined for the DCH link:
M = 24 x (max (NN) + 1)

(b) If PRI 111 nn is not defined and the backup D-channel is defined for the DCH link:
M = 24 x 2

(c) If PRI 111 nn and the backup D-channel are not defined:
M = 24.

(d) If DCHI is in ISL mode:
M = maximum number of ISL trunks defined

(e) If DCHI is in SHARED mode:
M = (a) or (b) or (c) + maximum number of ISL trunks defined.

(f) PR12 ONLY: unprotected data block of 65 words.

Note 20 : SIZE (BG_INPUT AREA) (= 15)
+ SIZE (BGW_WORK_ENTRY) (= 26)
+ SIZE (BGS_SCAN_ENTRY) (= 25)
Total=66

Note 21: One bit map table for TCAP per system.

Size of bit map (words)1/16 x number of CRs defined per system

Traffic for TCAP4 words per Application ID (1)

Note 22 : Bach DTI loop requires the following:

DTI_UDATA_LPBLK	47 words
DTI2_UDATA_CATD	9 words

Note 23: Two words in the attendant unprotected data block per attendant console is required. This is accounted for in the attendant data block size.

If Enhanced usy Lamp field (EBLF) is ON, a bit is required to indicate idle/busy status of each DN. This equals 7 (16 bit) words per hundreds group defined.

Note 24 *:* Enhanced Ovefflow requires an additional 4 words per ACD DN.

Table 5
Protected data storage requirements

Feature	Version	Storage in Words	Comments
	Fixed amount of storage required for system operation.		
	711 R4	2981	
	711 R5	3077	
	711 R7	3253	
	711 R8	3249	
	711 R9-14	3250	
	811 R4	3109	
	811 R5	3148	
	811 R7	3253	
	811 R8	3305	
	811/1011 R9-14	3306	
	911 R4	3379	
	911 R5	3460	
	911 R7	3568	
	911 R8	3620	
	911 R9-14	3621	
	1011 R15	3461	
	1111/1211 R8	2981	
	1111/1211 R9-14	2982	
	1111/1211 R15	3092	
	For EACH of the following:		
500 and 2500 Sets	711 R4-7		(Note 1)
	711 R8-10		
	811 R4-7		
	811/1011 R8-15		
	911 R4-7		
	911 R8-14		
	1111/1211 R8-15		
SL-1 Sets	711		(Note 2)
	811/1011		
	911		
	1111/1211		

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Add-on K/L strips	711	10/rs	
	811/1011	10/rs	
	911	10/rs	
	1111/1211	10/rs	
Data Service Access TNs	711 R8-14		(Note 29)
VMS Access TNs	811/1011 R8-15		
	911 R8-14		
	1111/1211 R8-15		
Template Head Table	711	1 + # Templates	
	811/1011	1 + # Templates	
	911	1 + # Templates	
	1111/1211	1 + # Templates	
Templates	711 R4-5	3 + # Entries	(Note 21)
	711 R7-14	4 + # Entries	
	811 R4-7	4 + # Entries	
	811/1011 R8-15	4 + # Entries	
	911 R7-14	4 + # Entries	
	1111/1211 R8-15	4 + # Entries	
Trunks	711 R4-9	10.5	(Note 22)
	711 R10-12	13.5	
	711 R13-14	16.5	
	811 R4-7	10.5	
	811/1011 R8-12	13.5	
	811/1011 R13-15	16.5	
	911 R4-9	10.5	
	911 R10-12	13.5	
	911 R13-14	16.5	
	1111/1211 R8-9	10.5	
	1111/1211 R10-12	13.5	
	1111/1211 R13-15	16.5	

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Attendants	711		(Note 3)
	811/1011		
	911		
	1111/1211		
Customers	711 R4	161	(Note 38 for)
	711 R5	166	Releases 13
	711 R7	181	through 15)
	711 R8	203	
	711 R9	201	
	711 R10	207	
	711 R12	211	
	811 R4	161	
	811 R5	166	
	811 R7	181	
	811 R8	203	
	811/1011 R9	201	
	811/1011 R10	207	
	811/1011 R12	211	
	911 R4	161	
	911 R5	166	
	911 R7	181	
	911 R8	203	
	911 R9	201	
	911 R10	207	
	911 R12	211	
	1111/1211 R8	203	
	1111/1211 R9	201	
	1111/1211 R10	207	
	1111/1211 R12	211	
	1011 R15	46	
	1111/1211 R15	46	

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Trunk Routes	711 R4	31	# of Routes
	711 R5	33	(Note 35 for
	711 R7-8	34	Release 14
	711 R9	35	through 15)
	711 R10	37	
	711 R12	43	
	711 R13	50	
	811 R4	31	
	811 R5	33	
	811 R7-8	34	
	81 1/101 1 R9	35	
	81 1/1011 R10	37	
	81 1/101 1 R12	43	
	81 1/1011 R13	50	
	911 R4	31	
	911 R5	33	
	911 R7-8	34	
	911 R9	35	
	911 R10	37	
	911 R12	43	
	911 R13	50	
	1111/1211 R8	34	
	1111/1211 R9	35	
	1111/1211 R10	37	
	1111/1211 R12	43	
	1111/1211 R13	50	
Code Restrictions	711	51	x # Code
	811/1011	51	Restriction
	911	51	Routes
	1111/1211	51	
NFCR	711		(Note 17)
	811/1011		
	911		
	1111/1211		

-continued -

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Peripheral Signaling	711	30	1 item
	811/1011	30	
	911	30	
	1111/1211	30	
Network Group	711	16	
	811 R4-7	32	
	811/1011 R8-15	32	
	911	38	
	1111/1211	38	
Network-LOC	711 R4-5	68	
	711 R7-14	70	
	811 R4-5	68	
	811 R7	70	
	811/1011 R14-15	70	
	911 R4-5	68	
	911 R7-14	70	
	1111/1211	70	
Network-RPE	711 R4-5	71	
	711 R7-14	73	
	811 R4-5	71	
	811 R7	73	
	811/1011 R8-15	73	
	911 R4-5	71	
	911 R7-14	73	
	1111/1211	73	
TDS	711	2	
	811/1011	2	
	911	2	
	1111/1211	2	

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
MF Sender	711	2	
	811/1011	2	
	911	2	
	1111/1211	2	
Conference	711	2	
	811/1011	2	
	911	2	
	1111/1211	2	
Digitone Receiver	711	8	
	811/1011	8	
	911	8	
	1111/1211	8	
DN Translator (Note 4)	711		
	811/1011		
	911		
	1111/1211		
DIG Translator (Note 5)	711		
	811/1011		
	911		
	1111/1211		
SCL Master Head Table for	711	1 + Number of Lists	1 item
	811/1011	1 + Number of Lists	(Note 39 for
	911	1 + Number of Lists	Releases 13
	1111/1211	1 + Number of Lists	through 15)
SCL Head Table	711		1 per list
	811/1011		(Note 15)
	911		
	1111/1211		

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
SCL	711		# SC Lists
	811/1011		(Note 6)
	911		
	1111/1211		
CAS—Main	711	0	#Customers
	811/1011	0	
	911	0	
	1111/1211	0	
CAS—Remote	711	15	#Customers
	811/1011	15	
	911	15	
	1111/1211	15	''
BARS	711		#Customers
	811/1011		(Note 7)
	911		
	1111/1211		
FTC	711		32 Tables
	811/1011		(Note 42)
	911		
	1111/1211		
EFTC	7111		32 Tables
	811/1011		(Note 44)
	911		
	1111/1211		
NARS	711		#Customers
	811/1011		(Note 8)
	911		
	1111/1211		

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
CDP	711 811/1011 911 1111/1211		# Customers (Note.9)
ACD	711 811/1011 911 1111/1211		# Customers (Note 10)
Group DND	711 811/1011 911 1111/1211		# Customers (Note 11)
DISA	711 811/1011 911 1111/1211		# Customers (Note 12)
AUTH	711 811/1011 911 1111/1211		# Customers (Note 13)
HIST	711 811/1011 911 1111/1211		1 item (Note 14)
CPRK	711 811/1011 911 1111/1211		# Customers (Note 4)

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
IMS	711	370	1 per list
	811/1011	370	(Note 16)
	911	370	
	1111/1211	370	
NFCR	711		1 per customer
	811/1011		(Note 17)
	911		
	1111/1211		
Soft Memory	711	35	1 item
	811/1011	35	
	911	35	
	1111/1211	35	
TDET	711	3	# TDET
	811/1011	3	
	911	3	
	1111/1211	3	
DTI	711 R4, 7-14		1 item
	811 R5-7		(Note 18)
	811/1011 R8-15		
	911 R5, 7-14		
	1111/1211		
AMP	711 R4, 7-14		# Modem Pools
	811 R5, 7		(Note 19)
	811/1011 R8-15		
	911 R5-14		
	1111/1211		

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
Multiple Office Code Screening	711 R4, 7-14 811 R5-7 811/1011 R8-15 911 1111/1211		1 per location code (if defined) (Note 20)
M2009 Telephone	711 811/1011 911 1111/1211		# telephones (Note 23)
M2018 Telephone	711 811/1011 911 1111/1211		# telephones (Note 25)
M2112 Telephone	711 811/1011 911 1111/1211		# telephones (Note 24)
M23 17 Digital Set	711 811/1011 911 1111/1211		# of sets (Note 3 1)
M3000 Touchphone	711 811/1011 911 1111/1211		# telephones (Note 26)
Multi-Tenant	711 811/1011 911 1111/1211		# of Customers (Note 27)

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
ATM Schedule Block	711		(Note 28)
	811/1011		
	911		
	1111/1211		
ATM Data Block	711	12	# ATM Routes
	811/1011	12	
	911	12	
	1111/1211	12	
DLI	711		# DLI Loops
	811/1011		(Note 18)
	911		
	1111/1211		
ESDI	711	16 + N x 7	N = # Ports
	811/1011	16 + N x 7	
	911	16 + N x 7	
	1111/1211	16 + N x 7	
CSL	711	2	# Links
	711 R13-14	4	
	811/1011	2	
	811/1011 R13-15	4	
	911	2	# Links
	911 R13-14	4	# Links
	1111/1211	2	# Links
	1111/1211 R13-15	4	# Links
VAS	711	16 + N	N = # Servers
	811/1011	16 + N	
	911	16 + N	
	1111/1211	16 + N	

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
VAS DSDN	711		# Customers
	811/1011		(Note 30)
	911		
	1111/1211		
CPND	711		Per system
	811/1011		(Note 32)
	911		
	1111/1211		
LLC	711	5	
	811/1011	5	
	911	5	
	1111/1211	5	
Auxiliary Customer	711	187	# Customers
	811/1011	187	
	911	187	
	1111/1211	187	
ISDN PRA	711 R12-14		# PRI
	811/1011 R12-15		(Note 33)
	911 R12-14		
	1111/1211 R12-15		
ISDN PRA (Note 34)	711 R12		# DCHI
	811/1011 R12-13		
	911 R12-13		
	1111/1211 R12-13		
ISDN PRA	711 R12-14		SID tables
	811/1011 R12--15		(Note 36)
	911 R12-14		
	1111/1211 R12-15		

— continued —

Table 5
Protected data storage requirements (continued)

Feature	Version	Storage in Words	Comments
AWU Count	711	144	
	811/1011	144	
	911	144	
	1011 R15	288	
	1111/1211	144	
	1111/1211 R15	288	
ISL	711 R12-14		#DCHI
	811/1011 R12-15		(Note 37)
	911 R12-14		
	1111/1211 R12-15		
ISDN PR12	711		# PRI2
	811/1011		(Note 33)
	911		
	1111/1211		
ISDN PR12	711		# DCHI
	811/1011		(Note 34)
	911		
	1111/1211		
Pretranslation	711		# PREXL
	811/1011		(Note 40)
	911		
	1111/1211		
JDMI/DTI2	711		(Note 4 1)
	811/1011		
	911		
	1111/1211		
EBLF	1011		(Note 44)
	1111/1211		
EOVF	1011 R15		(Note 45)
	1111/1211 R15		

Note 1 : The size of the protected line block for **PBX** telephones is determined from the following:

Basic Line Block	4 words Release 4 5 words Releases 5 through 9 6 words in Release 10 7 words in Releases 12 through 15
Basic Line Block (ODAS)	7 words Releases 4 and 5 8 words Releases 7 through 12 10 words Releases 13 through 15
Card Block Component	1.5 words

The key layout portion of the template requires (2 + **nf)/rs** words in Release 4 or, (4 + **nf)/rs** words in Releases 5 through 15, where "nf' is the number of features defined for the telephone, and "rs" is the number of telephones sharing the same template.

In addition to the basic line block, each feature requires extra data space as follows:

Feature	R4-5	R7-12	R13	R14-15
Associate Set	—	2 words	2 words	2 words
Automatic Wake-Up		1 word	1 word	1 word
Call Forward Key (4-24 digits)	I-6 words	1-6 words		I-6 words
Call Forward by Call Type		2 words	2 words	2 words
Call Party Name Display		1 word + 3 to 13 words (6-26 characters, 2 characters per word)	1 word + 4 to 14 words (6-26 characters, 2 characters per word)	1 word + 4 to 14 words (6-26 characters, 2 characters per word)
CFNA/Hunting Key	1 word	1 word	2 words	2 words
Dial Intercom Key	1 word	1 word		1 word
DN Key	1 word	1 word	2 words	2 words
EFD/EHT DN	—	1 word (R12)	2 words	2 words
Hot Line DN (I-31 digits)	—	I-8 words	2-l 0 words	2-l 0 words

— continued —

Feature	R4-5	R7-12	R13	R14-15
Enhanced Hot Line				
(l-31 digits)		2-l 0 words (R10-12)	2-10 words .	2-10 words
Last Number Redial				
(3-32 digits)		1 word (R8)	1 word	
(4-32 digits)		l-8 words (R9-10)	l-8 words	l-8 words
Manual Line	—	1 word	2 words	2 words
Message Center DN	—	1 word	2 words	2 words
Message Registration		1 word	1 word	1 word
Pretranslation Enhancement				1/2 word (for 255 calling groups)
SCI/CCOS/RMS		1 word	1 word	1 word
Speed Call Controller	—	1 word	1 word	1 word
Speed Call Key	1 word	—	—	
Speed Call User	—	1 word	1 word	1 word

— continued —

Feature	R4-5	R7-12	R13	R14-15
Stored Number Redial (4-32 digits)	I-8 words	I-8 words	I-8 words	1-8 words
System Speed Call User	—	1 word	1 word	1 word
Tenant Number	—	1 word	1 word	1 word

Note 2 : The size of the protected line block for SL-1 telephones is determined from the following:

Basic Line Block	7 words in Release 4 8 words in Release 5 9 words in Release 7 10 words in Releases 8-13 13 words in Release 14-15
Basic Line Block (ODAS)	10 words Releases 4 and 5 -- 12 words Releases 7-12 16 words Releases.13 -15
Card Block Component	1.5 words

The key layout portion of the template in Release 4 requires 12/rs words, where rs = the number of telephones sharing the same template.

The key layout portion of the template, in Releases 5 through 15, requires (4 + the number of key lamp strips x 10)/rs words, where rs = the number of telephones sharing the same template.

In addition to the basic line block requirement, each feahue requires extra data space as follows:

Feature	R4-5	R7-12	R13	R14-15
ACD Agent Key	1 word	1 word	1 word	1 word
ACD Display Queue Key	1 word	1 word	2 words	2 words
ACD Interflow Key	1 word	1 word	2 words	2 words
ACD IN-CALLS key	9 words	11 words	11 words	11 words
ACD Night Service DN			2 words	2 words
Autodial Key (4-32 digits)	l-8 words			
Autodial Key (4-24 digits)		l-6 words	l-6 words	l-6 words
Automatic Wake-Up		1 word (R10-12)	1 word	1 word
Call Forward Key (4-24 digits)	l-6 words	l-6 words	l-6 words	l-6 words
Call Forward by Call Type		2 words (R1 0-1 2)	2 words	2 words

— continued —

Feature	R4-5	R7-12	R13	R14-15
CFNA DN	1 word	1 word	2 words	2 words
Conference Autodial				1-6 words
Conference Hotline				3-l 0 words
Conference Speed Call				1 word
DIG Key	1 word	1 word	1 word	1 word
DN Key	1 word	1 word	2 words	2 words
EFD/EHT DN		1 word	2 words	2 words
Flash Call Key	1 word	1 word	1 word	1 word
Flash Override Call Key	1 word	1 word	1 word	1 word
Hot Line (1-31 digits)				3-l 0 words
Hot Line, Enhanced		2-l 0 words (R1 o-1 2)	2-l 0 words	
Hunt DN	1 word	1 word	2 words	2 words
Immediate Call Key	1 word	1 word	1 word	1 word

— continued —

Feature	R4-5	R7-12	R13	R14-15
Last Number Redial (4-32 digits)		1 word (R8) I-8 words (R9-12)	1 word	I-8 words
Message Center DN		1 word	2 words	2 words
Message Registration		1 word (R10)	1 word	1 word
Park Key	1 word	1 word	1 word	1 word
Pretranslation Enhancement				1/2 word (for 255 calling groups)
Priority Call Key	1 word	1 word	1 word	1 word
Private Line Key		1 word	2 words	2 words
SCI/CCOS/RMS (131 digits)		1 word (R10-12)	1 word	
Signal Key	1 word	1 word	2 words	2 words
Speed Call Controller		1 word	1 word	1 word
Speed Call Key	1 word			

— continued —

Feature	R4-5	R7-12	R13	R14-15
Speed Call User		1 word	1 word	1 word
Stored Number Redial Key (4-32 digits)	I-8 words	I-8 words	1-8 words	I-8 words
Tenant Number		1 word	1 word	1 word
Time and Date Key		1 word	1 word	1 word
Voice Call Key	1 word	1 word	2 words	2 words

Note 3 : The size of the protected line block for attendant telephones is determined from the following:

Card Block Component	3 words
Primary Line Block	14 words in Release 4 15 words in Releases 5 through 12 21 words in Releases 13 and 14 24 words in Release 15
Secondary Line Block	4 words 3 words in Release 15

In addition to the basic linebloclc, each feature requires extra data space as follows:

Feature	Requirements
Autodial Key	8 words
	6 words in Releases 7-15)
Flash Call Key	1 word (R8-12)
Flash Override Call Key	1 word
Group DND Key	1 word
Immediate Call Key	1 word
Paging Key	1 word
	2 words in Releases 13-l 5
Priority Call Key	1 word
Speed Call Key	1 word
Store Number Redial Key	8 words

Note 4 : Prior to Release 13, the memory requirements for the Directory Number Translator are (in words of protected data store):

(2 x S) + AS + 12 x (1 + N1 + N2 + N3)
+ AD x (2 + AI x 2) + (DD x 2) + SPDN
+ number of listed DN
+ 1 per defined DN
+ 16 (+ 64 with Releases 8 and 9)
(+ 65 with Release 10)
(+ 66 with Release 12)
if any attendants are defined
+ 1 if special service prefix defined
+ 3 per NARS/BARS access code defined
+ 7 if RSANI access code defined
+ 1 if CAS Hold DN is defined
+ 2 if CAS RLT DN is defined
+ 3 per CDP steering code defined
+ 2 per defined Test Line DN
+ 1 per defined ACD-DN
+ 1 per defined DIG Group
+ 1 per SL1 DN

Releases 13 through 15:

(2 x S) + AS + 12 x (1 + N1 + N2 + N3 + N4 + N5 + N6)
+ AD x (2 + AI x 2) + (DD x 2) + SPDN
+ number of listed DNs
+ 2 per defined DN
+ 16 (+ 66)
if any attendants are defined
+ 1 if special service prefix defined
+ 3 per NARS/BARS access code defined
+ 10 if RSANI access code defined
+ 2 if CAS Hold DN is defined
+ 2 if CAS RLT DN is defined
+ 3 per CDP steering code defined
+ 2 per defined Test Line DN
+ 1 per defined ACD-DN
+ 1 per defined DIG Group
+ 1 per SL1 DN

where:

S = number of different DN appearing on SL- 1 telephones, 500/2500 telephones mixed with SL- 1 telephones, and private line 500/2500 telephones

AS = number of appearance of DN within S

N1 = number of different first digit in the numbering plan

N2 = number of different sequence of the first two digits in the numbering plan (if DN is more than 2 digits)

N3 = number of different sequence of the first three digits in the numbering plan (if DN is more than 3 digits)

N4 = number of different sequence of the first four digits in the numbering plan (if DN is more than 4 digits)

N5 = number of different sequence of the first five digits in the numbering plan (if DN is more than 5 digits)

N6 = number of different sequence of the first six digits in the numbering plan (if DN is more than 6 digits)

AD = number of ACD-DNs

AI = number of ACD POSITION-IDs in each ACD-DN

DD = number of DISA-DNs

SPDN = number of System Park DNs

Note ***5*** : The protected data store requirements for the Dial Intercom feature for each customer using the package are as follows:

$1 + G \times (1 + 2 \times M)$

where:

G = number of groups
M = number of members in each group

Release 14 through 15:

$(n + 1) + (x \times (2 + (y \times 2)))$

where:

n = maximum number of dial intercom groups in Overlay 15
x = actual number of dial intercom groups configures
y = average number of members in each dial intercom group

Note 6 : The size of a Speed Call List is:

((NB -1) x 256) + (NBR x WE)

where:

NB and WE is calculated as described in Note 15 under the Speed Call List Head Table

NBR is the remainder of the calculation to determine NB, which was

NB = EL/EB

When EL/EB is zero, use the following formula:

((NB - 1) x 256) + (EB x WE)

The following quick reference chart facilitate the programming of the Speed Call List memory requirements. Locate the intersect point of the required DN and list sizes to determine the number of words needed.

Speed Call Quick Reference Chart

List Size	DN Size 4	8	12	16	20	24	28	31
1	6	7	8	9	10	11	12	13
5	10	15	20	25	30	35	40	45
10	15	25	35	45	55	65	75	85
20	25	45	65	85	105	125	145	165
25	30	55	80	105	130	155	180	205
30	35	65	95	125	155	185	215	245
40	45	85	125	165	205	245	290	326
50	55	105	155	205	255	310	360	406
60	65	125	185	245	312	370	340	486
70	75	145	215	290	362	430	500	568
75	80	155	230	310	402	460	538	608
80	85	165	245	330	442	490	576	648
90	95	185	280	370	462	556	646	728
100	105	205	310	410	512	616	716	808
200	205	412	615	820	1026	1226	1431	1612
250	255	511	765	1020	1284	1531	1787	2013
300	312	619	920	1226	1541	1841	2147	2416
400	412	826	1226	1636	2055	2542	2863	3220
500	512	1026	1531	2041	2570	3063	3573	4023
600	619	1234	1853	2708	3085	3678	4289	4827
700	719	1441	2147	2862	3599	4289	5004	5631
750	769	1541	2297	3062	3856	4594	5359	6033
800	826	1648	2452	3268	4113	4904	5720	6435
900	926	1855	2667	3678	4628	5515	6431	7240
1000	1018	1955	3050	4083	5142	6125	7146	8043

Note 7 : The protected data store requirements for BARS (on a per-customer basis) are:

Release 4

137
+ 2.73 x (HNPA + NPA) + 2.73 x (1HNPA + 1NPA)
+ RL x (8 + 3 x RLE) + DME x (3 + I/4)+ FCAS

Releases 5 and 7

137
+ 2.73 x (HNF'A + NPA) + 2.73 x (1HNPA + 1NPA)
+ RL x (8 + 3 x RLE) + DME x (3 + I/4)
+ FCAS+ SDRR x (3 + 2 x SDE) + ITGE

Releases 8 through 12

16
+ SUM+ RL x (8 + 3 x RLE) + DME x (3 + I/4)
+ FCAS+ SDRR x (3 + 2 x SDE) + ITGE

Releases 13 and 14

BASICESN
+ SUM + RL x (8 + 3 x RLE) + DME x (3 + I/4)
+ FCAS + SDRR x (3 + 2 x SDE) + ITGE

Release 15

BASICESN
+ SUM + RL x (8 + 3 x RLE) + DME x (4 + I/4)
+ FCAS + SDRR x (3 + 2 x SDE) + ITGE

where:

SUM = $11 \times \frac{[(10 \times R) \times x n] - 1}{(10 \times R) - 1}$ words

n = maximum level of tree (n > 0)

HNPA = number of NXX in the home NPA of the SL-1

I =	the average number .of digits that must be inserted as part of digit manipulation
NPA=	number of NPA (area codes) in the North American dialing plan
lHNPA=	number of 1 + NXX in the home NPA of the SL-1
1NPA =	number of 1 + NPA (area codes) in the North American dialing plan
R =	the rate of digits equipped in each level of the tree (translator)
RL=	the number of route lists
RLE=	he average number of route lists entries per route list
DME =	the number of distinct digit manipulation entries (included the default 0th entry)
FCAS =	(N + 1) + N(M + 1) + MN[4 + (100P + 15)/16]

where:

N = the number of defined FCAS tables
M = the average number of NPA codes per table
P = the average number of first digit of NXX codes

SDRR =	Number of supplemental digit restricted/recognized blocks defined for NPA, NXX, LOC, SPN
SDE =	Average number of SDRR entries for each SDRR block
ITGE =	9 x ITEI; where ITEI = the number of Incoming Trunk Group Exclusion Index

BASICESN =
SIZE (ESN_DATA_BLOCK)+SIZE (NCTL_DATA_BLOCK

129 + 305 = 434

SIZE (ESN_TRAN-BLOCK) = 1 1

This formula is based on the assumption that the NPA/NXX translation tree is half full and distributed evenly. This should represent the typical case. For more precise calculation, use NABS formula. .

Note 8 : The protected data store requirements for NABS (on a per-customer basis)are:

Release 4

137 + 12 x (1 + Al+ A2) + 12 x (A3 + A4)
+ 12 x (1 + B1 + B2) + 12 x (B3 + B4)
+ 4 x RN + RL x (8 + 3 x RLE) + DME
x(3+ I/4) + LOC x 6 + FCAS+ SCC

Releases 5 and 7

137 + 11 x (1 + Al+ A2) + 11 x (A3 + A4)
+ 11 x (1 + B1 + B2) + 11 x (B3 + B4)
+ SDRR x (3 + 2 x SDE) + RL x (8 + 3 x RLE) + DME
x (3 + I/4) + LOC x 6 + FCAS + SCC + ITGE + MDID

Releases 8 through 12

16 + SUM1 + SUM2
+ SDRR x (3 + 2 x SDE) + RL x (8 + 3 x RLE) + DME
x (3 + I/4) + LOC x 6 + FCAS + SCC + ITGE + MDID

Releases 13 and 14

BASICESN + SUM1 + SUM2
+ SDRR x (3 + 2 x SDE) + RL x (8 + 3 x RLE) + DME
x (3 + I/4) + LOC x 6 + FCAS + SCC + ITGE + MDID

Release 15

BASICESN + SUM1 + SUM2
+ SDRR x (3 + 2 x SDE) + RL x (8 + 3 x RLE) + DME
x (4 + I/4) + LOC x 6 + FCAS + SCC+ITGE+MDID

where:

SUM1 = (SUM of network translator 1)

SUM2 = (SUM of network translator 2)

SUM =

$$11 \times \frac{[\,(10 \times R)\ xx\ n\,] - 1}{(10 \times R) - 1} \text{ words}$$

n = maximum level of tree ($n > 0$).

A1 = number of different **first** digit in network translator 1.

A2 = number of different sequence of the **first** two digits in the non **1+** number in network translator 1.

A3 = number of different second digits in the **1+** number in network translator 1.

A4 = number of different sequence of the second and third digits in the **1+** number in network translator 1.

B1 = number of different first digit in network translator 2.

B2 = number of different sequence of the first two digits in the non **1+** number in network translator 2.

B3 = number of different second digits in the **1+** number in network translator 2.

B4 = number of different sequence of the second and third digits in the **1+** number in network translator 2.

R = is the rate of digits equipped in each level of the tree (translator).

RL= the number of route lists.

RLE = the average number of route lists entries per route fist.

DME= the number of distinct digit manipulation entries (included the default 0th entry).

I = the average number. of digits that must be inserted as part of digit manipulation.

LOC = number of on-net or virtual locations.

FCAS = (N + 1) + N(M + 1) + MN[4 + (100P + 15)/16]

where:

N = the number of defined FCAS tables
M = the average number of NPA codes per table
P = the average number of first digit of NXX codes

SCC = Number of entries in the SCC table.

SDRR = Number of supplemental digit restricted/recognized blocks defined for NPA, NXX, LOC, SPN.

SDE = Average number of SDRR entries for each SDRR block.

ITGE = 9 x ITEI; where ITEI = the number of Incoming Trunk Group Exclusion Index.

MDID = (2 x number of total office codes) + (2 x number of total DID ranges regardless of which office codes they belong to). Maximum of 20 ranges or office codes can be defined per location code, (i.e., 1 office code and 20 ranges, or 20 office codes and 1 range for each office code).

BASICESN =
SIZE(ESN_DATA_BLOCK) + SIZE(NCTL_DATA_BLOCK)
129 + ***305*** ***= 434***

Note 9 : Prior to Release 13, the protected data store requirements for CDP (on a per-customer basis) are:

137 + SC x 2 + RL x (8 + 3 x RLE) + DME x (3 + I/4)

Releases 13 through 15

BASICESN + SC x 3 + RL x (8 + 3 x RLE) + DME x (3 + I/4)

where:

SC =	number of steering codes
RL=	the number of route lists
RLE=	the average number of route lists entries per route list
DME=	the number of distinct digit manipulation entries
I =	the average number of digits that must be inserted as part of digit manipulation.

BASICESN =
SIZE(ESN_DATA_BLOCK) + SIZE(NCTL_DATA_BLOCK)
129 + *305* = *434*

CDP Steering Codes also occupy SL- 1 DN tree spaces. This portion of data store is calculated in DN tree formula (See Note 4).

Note 10 : The ACD feature requires the following additional data store (total for system):

For ACD-C not equipped

(K3 x DN) + (K4 x PID) + AID + (K5 x CUST) .

Simplified

(46 x DN) + (12 x PID) + AID+ (3 x CUST)

For ACD-C equipped

[K1 + (K2 x CCUST)] + (K3 x DN) + (K4 x PID) + AID + (K5 x CUST)

Simplified

[25 + (8 x CCUST)] + (46 x DN) + (12 x PID) + AID + (3 x CUST)

where the multiplication constants (Ki) are:

K1 = 25	size (P_ACD_IO_BLK) (=25).
K2 = 8	size (P_ACD_SCHED_BLK) (=8).
K3 = 46 (R4-5)	size (P_ACD_BLOCK) (=32) + ptr to blk from ACD LIST (=1) + word offset (ACD-POS-TN) (=13).
K3 = 47 (R7-8)	size (P_ACD_BLOCK) (=33) + ptr to blk from ACD LIST (=1) + word offset (ACD-POS-TN) (= 13).
K3 = 48 (R10)	size (P_ACD_BLOCK) (=34) + pointer to block from the ACD List (=1) + word offset (ACDPOS-TN) (=13).
K3 = 49 (R12)	size (P_ACD_BLOCK) (=39) + pointer to block from the ACD List (=1) + word offset (ACD-POS-TN) (=13).

K3 = 57 (R13-14)	size (P_ACD_BLOCK) (=40) + pointer to block from the ACD List (=1) + word offset (ACD_POS_TN) (=16).
K4 = 12	size (P_ACD_KEY_DATA) (=11) + store for ACD_POS_TN (=1).
K4 = 14 (R13-14)	size (P_ACD_KEY_DATA) (= 13) + store for ACD_POS_TN (=1).
K5 = 3	header (ACD_LIST) (=1) + header (ACD_AGENT_ID_TBL) (=2).

and the variables are represented by:

AID = total no. of AGENT IDs (for the system)
CCUST = total no. of customers with ACD-C package
CUST = total no. of customers with ACD-C/D packages
DN = total no. of ACD DNs (for the system)
PID = total no. of AGENT POSITIONS (for the system).

Note *11*: The protected store requirements for Group DND (on a per-customer basis) are:

1 + G x (1 + M)

Release 13 through 15:

1 + G x (1 + 2 x M)

where:

G = number of groups
M = number of members in each group (2 words per member for R13-14)

Note 12 : The protected store requirements for DISA (on a per-customer basis) are:

1 + (DN x 6)

Release 13 through 15

1 + (DN x 7) ----- 1 + (DN x 7)

where:

DN = number of DISA-DNs.

Note 13: The protected store requirements for Authorization Code (on a per-customer basis) are:

1250 + (A x ((L/4 x 128) + 64)) + (B x (1018 + (C x 32)))

Releases 13 through 15:

1308 + (A x ((L/4 x 128) + 64)) + (B x (1018 + (C x 32)))

where:
L = digit length
T = total authcode
A = number of overflow blocks
B = number of auth blocks
C = number of resolution blocks per auth block.

For L less than 4 or L greater than 7

A = (T/128) + 1
B = C = 0.

For L in the range of 4 - 7

A = ((0.2 x T)/128 + 1)
B = ((0.8 x T)/1000 + 1)
C = 8

Note 14 : History file buffeican be 1—64K.per customer option.

Note 15 : For System Speed Call List (SCL) Head Table:

3 + NB/4 + NB (round NB/4 up)

NB (no. of blocks) = EL/EB (round any remainder up)

where:

EL = entries per list (given),

EB = entries per block, 256/WE (round up remainder)

where:
WE = words per entry, DNS/4 (round up)
where: DNS is DN size (given).

Note 16 : IMS protected memory requirements:

APP_SIZE_TBL = 10 words
MSG_SIZE_TBL = 40 words
LTN_TN_TBL = 255 words
LTN_LINK_TBL = 65 words

Note 17: New Flexible Code Restriction (NFCR) requires the following memory requirements:

1) A 129 word block that contains:

(a) A 128 word table that contains the pointers to the FRL block for each route.

(b) A pointer to the tree root address table.

2) A table that contains the pointers to the NFCR trees. Its length is defined by the maximum number of trees (defined in the customer data block).

3) Four words are required for each route that has defined FRL codes.

4) Storage for customer defined trees. Amount of memory used depends on the size of the code restriction trees the customer has defined.

It is possible to calculate an upper bound for the amount of memory that a tree is using by applying the following formula:

1) The INIT condition occupies 12 words, or 14 words in R12-14.

2) For each digit sequence after the INIT condition:

(a) If the digit sequence is greater than 1 digit, memory required = (3 x number of digits) • 4.

(b) If the digit sequence has a count field, memory required for digit sequence increases by 1.

(c) If the digit sequence is from a BYPS, memory required for digit sequence increases by 1.

Note *18* : **DTI/DLI Protected** Data Store requirements:

Releases 4 and 5

PDD-BLOCK =	12 words
PAD-TABLE =	36 words
MISCELLANEOUS =	2 words
TOTAL=	50 words

Release 7

= PDD-BLOCK + (N x P_DTI_TSET_BLOCK) + (T x local network data)

= 18 + (N x 10) + (TX 70)

Releases 8 through 15

= PDD-BLOCK + (N x P_DTI_TSET_BLOCK) + (T + L) x local network data+ (L x (P LOOP DLI + preallocated card data))

= 18 + (N x 10) + [(T + L) x 70] + [L x (19 + 144)]

where:

N = the number of threshold sets
T = the number of DTI loops
L = the number of DLI loops.

Note 19 : The protected data store requirements for the modem pools on a per route basis (Modem Data Block):

1 + (1 x M)

where:

M = greatest member number in modem pool route

Other AMP data store requirements have been added to their respective fields.

Note 20 : The size of the protected multiple office code screening line block is determined from the following:

2 words for each NXX code defined

2 words for each range defined (maximum_ 20 ranges perlocation code ▪ 80 words **pds).**

Note 21 : Templates are incremented in blocks of 10 words.

Note 22 : The trunk block size is 11.5 words with ODAS,
or 14.5 words in Releases 10 and 12,
or 19.5 words in Releases 13 and 15.

Note 23 : Requirements for voice/data port are the same as an SL-1 basic telephone (Note 2) except the key layout portion of the template requires:

Before Release 9:

(24 + # of non-key **features)/#** of telephones sharing the same template-

After Release 9:

(10 + # of non-key **features)/#** of telephones sharing the same template.

Note 24 : Requirements for voice/data port are the same as an SL-1 basic telephone (Note 2) except the key layout portion of the template requires:

Before Release 9:

(24 + # of non-key **features)/#** of telephones sharing the same template.

After Release 9:

(12 + # of non-key **features)/#** of telephones sharing the same template.

Note 25 : Requirements for voice/data port are the same as an SL- 1 basic telephone (Note 2) except the key layout portion of the template requires:

Before Release 9:

(34 + # of non-key features)/# of telephones sharing the same teniplate.

After Release 9:

(21 + # of non-key features)/# of telephones sharing the same template.

Note 26 : Requirements for voice/data port are the same as an SL-1 basic telephone (Note 2) except the key layout portion of the template requires (44 + # of non-key features)/# of telephones sharing the same template. For M3000 data port, requirements are the same as an SL- 1 basic set (see Note 2).

Note 27 : Protected-data store required by the Multi-Tenant Service feature includes the following:

1028 words per customer that enables Tenant Service for:

Releases 4, 5 and 7:

= size (P_TENANT_PTRS) (=644)
+ size (TEN_CPG_ORDLS) (=256)
+ size (RTE_CPG_ORDLS) (= 64)
+ size (CPG_DEFS) (= 64)

Releases 8-14:

= size (P_TENANT_PTRS) (=644)
+ size (TEN_CPG_ORDLS) (=256)
+ size (RTE_CPG_ORDLS) (= 64)
+ size (CPG_DEFS) (=256)

32 words per Tenant access map
= size (ACCESS-ARRAY)

32 words per Outgoing Route access map
= size (ACCESS-ARRAY)

Note 28 : Protected data store requirements for ATM schedule block are as follows:

Releases 4, 5 and 7:

24 + ((9 x NC + 1) x NH)

Releases S-15:

24 + ((9 x NC + 1) x NH) + 13 x AR

where:

NC = Number of Customers.
NH = Number of hours to be scheduled.
AR = Number of routes to be tested.

Note 29 : For all machine types, the additional protected data store for a virtual terminal (DS access TN or VMS access TN) is exactly the same as for an SL-1 set, with one exception. For any of the two TN types, the Card Block Component is dependent on the shelf/card to which the terminal is assigned. The component is 0 if the TN is on a preallocated card, or 1.5 words otherwise. A preallocated card may be one of the following shelf/cards: O/l - 0/7, l/l - 1/8, 2/1 - 2/8 or 3/8 on a DLI loop. See Note 18.

Note 30 : The protected data store requirement (in words) for VAS Data Services per customer, for each customer that has at least one DSDN, is:

= DSDN_VAS_TBL + (DSDN-LIST x N)
16+ (39 + N)

where:

N = the number of VAS for which at least one DSDN is defined.

Releases 10 and 12

= DSDN_VAS_TBL + (DSDN LIST x N)
16 + (248 x N)

Release 14 and 15

= DSDN_VAS_TBL + (DSDN_LIST x N)
16 + (76 x N)

where:

N = number of VAS for which at least one DSDN is defined.

Note *31* : Requirements for a Voice/Data port are the same as an SL- 1 basic set (see Note 2), except that the key layout portion of the template requires 34 + # of non-key features / # of sets sharing the same template.

For M2317 data ports, the requirements are the same as the SL- 1 basic set (see Note *2).*

Note 32 : Protected data store requirements for CPND per system in words is:

32 + (10 x C) + (1 x SP) + (11* x DIG) + ((1 + N/2)x NA) + (1 x SL)

where:

C = number of customers

SL = number of non-PBX DNs with or without name defined (including trunk routes, ACD ATTN, and SL- 1)

SP = number of single appearance PBX DNs with name defined

DIG = number of DIG Groups
* = 101 for 2-digit DIG Groups

N = Name length

NA = number of Names.

Note 33 : For each PR loop configured, add 5 words for the P-PREP-BLOCK to the PTERM LOOP-BLOCK.

Note 34 : Each system that has DCHIs shares P_DCH_TBL which has 16 words in length. Each DCHI consists of the following protected data blocks:

P_DCH_BLOCK = 23 words

Releases 13 and 14:

P_DCH_BLOCK = 25 words

Release 15:

P_DCH_BLOCK = 26 words

Protected call reference table = 1 + (24 x # of PRI loops controlled by DCHI). If DCHI is in PRA mode, add the following:

Protected call reference table = 1 + (maximum number of ISL trunks defined) if DCHI is in ISL mode

Protected call reference table = 1 + (24 x # of PRI loops controlled by DCHI) + (maximum number of ISL trunks defined) if DCHI is in SHARED mode.

Note 35 : For each ISA route configured for IFC = ESS4, add 2 words for the ISA-SRVCBLOCK.

With Releases 14 and 15, if IFC = ESSY, add 4 words for the ISA-SRVCBLOCK.

Note 36 : A pointer named ISA_SID_MTHPTR has been added to fix memory. This pointer is set to nil when SID is not defined for ISDN routes.

A data block of 32 words is defined and accessed through this pointer if SID is defined for at least one ISDN route in the system. This data block contains pointer to SID tables for each customer. The structure mapping onto this data block is ISA_CUSTID_TPTR.

A data block of 64 words is allocated for each customer if at least one route is defined to have SID. The structure mapping onto this data block is **ISA_SID_RT_LIST.**

Note 37 : Protected ISL Trunk TN table = **1+** maximum number of ISL Trunks defined.

Note 38 : The protected customer data per customer defined is as follows:

B + (X x (P + A))

where:

P = Protected customer data block (255) (262 in Release 15)
A = auxiliary customer data (14)
B = 1000 for XN, XT, RT, and NT machines
320 for all other machine types
X = number of customer groups defined

If background terminal is equipped, an additional auxiliary data block is allocated which requires 35 words. This brings the total requirement to 305 words.

Note 39 : No protected storage is required unless the system is equipped with the Speed Call package (66) and the entry to MSCL prompt in Overlay 17 is greater than 0. In this case, the protected memory required for SCL main header table is:

words required = N + (1 x A)

where:

N = 1 (number of header words)
A = number of SCL as defined in Overlay 17 (**MSCL** prompt)

Note **40** : For each customer, an additional 255 words is needed for **PREXL_SCLN** in pool CDB (compool).

Note 41 : The protected data store requirements for DTI2 is as follows:

DTI2_SYSTEM_DATA	9 words
DTI2_SCAT_NT	16 words
DTI2_SCTA	16 words
DTI2_PCADA_NT	16 words
DTI2_PCADA	16 words

Note 42 : There are 32 pointers to FTC protected structures. Each FTC table has 90 words

Note 43 : There are 256 pointers to EFTC protected structures. Each EFTC table has an additional 27 words.

Note 44: A bit is required in the customer data block to indicate EBLF allowed/denied. A bit is required in the protected attendant block if attendant consoles have the Console GFraphics Module (CGM) configured. Additional memory is required only if EBLF is ON. 104 words are allocated in the fixed protected memory even if EBLF is not used.

Words required:

x+((z-3)xyxll)

where:

- x = number of customers with EBLF
- y = average number of hundreds groups per customer
- z = average DN length (4, 5, 6, 7)

Note 45 : **EOVF** requires the following **in Release** 15:

per target table	113 words
per source table	174 words
per ACD DN	6 words

The words required for the source table **are** allocated for every target ACD DN.

List of terms

AA
Attendant Administration

AAB
Automatic Answerback

ACDA
ACD Basic

ACDB
ACD Advanced

ACDC
ACD Management Reoprts

ACDD
ACD Auxiliary data System

ACDR
AUTOVON CDR

AIOD
Automatic Identification od Inward Dial

AMP
Automated Modem Pooling

ANI
Automatic Number IdentificationANI Route Selection

ANIR
ANI Route Selection

AOP
Attendant Overflow Position

ATVN
AUTOVON

AUTH
Authorization code

AWU
Automatic Wakeup

BACD
Automatic Call Distribution-Base

BARS
Basic Automatic Route Selection

BAUT
Basic Authorixation Code

BCSOB
SL- 1 Output Buffer

BGD
Background Terminal Facility

BQUE
Basic Queuing

BRTE
Basic Routing

CAB
Charge/Authorization Base Package

CAS
Centralized Attendant Service

CASM
CAS Main

CASR
CAS Remote

CCBQ
Coordinated Call Back Queuing

CCBQCM
Coordinated Call Back Queuing to Conventional Mains

CDP
Coordinated Dialing Plan

CDR
Call Detail Recording

CDRE
CDR Expansion

CDRQ
Emergency Acces Enhancement (911 Option)

CFCT
Call Forward by Call Type

CFNA2
Call Fortward No Answer - Second Level

CHG
CDR with Charge Account

CLNK
CDR with Magnetic Tape

CMAC
ESN Communication Management Center

CPND
Call Party Name Display

CPRK
: Call Park

CTY
: CDR TTY

CUST
: Multi-Customer

DDSP
: Digit Display SL- 1 Set

DHLD
: Deluxe Hold

DI
: Dial Intercom

DISA
: Direct System Inward Access

DLDN
: Departmental LDN

DND
: Do Not Disturb

DNDG
: DND Group

DNDI
: DND Individual

DNIS
: Dial Number Identification Service

DNXP
: Directory Number Expansion

DRNG
: Distinctive Ringing

DSET
Digital Set M2000

DTI
Digital Trunk Interface

EES
END-to-End Signaling

EOVF
EWnhanced Overflow (NACD)

FCA
Forced Charge Account

FCBQ
Flexible Call Back Queuing

FTC
Flexible Tone and Digit Switch Control

GRP
Groupe Call

HIST
History File

HOT
Hot LIne Services
Enhanced Hot Line
Flexible Hot LIne

IAP3P
Integrated Services Digital Network Application Protocol

ICDR
Internal CDR Records

IDC
Incoming DID Digit Conversion

IMS
Integrated Messaging System

INTR
Intercept

ISA
Integrated Services Access
Integrated Services Digital Network

ISDN
Integrated Services Digital Network

ISL
Integrated Services Digital Network Signaling Link

IVMS
Integrated Voice Messaging System

LLC
Line Load Control

LMAN
ACD Load Management

LNK
Auxiliary Processor Link

LSEL
Line Selection

MCBQ
Network Queuing - Main

MCT
Malicious Call Trace

MOD
Music on Delay

MOH
Music on Hold

MR
Message Registration

MSB
Make Set Busy

MUS
Music on Hold

MWC
Message Center

NARS
Network Automatic Route Selection

NAUT
Network Authorization Code

NCOS
Network Class of Service

NFCR
New Flexible Code Restriction

NSC
Network Speed Calling

NSIG
Network Signaling

NTRF
Network Traffic

NTWK
Network Ring Again

NXFER
Network Transfer

OCC
Other Common Carriers

ODAS
Office Data Administration System

OHQ

Off Hook Queuing

OPAO

Out-pulsing of Asterisk and Octothorpe

OPTF

Advanced Features

PBXI

PBX Interface/Digital Trunk Interface

PBXOB

Non SL-1 Output Buffer

PMSI

Property Management system Interface

PQUE

Priority Queuing

PRA

Primary Rate Access

RAN

Recorded Announcement

RESDB

Resident Debug

RMS

Room Status Service

ROA

Recorded Attendant Overflow Announcement

RPE

Remote Peripheral Equipment (1.5 Mb/s)

SCC

Special Common Carrier

SCI
Station Category Indication

SLP
Station Loop Preemption

SNR
Stored Number Redial

SR
Set Relocation

SSC
System Speed Call

SS5
500 Set Access to 2500 Set Features

SS25
2500 Set Features

TAD
Time and Date

TDET
Tone Detector

TENS
Multi Tenant Services

TOF
Time Overflow Queuing

TSET
Digital Set M3000 (Touchphone)

UMG
User-to-User Teleset Messaging

UST
User Status

SL-1

Generic Xl 1

Memory calculations

Information subject to change without notice.

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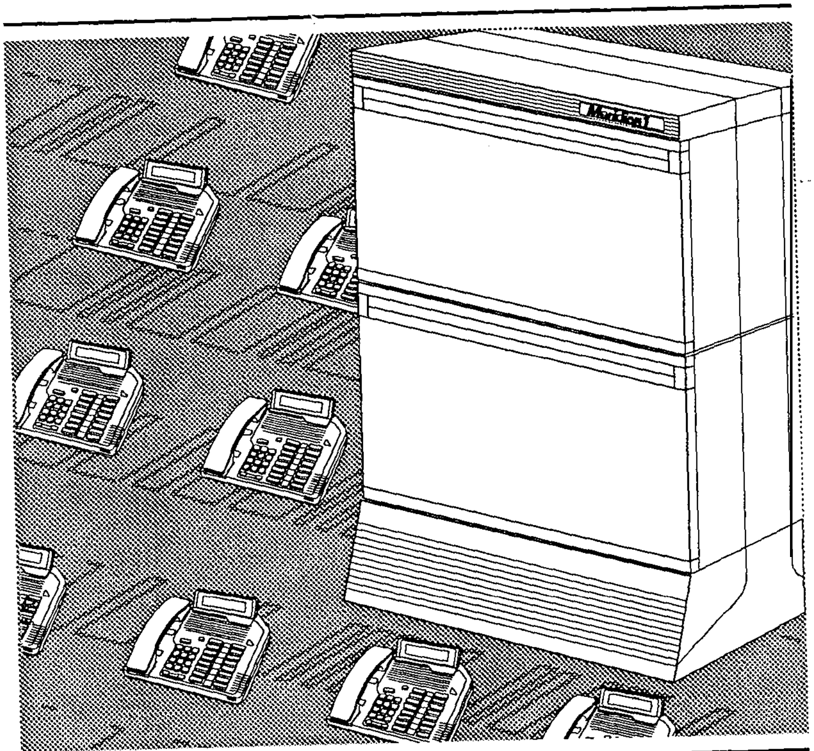

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About this document

This document describes the SL-1 System power and grounding architecture for both AC and DC systems and provides guidelines for calculating system power consumption as well as reserve power requirements.

References

For information about the power plant used with DC-powered system option 7 1, see the following publications:

— *J2412A — Description, Engineering, Ordering Information, Installation, Connections, Operation and Maintenance* (167-2191-200)

— *NT5C03 Switched Mode Rectifier -48V/50A -Description, Maintenance and Ordering Information PO673491* (169-2031-200)

See the SL-1 planning & engineering guide for

— *Master index* (553-3001-000)

— *System overview* (553-3001-100)

— *Installation planning* (553-3001-120)

— *System engineering* (553-3001-151)

— *Power engineering* (553-3001-152)

— *Spares planning* (553-3001-153)

— *Equipment identification and ordering* (553-3001-W)

See the list of line and trunk circuit descriptions in the *Master index* (553-3001-000) for specific references to lines and trunks.

See the SL-I installation and maintenance guide for

- *System installation procedures* (553-3001-210)
- *Circuit pack installation and testing* (553-3001-211)
- *Installation procedures for telephone sets and attendant consoles* (553-2201-215)
- *Extended systems installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-25 1)
- *General maintenance information* (553-3001-500)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

See the SL-I XII software guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- *XII software management* (553-3001-300)
- *XII features and services* (553-3001-305)

See the SL-I XII input/output guide (553-300140) for a description of all administration programs, maintenance programs, and system messages.

Contents

SL-1 system power overview

The SL-1 system is an advanced telecommunications system providing state of the art functionality to the customer. The associated power system provides the necessary power for system operation.

General information

The power system required by the SL- 1 system can be divided into two main categories: external and internal.

The external system consists of the power source and power plant which is located outside of the SL-1 system. This includes the power plant and the reserve power plant, if required, as well as the distribution and grounding components.

The internal system consists of the hardware within the SL-1 system which distributes and converts power. This is made up of a specific power distribution unit (PDU), shelf power converters or power supplies as well as distribution cables and grounding hardware. The internal system is chosen to suit the existing or specified external power system and cannot be changed in the field.

There are two basic powering schemes which cause both the internal and the external hardware to change — AC powering and DC powering. The choice of which powering scheme to use is up to the customer and is determined by system cost, reserve power requirements and the type of existing equipment at *the* site. See Installation *planning* (553-3001-120). Figures 1 and 2 show the two basic schemes. Note that both require a source of commercial AC power. In Figure 2, because of the required rectifier, it is referred to as the DC system, which means that the PBX will require a nominal 48 V dc at its input terminals located in the pedestal. The PBX in Figure 1 requires a nominal 208 or 240 V ac at its input terminals located in the pedestal.

In discussing these powering schemes, unless otherwise specified, AC distribution will mean a single phase circuit without a neutral conductor, but with an accompanying green wire ground conductor. The nominal voltage is assumed to be either 208 or 240 volts but any voltage within the range shown in Table 1 is applicable. DC distribution is typically a nominal 48 volts at the input to a UEM power converter under load.

AC or DC powering

DC powering and AC powering differ primarily in the use of rectifiers. DC systems always require the use of rectifiers (see Figure 2). This is a cost disadvantage for DC in applications that do not require "backup" in the event of a utility power failure. The reason for this is due to the double conversion that is required: line voltage to -48 V dc and then 48 V dc to the required circuit voltages. AC powering, on the other hand, requires only a single conversion — line voltage to the required circuit voltages.

The use of a rectifier in DC powering does however become a cost advantage in applications that require battery backup. The reason for this cost advantage is that an AC Uninterruptible Power System (UPS) consists of not only a rectifier but also requires the additional cost of an inverter. Both AC and DC require similar battery banks so there will not be much of a cost advantage or disadvantage with these battery plants.

The actual distribution of DC and AC power is similar. DC power will be brought into the Pedestal and distributed to the Modules in a similar way to AC power, the difference being that AC uses AC-to-DC Power Supplies rather than DC-to-DC Converters.

> *Note:* The DC system requires the use of additional input wires in order to handle the lower voltage and its associated higher current.

Figure 1
AC powered system

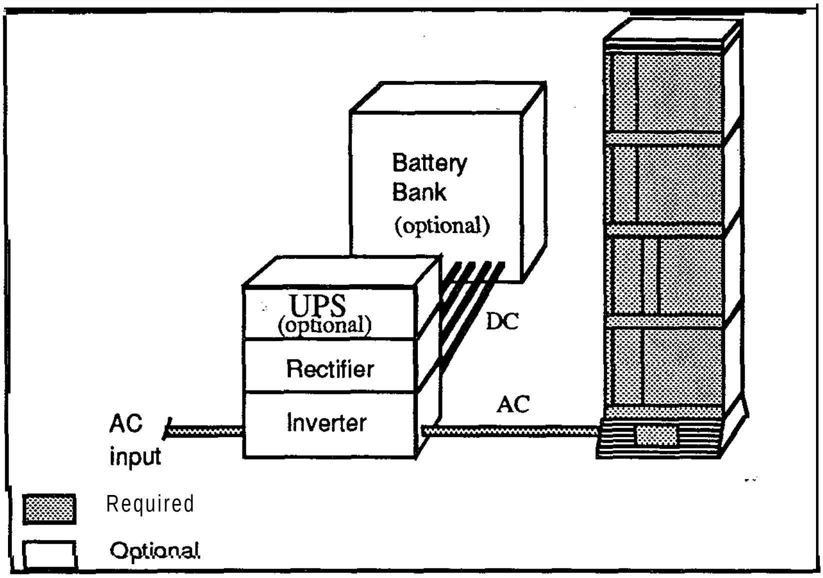
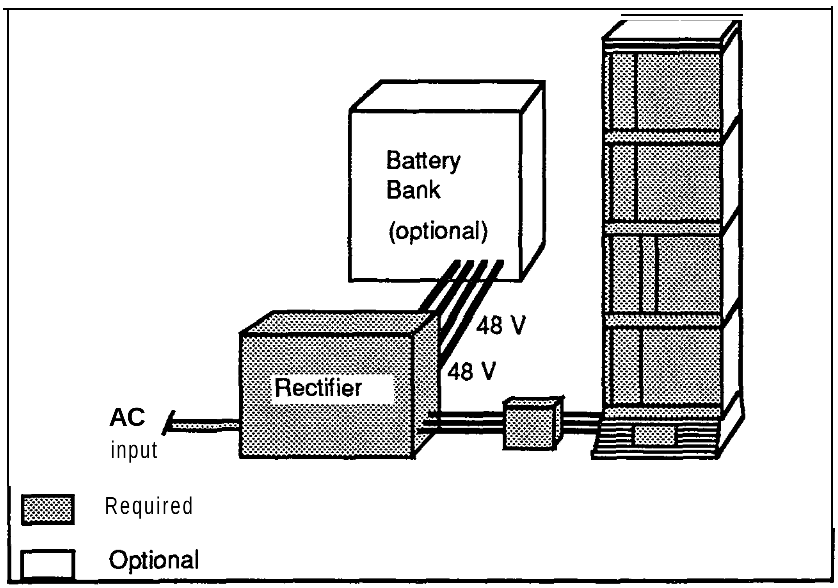


Figure 2
DC powered system



AC power system description

This section describes the characteristics of the Meridian SL-1 system where equipment columns are directly powered by commercial power.

The commercial power voltage is brought directly into the Pedestal Power Distribution Unit. From there it is passed through separate wiring to the individual modules in order to provide power to the module power supplies.

Input power specifications

AC power supplies operate at a nominal 2081240 V. A typical system operating from 208 V using four UEMs will draw 15-24 Amps, depending on the configuration. These are fed from a central point in the pedestal, access to these connections is provided and should be used to confirm that the line voltage is within the required range as indicated in Tables 1 and 2.

Table 1
AC input specifications

Input	Minimum	Nominal	Maximum
Voltage (V ac) at pedestal	180	2081240	250
Frequency (Hz)	47	50/60	63
Current to a pedestal	—	see note	24A

Note: Current is dependent on equipment installed see "Operating power calculation guidelines."

Table 2
Transient tolerance

Transient tolerance (See note)	Amplitude	Duration
Surges	288 U ac	8.34 mS to 50 ms
	276 U ac	50 mS to 500 ms
Sags	146Uac	8.34 mS to 50 ms
	166Uac	50 mS to 500 ms
Spikes	815 Upk	<4.17 ms
	815 U pk to 408 U pk	4.17 to 8.3 ms
Notches	to ou	<4.17 mS
	0 V to 206 V	4.17 mS to 8.3 ms

Note: All transients are applied at the peak of the AC waveform.

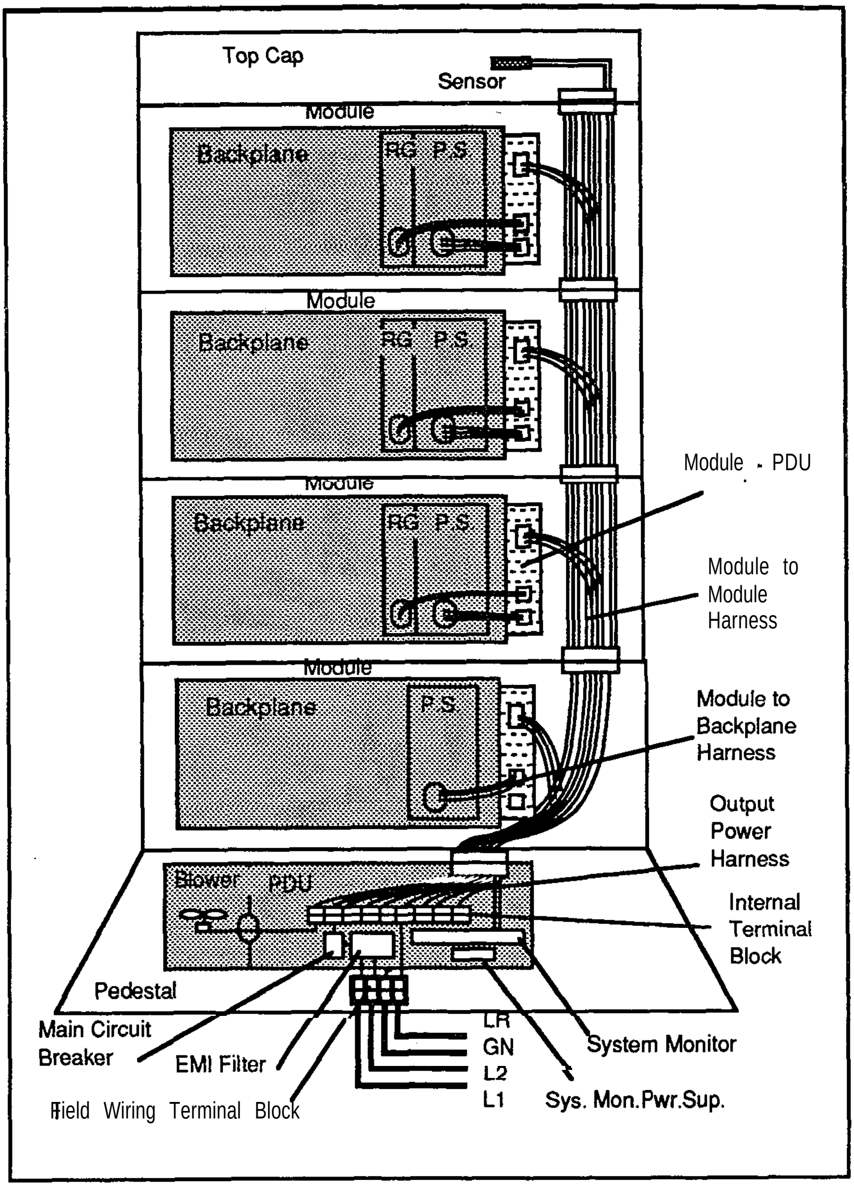
Internal power distribution

Figure 3 shows the internal AC power distribution elements:

- Pedestal Power Distribution Unit (PDU)
- Module to Module Harness
- Module Power Distribution Unit (MPDU)
- Module to Backplane Harness
- AC Power Supplies

The power cables enter the Pedestal and connect to the Field Wiring Terminal Block which is located in the Power Distribution Unit (PDU). From that terminal block, the AC voltage passes into the Power Distribution Unit (PDU) which has a single circuit breaker providing power to each of the four modules and the cooling fans. The System monitor runs off a small AC Power Supply which operates independent of the circuit breaker. Module to Module distribution produces individual AC power to each module.

Figure 3
AC internal power distribution



Pedestal Power Distribution Unit (PDU)

The Pedestal PDU provides the following:

— The Field Wiring Terminal Block provides a connection point for the external wiring that is brought into the Pedestal.

— The EM1 Filter provides filtering of the wires connecting back to the Utility in order to meet FCC and DOC requirements.

— The Main Circuit Breaker provides both a single protection device for overload currents and a single trip device to shut down the column in the event of a thermal overload.

— The Internal Terminal Block provides individual power hand-off points so that each Module is independently powered from the Pedestal in order to minimize wire size.

— The Power/Signal Harness provides the Power and Signal interconnections in the Pedestal for the Blower Unit and System Monitor.

— The System Monitor Power Supply (a small +5V power supply) provides power to the System Monitor, even when the main circuit breaker has tripped.

— The Output Power Harness provides the independent power connections from the Pedestal to the Module above it.

Module to Module Harness

The Module to Module Harness provides the following:

— The Module Feed provides the independent power feed(s) to the Module above itself.

— The Module PDU Feed provides the power feed to the Module PDU.

Module Power Distribution Unit (MPDU)

The Module PDU provides the following functions:

— The Circuit Breaker provides a Module level of current protection so that a fault on one Module will be disconnected while the other Modules remain functional.

— The MPDU to Backplane Harness feed provides the power feed to the backplane harness which in turn provides power to the AC Power Supplies through the backplane power connector.

Module to Backplane Harness

The Module to Backplane Harness provides the power to the AC Power Supplies through the backplane power connector.

AC Power Supplies

There are three different power supplies that provide power to the Peripheral Equipment, Common Equipment and Common/Peripheral Equipment Modules. In addition, the Ringing Generator provides ringing voltage for the Peripheral Equipment Modules.

At each shelf, the 208/240 V ac is received through the backplane distribution harness and converted to the necessary voltages for the individual module. Circuit breakers are located on each MPDU to provide for safe operation and easy maintenance.

The output voltages and currents of the power supplies are listed in Tables 3 hrough 6.

fable 3
Peripheral Equipment Power Supply

NT8D06AA	
output v	Output A
+5.1 v	28 A
+8.5 V	4.0 A
+10 v	0.5 A
-lov	0.5 A
+15 v	17A
-15 v	15 A
-48V	7.7 A

Table 4
Common Equipment Power Supply

NT8D29AA	
output v	output A
+5.1 V	60A
+12 V	2.5 A
-12 v	1.0 A

Table 5
Ringing Generator

NT8021 AA	
Output VNA	Output F
70 V ac/8 VA	25/50 Hz
80 V ac/8 VA	25/50 Hz
86 V ax/8 VA	20/25 Hz
output v	Output A
- 150v	0.200 A

Table 6
Common/Peripheral Equipment Power Supply

NT7D14AA	
output v	Output A
+5.1 V	60A
+8.5 V	2.5 A
+12	1.0 A
-12	0.75 A
+15 V	10 A
-15 v	10 A
-48 V	4.75 A
-150 v	0.13 A
output V/VA	Output F
86 V ac / 5 VA	20 Hz

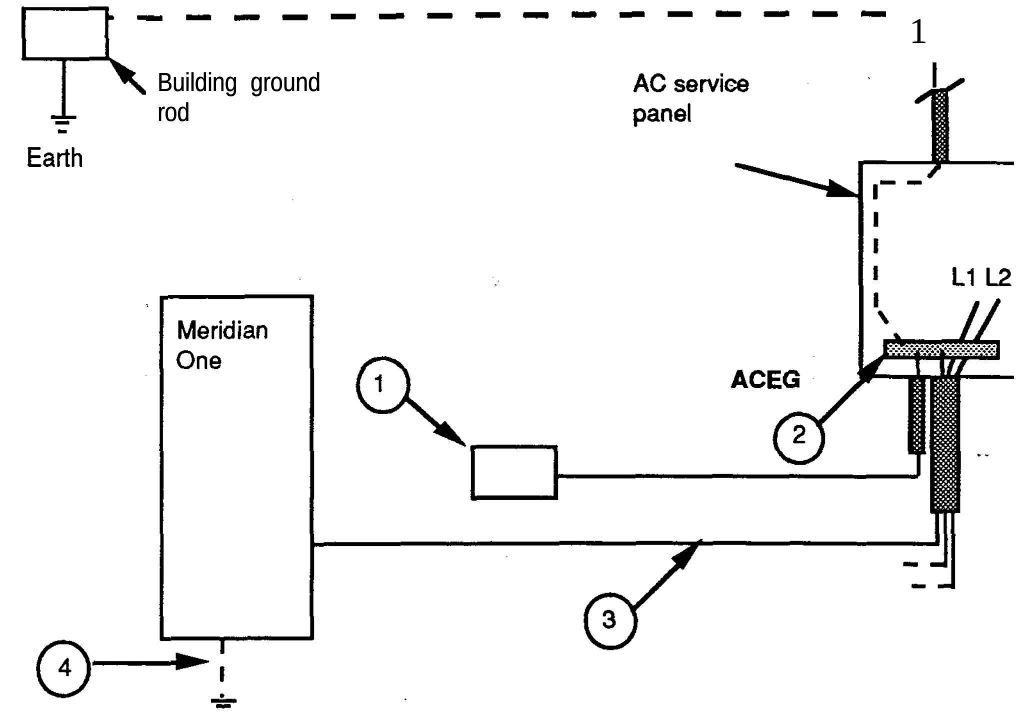
External power distribution and ground connections

The external distribution for AC powered systems is very simple. No additional equipment is required; simply connect to an AC source of power. One 208 or 240 volt circuit with 30 amps protection (circuit breaker or fuse) should be used to feed each pedestal.

Figure 4 shows the important grounding connections and the use of the ACEG (AC Equipment Ground) or IGB (Insulated Ground Bus). For a general discussion of the grounding philosophy, see the section "System grounding."

Figures 5 through 8 for AC distribution in this section are shown for connection to standard utility power. If an Uninterruptible Power System (UPS) is used, refer to the later section on AC reserve power.

Figure 4
Grounding and equalizing nodes



Items:

1. An equalizing node for the Meridian SL-1 system may be obtained through the ACEG the AC panel. If isolation as per NEC 384-127 (exception 1) cannot be provided, an alternate low impedance connection to the building ground may be required.

   In either case there are many constraints which must be observed. such as:

2,3 The NEC and CEC require exposed metal (Meridian 1 cabinet) be grounded by an **ACEG**

4. Stray connections to a foreign ground will bypass the single point concept. In high rise buildings large potentials can exist between an ACEG and other grounds including building steel.

General notes for AC figures

Permanent connection to Branch Circuit When conduit or a raceway is used it should be metal and regardless of the type, it must contain an insulated ground wire (green), 6 AWG or larger.

Cord connection to Branch Circuit A separate safety ground is always required when removable line cords are used for the following reasons:

- a telephone wire could contact AC elsewhere in the building while the cord is unplugged (during installation)
- to minimize hazards from lightning transients when unplugged
- to minimize the effects of stray grounds (pedestal to floor RS-232 links to monitors) during normal operation

The additional safety ground must be 6 AWG or larger, preferably insulated and must be connected from the pedestal Frame Ground to the Service Panel Ground Bus

One 30 Amp circuit per pedestal is required. Isolation as required by NEC 250-74 and 384-27 (Exception 1) is preferred.

Single Point Ground (SPG) and Isolated Ground Bus (IGB) The SPG in this grounding scheme is the Equipment Grounding Terminal Bar in the AC distribution panel **(ACEG).** If this bar is isolated from the distribution panel, as is recommended, then it is referred to as an IGB. In the following figures, the preferred method using an ACEG is illustrated.

Logic Return (LR) wiring and Logic Return Equalizer (LRE) location When multiple columns are present or where links will be made to existing SL-1 equipment, the LRs of the different columns must be joined. See ***System installation procedures*** (553-3001-210). An LRE (a bar or plate) in the immediate vicinity allows the LRs to be joined to a single equalizing point. A 6 AWG conductor then connects the LRE to the IGB in the AC panel.

For these multiple column applications, the LRE is typically located in a nearby rack, overhead trough or under a raised floor, It must be insulated from its support structure.

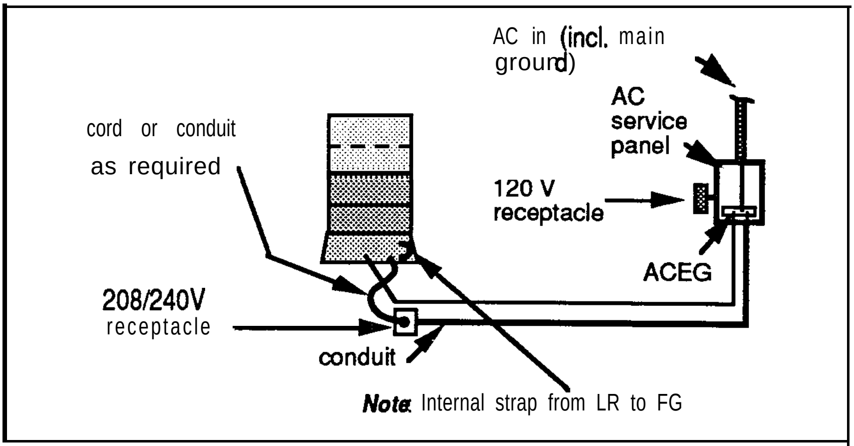
Note: This single point equalizing is required because communication between modules that are not in the same physical line-up would put small amounts of DC on the AC (green wire) ground. Likewise residual AC voltages would be superimposed (longitudinally) on the logic. There is a only a few volts of common mode rejection capability on these lines. Refer also to the System Grounding section later in this document.

120 V receptacles and cord or conduit items in the figures are used only as required.

Single column AC powered system

A single column system can be easily powered as shown in Figure 5.

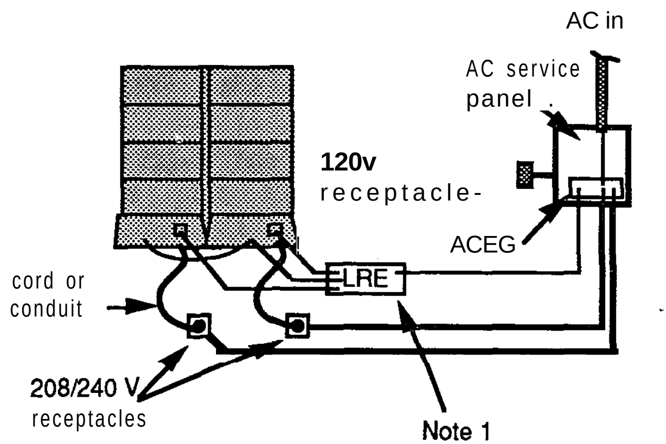
Figure 5
Single-column distribution



Multi-column AC powered system

A multi-column system (with one or more columns physically adjacent to each other) can be powered as shown in Figure 6.

Figure 6
Multi-column distribution

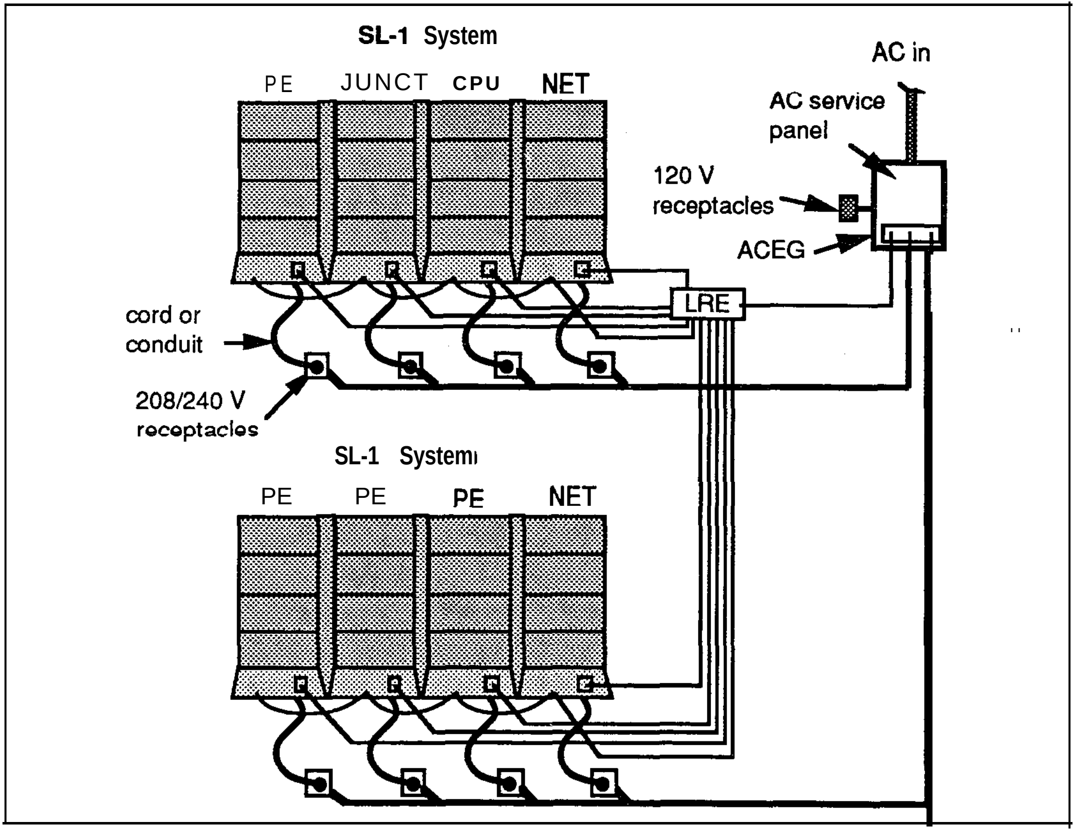


Note 1: This LRE may be a simple insulated connector, or if preferred, run the LR conductors separately to the ACEG.

Multi-row AC powered system

A multi-row system (with several rows of one or more columns physically adjacent to each other) can be powered as shown in Figure 7.

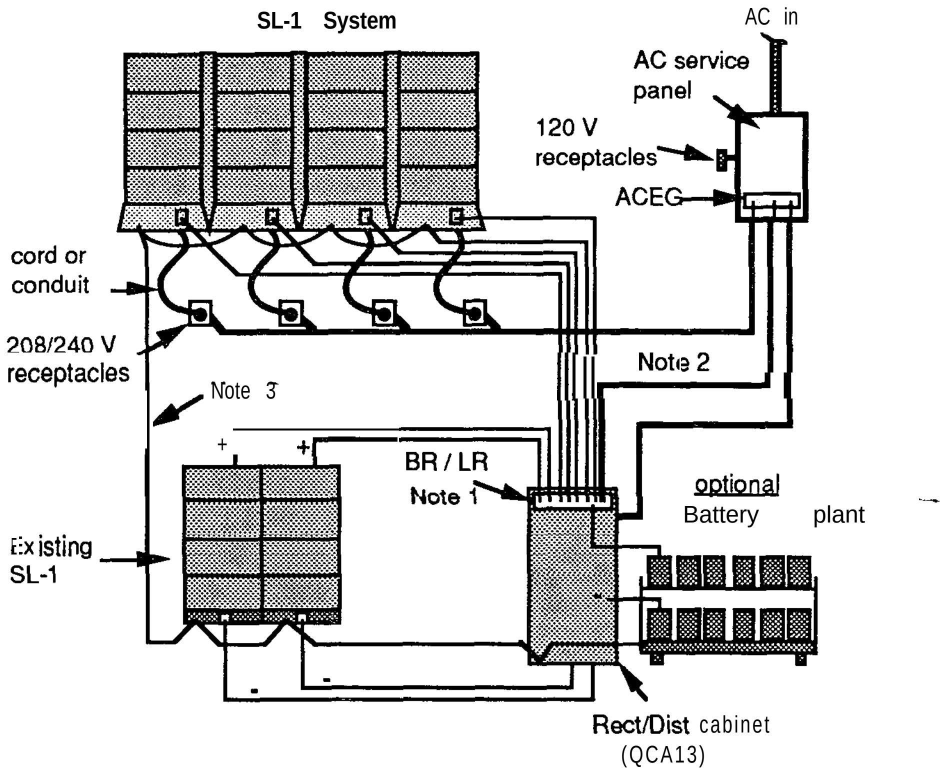
Figure 7
Multi-row distribution



Extended systems

A typical large extended system with both new and existing equipment is shown in Figure 8.

Figure 8
External distribution for AC systems



Notes:

1. The rectifier cabinet will contain a bus for terminating BRs and LRs, but if the runs are too long, a local LRE may be needed. See 'General notes for AC figures." It should still connect to this bus.

2. This conductor and the safety ground must be 6 AWG minimum but may be larger, depending on battery fusing.

3. May be run independently to ACEG.

DC power system description

This section outlines the characteristics and requirements for the DC auxiliary power that the system is connected to.

Input power specifications

The DC supply chosen must accept the calculated current drain and operate within the following specifications:

Table 7
input specifications

Input	Pedestal	Battery
Maximum range	-40.0 to -56.5	-42 to -56.5
Expected nominal (with 24 stationary cells)	—	-52.08
Expected nominal (with 23 sealed cells)	—	-51.75
Expected nominal (with 24 sealed cells)	—	-54.00
Noise (max C msg)	—	32 dBrnC

Internal power distribution

Figure 9 shows the internal DC power distribution elements:

— Pedestal Power Distribution Unit (PDU)

— Module to Module Harness

— Module to Backplane Harness

— DC Power Converters

The power cables enter the Pedestal and connect to an internal terminal block located in the pedestal. From there, the DC voltage enters the Power Distribution Unit (PDU) which has five circuit breakers, one for each of the four modules and one for the cooling fans. The System monitor runs off a DC-to-DC converter. Module to Module distribution brings individual DC power to each module similar to AC distribution.

Pedestal Power Distribution Unit (PDU)

The Pedestal PDU provides the following:

— The Field Wiring Terminal Block provides a connection point in the bottom of the Pedestal for the external wiring.

— The Circuit Breakers provide individual Module protection devices for Module overload currents and a single trip function to shut down the Stack in the event of a thermal overload.

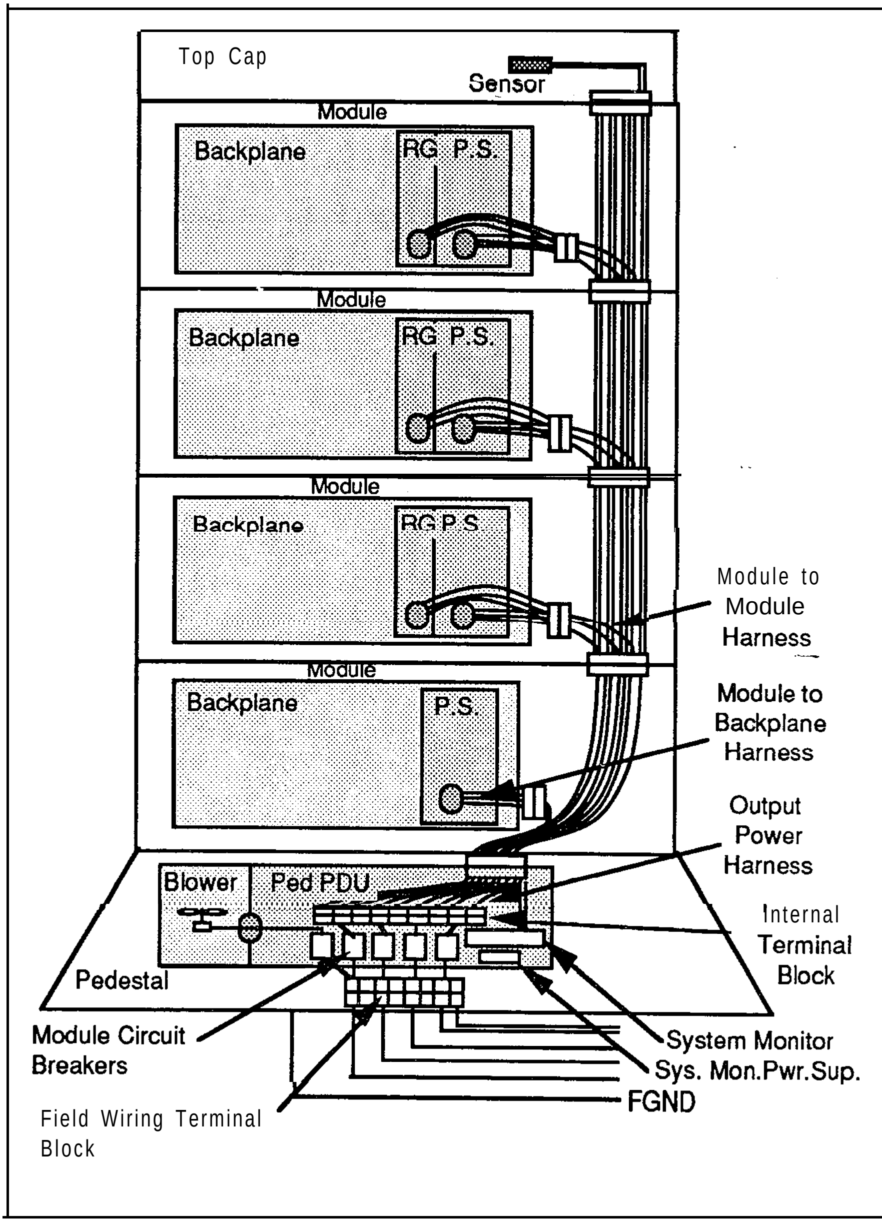
— The Internal Terminal Block provides individual power hand-off points so that each Module is independently powered from the Pedestal in order to minimize wire size.

— The Power/Signal Harness provides the Power and Signal connections in the PDU for the Blower Unit and System Monitor.

— The System Monitor Power Supply (a small +5V DC-DC Converter) provides power to the System Monitor, even when all of the Circuit Breakers have been tripped.

— The Output Power Harness provides the independent power connections from the Pedestal to the Module above it.

Figure 9
DC internal power distribution



Module to Module Harness

The Module to Module Harness provides the following:

— The Module Feed provides the independent power feed to the Modules above itself.

— The Module Harness Feed provides the power feed to the Module backplane Harness.

Module to Backplane Harness

The Module to Backplane Harness provides the power feed to the backplane connector which in turn provides power to the DC Power Converters.

DC Power Converters

Three different DC Power Converters provide power to the Peripheral Equipment, Common Equipment and Common/Peripheral Equipment Modules. The Ringing Generator provides ringing voltage for Peripheral Equipment Modules.

At each shelf, -48 V is received through the backplane distribution harness and converted to the necessary voltages for the individual module. Switches are located on each converter to provide for safe operation and easy maintenance. With separate Module breakers located in the Pedestal PDU, the-Module Power Distribution Unit (MPDU) is not necessary.

The output voltages and currents of the power converters are listed in Tables 8 through 11.

Table 8
Peripheral Equipment Converter

NT6D40AA	
Output V	Output A
+5.1 V	28A
+8.5 V	4.0 A
+10 V	0.5 A
-10 V	0.5 A
+15 V	17 A
-15 V	15 A
-48V	7.7 A

Table 9
Common Equipment Converter

NT6D41AA	
output V	Output A
+5.1 V	60 A
+12 V	3.5 A
-12V	1.0 A

Table 10
Ringing Generator

NT7D03AA	
Output VNA	Output. F
70 V ac/16 VA	20/25/50 Hz
80 V ac/16 VA	20/25/50 Hz
86 V ac/16 VA	20/25/50 Hz
output v	output A
-150 v	0.200 A

Table 11
Common/Peripheral Equipment Converter

NT7D04AA	
output v	output A
+5.1 v	5aA
+8.5 V	2.5 A
+12	1.0 A
-12	0.75 A
+15 v	10 A
-15 v	10 A
-48V	4.75 A
-150 v	0.2 A
Output VIVA	Output F
70 V acll6 VA	20/25/50 Hz
80 V ac/16 VA	20/25/50 Hz
86 V ac/16 VA	20/25/50 Hz

External power distribution and ground connections

The power plants shown in the following 'figures are typical but there are many variations possible for the item labeled "Rect/Dist." It could be existing customer equipment or a system that Northern Telecom either supplies or recommends. In any case, the rectifier and distribution equipment are required; the batteries are optional.

> ***Note:*** The NT6D52 Switched Mode Rectifier is a QRF12 mounted within an EMI enclosure.

In all cases it will be necessary to carefully plan ahead. Refer to the chapter entitled "Engineering and configuration guidelines."

Figures 10 through 13 also show the important grounding connections and the use of the IGB (Insulated Ground Bus). For a general discussion of the grounding philosophy, see "System grounding."

General notes for DC figures

Permanent Connection of the rectifier(s) to Branch Circuit When conduit or a raceway is used it should be metal and regardless of the type, it must contain an insulated ground wire (green), 6 AWG or larger.

Cord Connection of the rectifier(s) to Branch Circuit A separate safety ground is **always** required when removable line cords are used for the following reasons:

- a telephone wire could contact AC elsewhere in the building while the cord is unplugged (during installation)
- to minimize hazards from lightning transients when unplugged
- to minimize the effects of stray grounds (pedestal to floor RS-232 links to monitors) during normal operation

This additional safety ground must be 6 AWG or larger, preferably insulated and must be connected from the pedestal Frame Ground to the Logic Return Equalizer (with Northern Telecom power units). With customer provided power, the safety ground must go directly to the ACEG. See Figure 12.

It is preferred that the outlets for rectifier powering be isolated according to **NEC 250-74** and 384-27 (Exception 1).

Single Point Ground (SPG) and Isolated Ground Bus (IGB) The SPG in this grounding scheme is the AC Equipment Grounding bar in the AC distribution panel (ACEG). If this bar is insulated from the distribution panel, as is recommended, then it is referred to as an IGB. In the following figures, the preferred methods for using an ACEG and an IGB are illustrated.

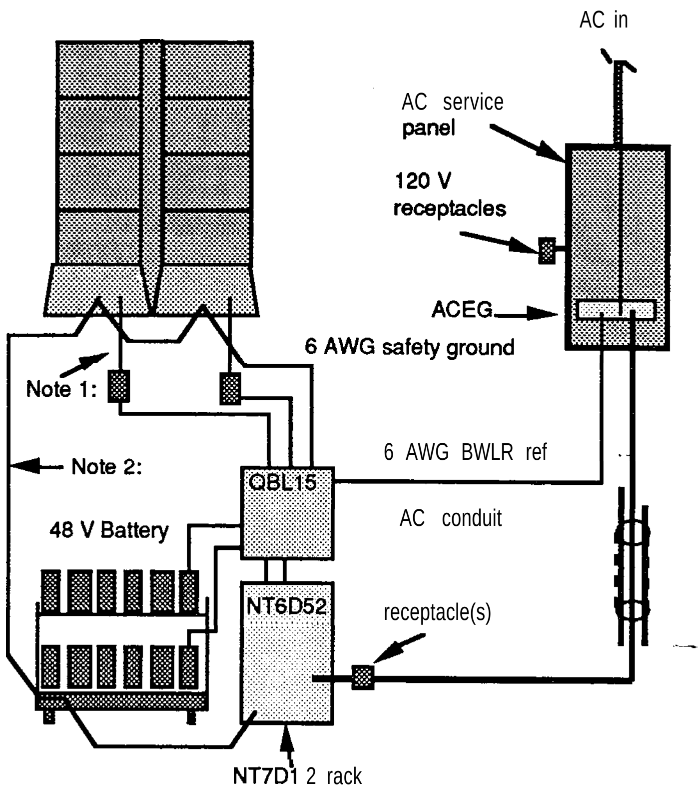
Logic Return (LR) wiring and Logic Return Equalizer (LRE) location When multiple columns are present or where links will be made to existing SL-1 equipment, the LRs of the different columns must be joined. Refer to ***System installation procedures*** (553-3001-210). When using a Distribution Unit such as the QBL15, QCA13 and most others, the existing Battery Return (BR) bus will serve double duty as the LRE. The logic return wire must be run in conduit to the LRE. A 6 AWG conductor then connects the BR (LRE) to the ACEG in the AC panel.

This single point equalizing is required because communication between modules that are not in the same physical line-up would put small amounts of DC on the AC (green wire) ground. Residual AC voltages would be superimposed (longitudinally) on the logic. There are a only a few volts of common mode rejection capability on these lines. Refer to “System grounding.”

120 V receptacles and cord or conduit items in the figures are used as required.

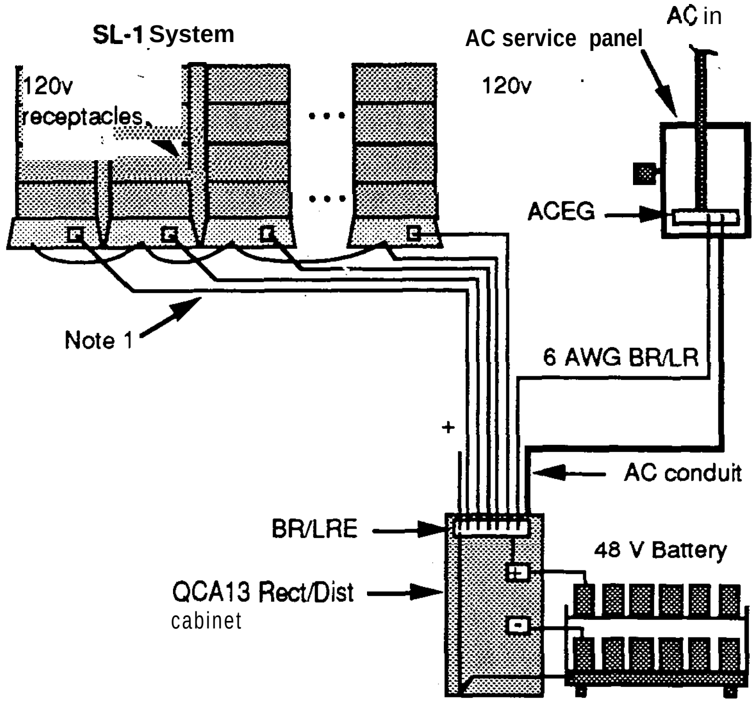
Junction Box A junction box close to the pedestal may be required depending on the wire size required between the pedestal and the distribution point. See the chapter entitled “Power conductors.”

Figure 10
Multi-column distribution with NT6D52 and QBL15



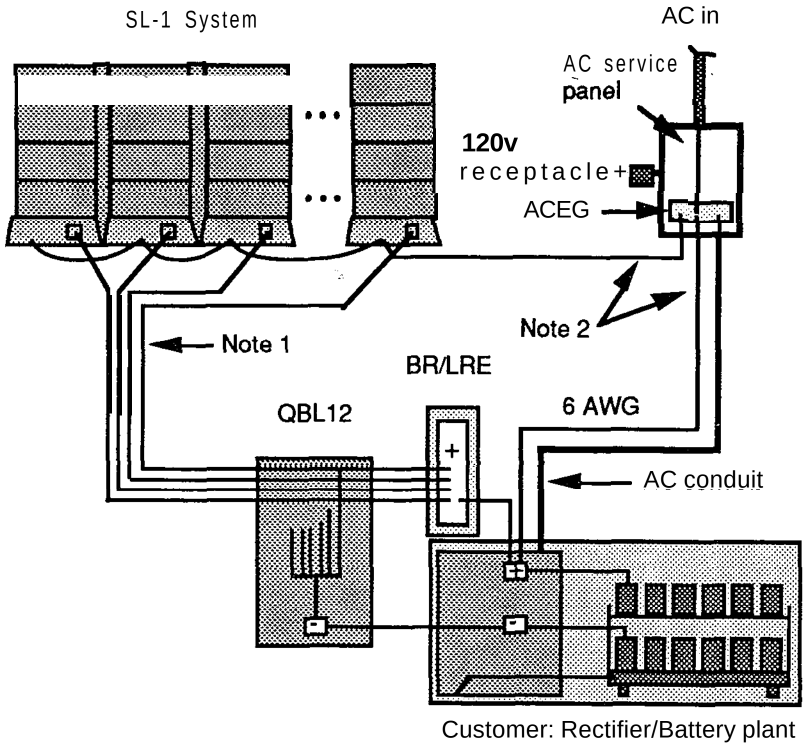
Note 1: This is a 3 conductor cable enclosed in conduit. BR(+) and LR go to the positive bus bar in the QBL15; BAT (-) connects to the appropriate fuse in the QBL15.
Note 2: May be run independently to ACEG.

Figure 11
Multi-column distribution with QCA13



Note 1: This is a 3 conductor cable enclosed in conduit. BR(+) and LR go to LRE; BAT(-) connects to the appropriate fuse in the QCA13.

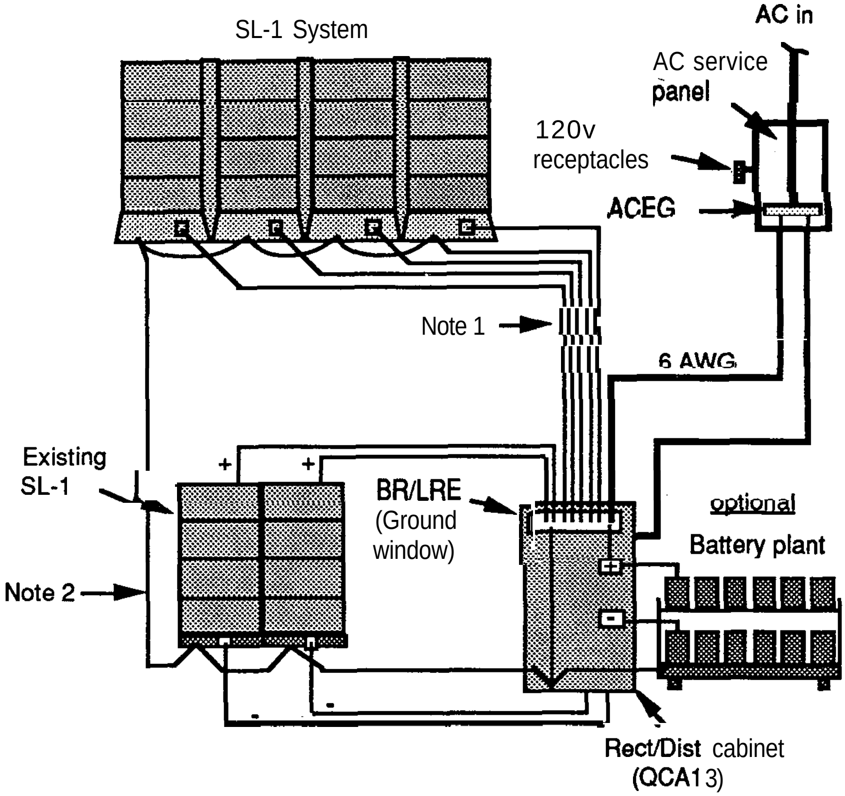
Figure 12
Multi-column distribution with QBL12 customer power



Note 1: This is a 3 conductor cable enclosed in conduit. BFi(+) and LR go to the QBL12 then go to a customer provided LRE. BAT(-) connects to the appropriate fuse in the QBL12.

Note 2: In the case of customer provided power, the SL-1 frame requires a direct connection to the ACEG. Additionally, the customer must make the connection between the positive bus bar and the ACEG.

Figure 13
Extended systems



Note 1: This is a 3 conductor cable enclosed in conduit. **BR(+)** and LR go to **LRE;** BAT(-) connects to the appropriate distribution fuse.
Note 2: May be run independently to ACEG.

System grounding

Proper grounding is essential to system operation. The SL-1 system requires a single-point ground. Proper grounding is required for trouble-free operation and for the safety of personnel. The DC resistance of the conductor joining the SL-1 system system ground reference to the main building ground should be as close to zero as possible. The maximum total resistance from an SL-1 System pedestal to the main building ground cannot exceed 0.5 ohms, The external earth ground should meet NEC/CEC requirements.

Lack of proper grounding can result in an installation that is not protected from lightning or power related faults and does not provide an optimum path for residual AC or DC currents. This may cause:

— Hazards for personnel working on or using the equipment

— Various service interruptions

— Excess noise on analog circuits

— High bit error rate on digital circuits

> ***Note:*** All voice and data lines leaving or entering the SL- 1 system which mn external to the building must have fault protectors that connect directly to earth ground. This is not the ground being discussed here.

Single Point Ground

This system does not, by design, require an isolated AC ground (IG) system (although local codes may require it). The system **does** require a single point ground (SPG) system. The SPG is needed because several conductors are used as returns. These include battery returns (BR) and logic returns (LR). Logic return is the name used to bring this particular return out of the pedestal. But, internally, several other internal ground returns (also called analog ground or talk battery return) are connected to the LR.

In its simplest form, the SPG may be the Isolated Ground (IG) bus or AC Equipment Ground (ACEG) bus in the AC panel. This can be implemented if:

— The electrical code allows isolated grounds (as per NEC 384-27 exception 1. in the USA).

— This ground bar located in the AC panel has sufficient terminal points.

— There is no non isolated communication links to existing PBX or other communication equipment.

Using an Isolated Ground bus is often a lower cost method but is not allowed by all telcos and may be prohibited by local ordinances. An alternate ground will be needed where an AC panel with an IG bus cannot be provided. When an alternate SPG is used or where there are too many return conductors to terminate on an IG bus in the AC panel, one or more ground collector nodes -- may be required. A grouping of like returns, prior to attaching to the SPG window is preferred to many long runs of smaller diameter cable. See "List of terms" for an explanation of these ground nodes.

LRE A Logic Return Equalizing bus (copper plate or bar) is needed on multi-column systems where the IG bus in the AC panel is:

— not being used because of local electrical code requirements

— too far removed from the pedestals being served

— too small (insufficient connection points)

— not expected to be the best ground available (for example, it is known to be noisy or there is a more direct ground connection)

When the LRE function is served by something like an ACIG bus or the LRE bus is also used to terminate system returns other than logic returns, there can be confusion over terms. In general, large spread out systems require a star-like ground system with local ground references like the LRE and ACIG coming together at a main ground window, while small systems tend to use a ground bar or plate for several purposes and it ends up taking on the name of it's primary function.

Additional requirements

The following must also be observed to implement the single-point ground concept:

— All ground conductors must be identified in accordance with local codes and terminated in a manner that is permanent, resulting in low impedance connections.

— Terminations should be accessible for inspection and maintenance during the life of the installation.

— All grounding conductors must be continuous with no splices or junctions and tagged, **"Do not remove or disconnect." They** should also be insulated against contact with foreign grounds.

— Grounding conductors must be no-load, noncurrent carrying cables under normal operating conditions.

— The use of building steel as part of the ground system (in the series path) is not recommended. However, in a steel-framed building, the SL-1 System main ground interface must be referenced to structural steel (either on the same floor or within one floor) in order to minimize lightning hazards.

Isolated ground topology

A dedicated Isolated Ground (IG) bus bar is required with this method. This IG bus is located in the ac panel and serves as the ground window. It is used for all AC (green wire) grounds as well as logic returns. It also accommodates a conductor which references to the (+) battery bus in a DC system. An alternate form of this isolated topology is to use one or more isolated equalizing bars external to the AC panel but which connect to ground exclusively through the AC IG bus.

Isolated orange outlets are required (as per NEC 250-74 exception 4). Grounding conductors shall be routed with the phase conductors (Article 300-20). All ground wiring for IG receptacles are to be terminated on the dedicated IG bus according to applicable codes (complies with NEC 384-27).

Non-isolated ground topology

In a non isolated system the AC equipment ground (ACEG) connects to the metal panel, and the associated conduit may also contact various structural metal. This ground alone is not adequate for the SL-1 system. A true SPG system will not be possible, but a dedicated ground conductor which connects to the main building ground is then used for the main ground window to terminate logic returns and reference the (+) battery bus. Frame grounds will connect to the ACEG.

Operating power requirements

Introduction

This section contains:

- power consumption data for both circuit packs and full modules
- guidelines and methods to help you determine total system power requirements, for both AC and DC systems

Circuit pack power consumption

The power consumption of all currently-supported peripheral equipment circuit cards is given in Tables 12 and 13.

All of the power data is stated in Watts for simplicity, with conversion to AC or DC current occurring only at the last step in the calculation. In addition, all of the stated numbers have *already* taken the average efficiency of the Module power converters into account.

The traffic assumptions used in these figures are 25% active (9 CCS) for digital and analog lines, and 100% active (36 CCS) for trunks. Note that the power consumption of digital line cards does not vary greatly with traffic, as it may with analog line cards.

Table 12
NT8D37 Intelligent peripheral equipment power consumption

Circuit pack	Typical power (Watts)
NT8D01 AC Controller-4	3 2
NT8D01AD Controller-2	32
NT8D02AA Digital LC	28
NT8D03AA Analog LC	20
NT8D09AA Analog/Msg Waiting LC	20
NT8D14AA Universal Trunk	36
NT8D15AA E&M Trunk	34
NT8D16AA Digitone Receiver	7

Table 13
NT8D13 Peripheral equipment power consumption

Circuit pack	Typical power (Watts)
QPC71 F	2.5
QPC192B	12.0
QPC250B	2.5
QPC297	7.1
QPC422A	10.9
QPC430E	14.8
QPC432C	10.2
QPC449D	15.6
QPC450E	7.0
QPC578D	24.6
QPC594D	32.8
QPC659C	40.4
QPC723A	14.8
QPC789A	26.4

Module power consumption

The typical and worst case power consumption data for each fully configured module are shown in Table 14.

The “typical power” data is generally adequate for use in system power engineering calculations, since it is representative of most systems with Modules fully loaded (configured) with cards, and under moderate traffic conditions.

The “maximum power” dam is shown for reference and planning purposes when needed, and was calculated for each module based on a fully-loaded card cage, in the worst-possible operational configuration (in terms of power consumption), with each card consuming typical power, plus 10% added margin. For example, the maximum power consumption for the NT8D37 Intelligent Peripheral Equipment Module was based on a configuration of sixteen NT8D14AA Universal Trunk cards, all under 100% traffic conditions, along with a Controller card and additional power margin.

Table 14
SL-1 System UEM power consumption

Module	Power consumptbn (Watts) Typical	Maximum
NT6D39 CPU/Network	400	420
NT6D44 Meridian Mail	400	450
NT8D11 Common/Peripheral Equip.	500	690
NT8D13 Peripheral Equipment	400	575
NT8D34 CPU	300	335
NT8D35 Network	300	325
NT8D36 Junctor	0	0
NT8D37 Peripheral Equipment	550	720
NT8D47 Remote Peripheral Equipment	300	350
Pedestal (Blowers)	50	80

System power calculation guidelines

The SL- 1 system was designed so that there would be no restrictions as a result of power or thermal limitations. In other words, any card can go in any slot, and all modules can be filled to capacity with any (logically) valid combination of cards, with no engineering rules.

Two system power calculation methods are shown below. For configuring rectifiers as well as configuring reserve power, it is recommended to use typical current drain values.

"Wired-for" method

This method is based simply on the number of modules and columns in the system, regardless of how many cards are initially equipped. This method will insure that the external power supply will have adequate capacity under all conditions and all possible growth scenarios within the modules installed.

Using Worksheet A, simply enter the quantity of each module, multiply by the power per module, and add up the total power. To calculate the current drain, divide by the nominal voltage. AC current is calculated by dividing 230 V ac nominal. DC current is calculated by dividing 52 V dc nominal. Both typical and maximum current may be calculated.

"As-equipped" method

This method provides a way to tailor the system power supply more closely to the actual power consumption of the system as installed. The method is to take the Common Equipment power consumption as a constant, then add the power consumption for the actual PE cards equipped (or planned) from Tables 12 and 13.

Using Worksheet B and C, enter the quantity of each circuit pack, multiply by the power per card, and add up the total power. Enter these numbers into Worksheet D, and follow the same steps used above. AC current is calculated by dividing 230 V ac nominal. DC current is calculated by dividing 52 V dc nominal. Both typical and maximum current may be calculated.

Notes on AC vs. DC systems

To calculate current drain at values other than the nominal values given in the worksheets, simply divide by the desired nominal value. For example, 208 V ac or 42 V dc.

For calculations normally done in apparent or complex power (such as AC wire and panel size, UPS rating for AC reserve power, etc.), simply divide the total real power (in Watts) by the typical system power factor of 0.6 to obtain the complex power (in VA).

Worksheet A
System power consumption - "Wired for"

Module	Qty	Typical Power =		Qty	Maximum x Power =	
NT6D39	______	x400=	______	______	x420=	______
NT6D44	______	x400=	______	______	x 450 =	______
NT8D11	______	x 500 =	______	______	x690=	______
NT8D13	______	x400=	______	______	x 575 =	______
NT8D34	______	x300=	______	______	x 335 =	______
NT8D35	______	x300=	______	______	x325=	______
NT8D37	______	x550=	______	______	x720=	______
NT8D47	______	x300=	______	______	x 350 =	______
Pedestals	______	x50=	______	______	x 80 =	______

Typical Power (Watts) = ______ Max. Power (Watts) = ______

AC System Current Drain (Amps ac)

Nominal: Typical Power / 230= ______ Max. Power / 230 = ______

DC System Current Drain (Amps dc)

Nominal: Typical Power / 52 = ______ Max. Power / 52 = ______

Worksheet B
NT8D13 Power calculation

Circuit Pack	Qty	x Power =	
QPC71F	______	x 2.5 =	______
QPC192B	______	x 12.0 =	______
QPC250B	______	x 2.5 =	______
QPC297	______	x 7.1 =	______
QPC422A	______	x 10.9 =	______
QPC430E	______	x 14.8 =	______
QPC432C	______	x 10.2 =	______
QPC449D	______	x 15.6 =	______
QPC450E	______	x 7.0 =	______
QPC578D	______	x 24.6 =	______
QPC594D	______	x 32.8 =	______
QPC659C	______	x 40.4 =	______
QPC723A	______	x 14.8 =	______
QPC789A	______	x 26.4 =	______

Total NT8D13 Power (Watts)= ______

Worksheet C
NT8D37 Power calculation

Circuit Pack	Qty	x Power =	
NT8D01AC	______	x 32 =	________
NT8D01AD	______	x 32 =	________
NT8D02AA	______	x 28 =	________
NT8D03AA	______	x 20 =	________
NT8D09AA	______	x 20 =	________
NT8D14AA	______	x 36 =	________
NT8D15AA	______	x 34 =	________
NT8D16AA	______	x 7 =	________

Total NT8D37 Power (Watts)= ________

Worksheet D
System Power Consumption - "As equipped"

Module	Qty	Typical Power =		Qty	Maximum x Power =	
NT6D39	______	x400=	________	______	x420=	________
NT6D44	______	x400=	________	______	x450=	________
NT8D11	______	x500=	________	______	x690=	________
NT8D13	(from Worksheet B) =		________	(from Worksheet B) =		________
NT8D34	______	x300=	________	______	x335=	________
NT8D35	______	x300=	________	______	x 325 =	________
NT8D37	(from Worksheet C) =		________	(from Worksheet C) =		________
NT8D47	______	x300=	________	______	x350=	________
Pedestals	______	x50=	________	______	x80=	________

Typical Power (Watts) = ________ Max. Power (Watts) = ________

AC System Current Drain (Amps ac)

Nominal: Typical Power / 230= ________ Max. Power / 230 = ________

DC System Current Drain (Amps dc)

Nominal: Typical Power / 52 = ________ Max. Power / 52 = ________

Upgrades to existing installations

Total power consumption of an installed system can be determined in several different ways. Two methods are listed below, in order of decreasing accuracy.

— Measure current drain for the complete installation over at least a two-week period under actual operating conditions. Determine peak current drain from these measurements.

— Measure idle (or near idle) current dram for the complete installation. Estimate peak current drain by multiplying the number of idle amperes by 1.5.

When adding or upgrading equipment, use either of these methods to determine existing current drain/power consumption. Use the guideline in this document to determine the added power consumption. The existing power plant may have to be replaced or its capacity increased to accommodate the additional power requirements. As always, be sure to provide sufficient capacity to accommodate planned growth of the SL-1 System.

Upgrades to existing systems may use either AC or DC equipment. Existing capacity, reserve power requirements, and available floor space are some of the factors to consider.

Thermal considerations

The maximum power dissipation in the form of heat for each UEM is listed in Table 15. These figures apply to both AC and DC powered systems. The power figures listed here are different than those shown in previous tables for system power consumption, since some of the power, especially for peripheral equipment, is distributed out to the loops and sets and is not dissipated within the UEM itself. Table 16 shows the maximum heat dissipation for some of the external DC power equipment supplied by Northern Telecom.

Table 15
SL-1 system heat dissipation

Module	Heat dissipation Watts	BTU/hr
NT8D11 Common/Peripheral Equipment	450	1530
NT6D39 CPU/Network	400	1360
NT8D34 CPU	300	1020
NT8D35 Network	300	1020
NT8D13 Peripheral Equipment	300	1020
NT8D37 Peripheral Equipment	425	1450
NT8D47 Remote Peripheral Equipment	300	1020
NT6D44 Meridian Mail	400	1369
NT8D36 Junctor	0	0

Note: Thermal load (BTU/hr) = Total power dissipation (Watts) x 3.4

Table 16
External power equipment heat dissipation

Equipment	Heat Dissipation Watts	BTU/hr
NT6D52AA 30A Rectifier	200	680
NT5C03 50A Rectifier	290	990

Note: Thermal load (BTU/hr) = Total power dissipation (Watts) x 3.4

Reserve power

Reserve power is available for both AC and DC systems. AC reserve power is provided by a separate Uninterruptible Power Supply (UPS), installed in series with the main system AC power feed. A UPS generally consists of a combination battery charger (AC-DC converter) and inverter (DC-AC converter), along with its associated batteries. The batteries may be internal or external to the UPS unit itself.

DC systems use the "traditional" telecommunications powering method of an external power plant consisting of rectifiers (AC-DC converters) continuously charging a bank of batteries, while the system power rails "float" in parallel on the battery voltage.

AC reserve power

There are a wide variety of UPS vendors and systems available. Some of the factors to consider when choosing a UPS are:

— Input and output voltage and frequency range

— Number and type of output receptacles

— Regulatory and safely agency approvals

— Efficiency, crest factor, and other performance considerations

— Alarm and status indications

— Battery recharge time

— Backup time required

-Existing batteries or other power equipment at the site

— Planned system growth

UPS sizing

Since power distribution for AC systems is provided on a per-column basis, partial system backup is available for all system options, thus reducing reserve power requirements. In other words, it is possible to back up all of the common equipment, but only a portion of the peripheral equipment, reducing both UPS and battery costs.

Even if it is desired to back up the entire system, the per-column powering allows the choice of provisioning one UPS per column, one UPS for the entire system (all columns), or any combination.

In order to determine the size of UPS needed, the total system (or column) power requirements are first determined as in the previous section "Operating power requirements." The real power in Watts (W) is then converted to complex or "apparent" power in Volt-Amps (VA) by dividing the real power by the typical system power factor of 0.6. The UPS is then sized in terms of its rating in VA (or kVA).

The sizing and provisioning of the UPS batteries will be determined by following the specific instructions provided by the manufacturer of the UPS that has been selected. The general approach, however, is to take the total system power in Watts, divide by the UPS inverter efficiency, and convert to battery current drain by dividing by the nominal discharge voltage of the battery string. The battery current drain is then multiplied by the time that is needed for the reserve power to operate to determine the battery requirements in Amp-hours (A-hrs).

Recommended UPS vendors and models

As of the publication date of this document, the following UPS systems have been tested by Northern Telecom and verified to work with the SL-1 system. These vendors and models meet high standards of both quality and functionality and are recommended to be used with the SL-1.

This list may change at any time in the future. Other UPS vendors may have products which work fine with SL-1 systems, and the vendors listed here may have other models and sizes that are also suitable. In particular, there are UPS systems larger than 10 kVA available that could be used with some of the larger system option 71 configurations.

Table 17
Verified UPS systems

Vendor	KVA Rating	Battery Voltage
Alpha Technologies	1	48
Alpha Technologies	1.5	48
Alpha Technologies	3	48
Best Power Technobgy	3	48
Best Power Technology	5	48
Exide Electronics	1.5	120
Exide Electronics	3	120
Exide Electronics	5	120
Exide Electronics	6	240
Exide Electronics	8	240
Exide Electronics	10	240

The UPS systems are available directly from the recommended vendors. For application assistance and direct sales information, the UPS vendor contacts in the U.S. are listed below:

Alpha Technologies, Inc.
3767 Alpha Way
Bellingham, WA 98225
(206) 647-2360
Fax: (206) 671-4936

Best Power Technology, Inc.
P.O. Box 280
Necedah, WI 54646
(608) 5657200
(800) 356-5794
Fax: (608) 565-2221

Exide Electronics
3201 Spring Forest Road
Raleigh, NC 27604
(9 19) 872-3020
Fax: (919) 878-1541

Alarm Monitoring

A UPS to System Monitor Alarm cable is available from Northern Telecom for **each** of the recommended UPS vendors. The alarm interface consists of an "inverter on" signal to indicate that the commercial power is down and the UPS is supplying power to the system, and a "summary alarm" signal from the UPS to indicate a fault or alarm condition. The cables are listed below:

Table 18
UPS to System Monitor Alarm cables

UPS vendor	NT part number
Alpha Technologies	NT8D46AU
Best Power Technology	NT8D46A.I
Exide Electronics	NT8D46AQ

Installation

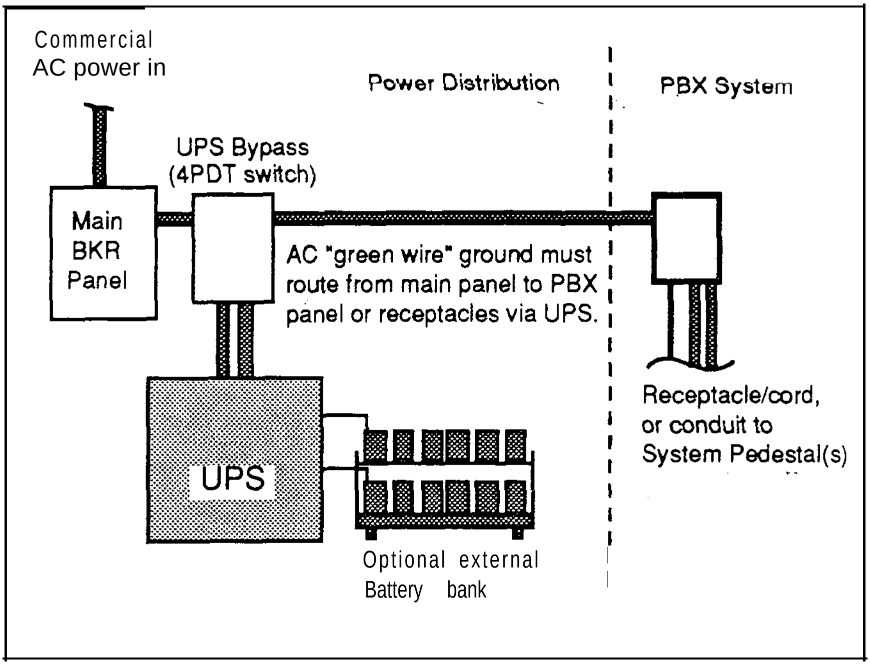
For UPS installation information, refer to the appropriate UPS vendor installation manual. It is recommended, however, that a UPS bypass switch be installed during the initial wiring if this switch function is not inherently a part of the UPS itself. The UPS bypass switch allows for the PBX to be run directly from commercial AC power while the UPS is taken off line during installation or service, or during battery maintenance.

CAUTION

Proper care must be taken when connecting the DC battery leads to the UPS. A battery reversal at the UPS can result in severe damage to the UPS.

A general block diagram of a UPS installation and associated wiring is shown in Figure 14.

Figure 14
AC reserve power configuration



DC reserve power

Reserve power for DC systems can be provided simply by adding batteries to the external distribution. The reserve battery capacity is determined by multiplying the system current drain by the time that is needed for the reserve power to operate. This will determine the total Ampere-Hour requirements of the batteries. Refer to Worksheets A through D.

The following guidelines should be used in determining DC reserve power requirements.

Current required

When considering battery backup you should know with reasonable accuracy the total system power requirement.

For new installations, Northern Telecom provides the operating company with data listing the total current drain for each configured system. A rectifier and distribution panel which has the capacity to meet these current drain figures, and some added capacity to charge batteries can then be selected. For existing installations, the total current dram of an installed system can be calculated in several ways. Refer to "Operating power requirements" for more information.

The amount of reserve battery capacity depends on the system line size (load), the time the reserve supply must last in the event of power failure, and the battery end voltage.

Batteries

Reserve batteries for a DC powered SL- 1 system must meet the following requirements as defined in Table 19.

Table 19
Battery requirements

	Float voltage (V)		Equalize voltage (V)	
Battery configuration	**cell**	**String**	**cell**	**String**
24 stationary cells	-2.17	-52.08	-2.25	-54.08
23 sealed cells	-2.25	-51.75	-2.35	-54.05
24 sealed cells	-2.25	-54.00	-2.35	-56.40

The float and equalization voltages defined in Table 19 are not an exact requirement as long as voltages do not exceed -56.5 V. See Table 7 in "DC power description."

Not all sealed cells require equalization, but the equalization voltage can be used for fast charging.

Batteries to be used with the SL-1 should be sized by using an end voltage of 44 V.

The noise limitations for a battery string are:

— 20 mV rms maximum ripple

— 32 dBrnC maximum noise

End cells and CEMF cells are not recommended because they are a noise source.

Other considerations

-Planned growth

— Backup time required

— Existing power system capability

— Space and thermal conditions

— Other equipment, lights, alarm systems

Engineering and configuration guidelines

Configuring the Meridian 1 power system requires attention to the following points:

- Both AC and DC-powering are available.
- The AC power supply or DC-DC Converter that is used in a particular module is virtually identical as far as external configuration purposes are concerned.
- Equipment Module power and cooling criteria are also the same for both AC and DC.
- A wide variety of Uninterruptible Power Supply (UPS) systems are available for AC-powered Meridian 1 systems that require reserve power.
- AC-powered systems, suited for those applications that do not need reserve power, require no external power components and connect directly to utility power.
- All DC systems can be configured as complete systems, with rectifiers provided by Northern Telecom. They can also be configured to connect to customer-provided external power.

AC and DC powering schemes differ primarily in the external power components (external, that is, to the Equipment Modules themselves).

The choice of which powering scheme to use is determined mainly by reserve power requirements and preferences, and by the existing power equipment at the site.

AC power architecture

The internal AC power system consists of the following main elements:

- Pedestal Power Distribution Unit (PDU)
- Module Power Distribution Unit (MPDU)
- AC Power Supplies

No arbitrary selection of these components is required — they are included automatically in the System functional determination process.

There are three different AC power supplies that provide power to all of the common equipment, peripheral equipment, and combined common/peripheral equipment modules, as well as a ringing generator that provides AC ringing (and message waiting lamp voltages) when required for the peripheral equipment modules.

No additional external power components are required for AC-powered systems. Reserve power, if needed, is accomplished through the use of an external Uninterruptible Power Supply (UPS).

Internal AC power equipment components

The following components are required to configure and AC powered system.

Common Equipment Power Supply AC (NT8D29AA)

The Common Equipment Power Supply AC is used in the Common Equipment modules in AC systems. It is located in the first slot on the left in the module labeled "CE Pwr Sup," and converts 208/240 V ac to +5 V and ±12 V dc, to provide all required voltages for CE and network circuit cards.

Configuration guidelines One Common Equipment Power Supply AC is used in each of the following AC modules:

- CPU Module (NT8D34AA)
- Network Module (NT8D35AA)
- CPU/Network Module (NT6D39AA)

Peripheral Equipment Power Supply AC (NT8D06AA)

The Peripheral Equipment Power Supply AC is used to provide power to all peripheral equipment modules in AC systems. It converts 208/240 V ac to +5 V, +8.5 V, ±10 V, ±15 V, and -48 V dc voltages used to power peripheral equipment logic cards and to supply "talk battery" to lines and trunks. This power supply is located in the far left hand card slot labeled "PE Pwr Sup."

Configuration guidelines One Peripheral Equipment Power Supply AC is used in each of the following AC modules:

- Intelligent Peripheral Equipment Module (NT8D37AA)
- Peripheral Equipment Module (NT8D13AA)

Common/Peripheral Equipment Power Supply AC (NT7D14AA)

The Common/Peripheral Equipment Power Supply AC converts 208/240 V ac to +5 V, +8.5 V, ±15 V, ±12 V, -48 V, -150 V dc, and 86 V ac/20 Hz ringing voltages used to power peripheral and common equipment, supply talk battery, and light Message Waiting lamps on 500/2500 sets. It is located in the left of the Module in the slot labelled "CE/PE Pwr sup."

Configuration guidelines One Common/Peripheral Equipment Power Supply AC is used in each of the following AC modules:

- Common/Peripheral Equipment Module (NT8D11AB or NT8D11AC)
- Remote Peripheral Equipment Module (NT8D47AA)

Ringing Generator AC (NT8D21AA)

The AC Ringing Generator AC operates from a nominal 208/240 V ac input and provides selectable AC ringing voltage outputs superimposed on -48 V dc. The frequency and voltage options are 70 V ac at 25/50 Hz, 80 V ac at 25/50 Hz, and 86 V ac at 20/25. It also supplies -150 V dc message waiting lamp 500/2500 set applications. The Ringing Generator mounts in the PE modules to the right of the Peripheral Equipment Power Supply.

Configuration guidelines One Ringing Generator AC is used in each of the following, when these AC modules support 500- or 2500-type analog sets:

- Intelligent Peripheral Equipment Module (NT8D37AA)
- Peripheral Equipment Module (NT8D13AA)

Pedestal (NT8D27AB)

The Pedestal supports the column of Equipment Modules, and houses the Power Distribution Unit, the Blower Unit, and a reusable dust filter.

The Field Wiring Terminal Block is mounted in the bottom of the Pedestal.

Configuration guidelines

— One per column in AC systems

— The Field Wiring Terminal Block is factory wired with the following straps:

- LRTN - FGND

Power Distribution Unit (NT8D53AB)

The AC Power Distribution Unit (PDU) distributes power to the entire column. It is located in the rear of the pedestal. It houses a main circuit breaker and the System Monitor.

Configuration guidelines One per Pedestal/column in AC systems

Module Power Distribution Unit (NT8D56AA)

The NT8D56AA Module Power Distribution Unit (MPDU) protects the power supply and distributes power within a module. It houses a single breaker and is used in conjunction with the NT8D29AA Common Equipment Power Supply AC.

Configuration guidelines One per Module in AC systems

Module Power Distribution Unit (NT8D56AB)

The NT8D56AB MPDU protects the power supply and distributes power within a module. It houses a single breaker and is used in conjunction with the NT7D14 Common/Peripheral Equipment Power Supply AC.

Configuration guidelines One per Module in AC systems

Module Power Distribution Unit (NT8D57AA)

The NT8D57AA MPDU protects the power supply and distributes power within a module. It houses a dual breaker and is used in conjunction with the NT8D06AA PE Power Supply AC and the NT8D21AA Ring Generator AC.

Configuration guidelines One per Module in AC systems

DC power architecture

The internal DC power system consists of the following main elements:

— Pedestal Power Distribution Unit (PDU)

— DC Power Converters

Like AC **systems,** there are three different DC power converters that provide power to all of the common equipment, peripheral equipment, and combined common/peripheral equipment Modules, as well as a ringing generator that provides AC ringing (and message waiting lamp voltages) when required for the peripheral equipment modules.

The external portion of DC-powered systems is generally referred to as the power plant, and mainly consists of the rectifiers and distribution equipment, as well as reserve batteries if required. For system options 21, 51, and 61, Northern Telecom offers a power plant based on the NT6D52AA Rectifier, with an output capacity of 30A per rectifier, along with a rectifier/battery connection and distribution box (QBL15). For system option 71, Northern Telecom offers the QCA13 power plant based on the NT5C03BJ Rectifier, with an output capacity of 50A per rectifier, with a total system capacity of 500A.

Customer-provided power is an option for all Meridian 1 systems. The QBL12 Battery Distribution Box is available to connect a wide variety of customer-provided power equipment to the system.

internal DC power equipment components.

The following components are required to configure and DC powered system.

Common Equipment Power Supply DC (NT6D41 AA)

The Common Equipment Power Supply DC is used in the common equipment Modules in DC systems. It is located in the first slot on the left in the module labeled "CE Pwr Sup," and converts -48 V dc to +5 V and ±12 V dc, to provide all required voltages for CE and network circuit cards.

Configuration guidelines One Common Equipment Power Supply DC is used in each of the following DC modules:

- CPU Module (NT8D34DC)
- Network Module (NT8D35DC)
- CPU/Network Module (NT6D39DC)

Peripheral Equipment Power Supply DC (NT6D40AA)

The Peripheral Equipment Power Supply DC is used to provide power to all peripheral equipment Modules in DC systems. It converts -48 V dc to +5 V, +8.5 V, ±10 V, ±15 V, and -48 V dc voltages used to power peripheral equipment logic cards and to supply "talk battery" to lines and trunks. This power supply is located in the far left hand card slot labeled "PE Pwr Sup".

Configuration guidelines One Peripheral Equipment Power Supply DC is used in each of the following DC modules:

- Intelligent Peripheral Equipment Module (NT8D37DC)
- Peripheral Equipment Module (NT8D13DC)

Common/Peripheral Equipment Power Supply DC (NT7D04AA)

The Common/Peripheral Equipment Power Supply DC converts 48 V dc to +5 V, +8.5 V, ±15 V, ±12 V, -48 V, and -150 V dc voltages used to power peripheral and common equipment, supply talk battery, and light Message Waiting lamps on 500/2500 sets. The supply provides the following selectable ringing voltage options: 70/80/86 V ac at 20/25/50 Hz. It is located in the left of the Module in the slot labelled CE/PE Pwr Sup.

Configuration guidelines One Common/Peripheral Equipment Power Supply DC is used in each of the following DC Modules:

— Common/Peripheral Equipment Module (NT8D11DC)

— Remote Peripheral Equipment Module (NT8D47DC)

Ringing Generator DC (NT7D03AA)

The AC Ringing Generator DC operates from a nominal -48 V dc input and provides selectable AC ringing voltage outputs superimposed on -48 V dc. The frequency and voltage options are 20/25/50 Hz and 70/80/86 V ac. It also supplies -150 V dc message waiting lamp 50012500 set applications. The Ringing Generator mounts in the PE modules to the right of the Peripheral Equipment Power Supply.

Configuration guidelines One Ringing Generator DC is used in each of the following, when these DC Modules support 500- or 2500-type analog sets:

— Intelligent Peripheral Equipment Module (NT8D37DC)

— Peripheral Equipment Module (NT8D13DC)

Pedestal (NT7D09AA)

The Pedestal supports the column of equipment modules, and houses the Power Distribution Unit, the Blower Unit, and a reusable dust filter.

The Field Wiring Terminal Block is mounted in the bottom of the Pedestal.

Configuration guidelines One per column in DC systems

Power Distribution Unit (NT7D10AA)

The DC Power Distribution Unit (PDU) distributes power to the entire column. It is located in the rear of the pedestal. It houses five circuit breakers (one for each module and one for the Blower Unit) and the System Monitor.

Configuration guidelines One per pedestal/column in DC systems

Module Power Distribution Unit

Not applicable to DC systems.

External DC Power equipment components

The following components are required to configure DC powered system.

Switched Mode Rectifier -48V/30A (NT6D52AA)

Converts 208/240 V ac (nominal) to -48 V dc (nominal), with a 30A output. **Connects** to the system through the QBL15 Battery Distribution Box. Based on QRF12.

Configuration guidelines System options 21/51/61 (DC versions). Generally one rectifier per every two fully loaded modules. Exact quantity depends on system configuration and power requirements.

Rectifier Rack Assembly (NT7D12AA)

This is a 19-inch open relay rack which is approximately 4'6" feet high. **It** supports up to three NT6D52AA Rectifiers.

Configuration guidelines System options 21/51/61 (DC versions). One rack per every three NT6D52AA Rectifiers, up to a maximum of two racks per system.

Rectifier Baffle/Mounting Kit (NT7D1201)

The Rectifier Baffle/Mounting Kit consists of a set of support brackets for mounting the NT6D52AA Rectifier to to NT7D12AA Rack, together with a heat baffle plate. The baffle directs exhaust air from the lower rectifier away from the inlet to the upper rectifier, thereby allowing cooling by natural convection.

Configuration guidelines System options 21/51/61 (DC versions). One per NT6D52AA Rectifier.

Battery Distribution Box (QBL15)

Allows the parallel connection of up to three NT6D52AA rectifiers, for connection to the SL-1 System and to reserve batteries. Includes main fuses, diode blocking, test points, QPC188 battery monitor card, and sense lead fusing on connections from each rectifier.

Configuration guidelines System options 21/51/61 (DC versions). One per every three NT6D52AA Rectifiers, up to a maximum of two Battery Distribution Boxes per system.

Battery Distribution Box (QBL12)

Connects customer-provided power equipment and batteries to the SL-1 System. Allows connection of up to 24 modules.

Configuration guidelines System option 71 (DC versions). Generally one per system.

DC Power Plant (QCA1 3)

Consists of a primary power cabinet with fusing and distribution hardware, monitoring and control, and up to four NT5C03 50A rectifiers. Up to two supplemental cabinets can be added, with up to four rectifiers in the first supplemental cabinet and up to two rectifiers in the second cabinet, for a total of 10 rectifiers and a total system capacity of 500A. (This power system is also referred to as the J2412 power plant; QCA13 is actually the cabinet designation, but is the more commonly used name.)

Configuration guidelines Used with system option 71 (DC version). Quantity as required by system power **consumptioti.**

Switched Mode Rectifier - 48V/50A (NT5C03BJ)

This is a solid **state, switched-mode** rectifier. Converts 208/240 V ac (nominal) to -48 V dc (nominal), with a 50A output. Used in the QCA13 power plant, with up to ten rectifiers in parallel.

Configuration guidelines Used with system option 71 (DC version). Quantity as required by system power consumption.

Commercial power and grounding requirements

Commercial power source The commercial power source refers to the main AC utility power feed, for either AC-powered or DC powered systems. For AC systems, this power is wired directly to the system. For DC systems, this power source would connect to the rectifiers, which would convert to -48V dc for distribution to the system.

In North America, the power supplied can be either 208Y or 240 V ac nominal. Three phase is not required but single power feeds from alternate phases would be normal practice where three phase power is available. The following Table shows the exact input voltage range:

Table 19
AC power ranges

Input	Minimum	Nominal	Maximum
Voltage (V ac) at pedestal	180	208/240	250
Frequency (Hz)	47	50/60	63

All power feeds used should contain a separate safety conductor (green wire). Northern Telecom strongly recommends that the supply conductors be dedicated and uninterrupted from a building primary source to a dedicated equipment room sub-panel.

Power sub-panel Power sub-panels must meet the following requirements or be modified when used for the Meridian 1:

— Panels should be located in the equipment room.

— No lighting, air conditioning, heating, generators or motors shall be serviced from this equipment room panel.

— In areas where isolated ground systems are permissible, this panel will provide sufficient ground connection points on the isolated ground plate or bar to handle the AC circuit grounds as well as the other ground reference conductors associated with the Meridian 1.

Service receptacles One dedicated outlet per pedestal (column) is a typical requirement for AC systems that are cord connected. For DC systems, or if reserve power is being used, the receptacles or conduit will serve the centralized rectifiers cr UPS system directly, with power then routing to the columns.

Unless otherwise specified, these circuits should be rated for 30 Amps. All circuits must be:

— Wired and fused independently of all receptacles.

— Tagged at the power panel to prevent unauthorized interruption of power.

— Not controlled by a switch

The NEMA receptacle types are as follows:

— Isolated Ground systems: IG-L6-30

— Non-Isolated Ground systems: L6-30

System grounding requirements Proper grounding is essential to trouble-free system operation and the safety of personnel. The Meridian 1 has several different grounds and signal returns that are generally referred to as grounds: logic return, battery return (for DC systems), AC “green wire” ground (in AC systems), and the personal hazard equipment ground.

The Meridian 1 does not, by design, need an AC Isolated Ground (IG) system (though this may be required by local codes), but it does need a single point ground system. This means that each of the various grounds, from each of the columns, should terminate at a single connection point before attaching to the actual ground reference at the main AC panel or transformer. The single-point ground may be implemented either by the use of the Isolated Ground bus in the AC panel, or by a separate logic return equalizing bus for battery returns, frame grounds, and logic returns where a non-isolated AC system is used.

The following must also be-observed to implement the single-point ground:

- All ground conductors must conform to local codes and terminate in a manner that is permanent, resulting in low impedance connections.
- All terminations should be accessible for inspection and maintenance.
- All grounding conductors must be continuous with no splices or junctions and tagged "WARNING - Ground Connection - Do not remove or disconnect."
- Conductors should be insulated against contact with foreign grounds.
- Grounding conductors must be no-load, non-current carrying cables under normal operating conditions.
- The use of building steel as part of the ground system is not recommended.

The DC resistance of the system ground reference wire from the I to the building ground should be as close to zero as possible with the maximum total resistance on all runs, within the building, not to exceed 0.5 ohms. The insulated grounding wire size shall conform to the National Electric Code (NEC) 250-294, 250-295 and sections 310-316 (equivalent CSA requirements when used in Canada).

Power conductors

Wire size calculation guidelines

Determining wire gauges to connect a pedestal to a rectifier or other external distribution hardware is a very simple procedure, but it can be tedious if a lot of external components are involved. A programmable calculator or computer can help if it is going to be done often.

> **CAUTION**
> **Do not over engineer the job!**
> Too many wire gauges delivered to a site can cost more money than **what will be saved in copper.**

The method

Using the maximum **current** in a conductor, determine the **length** that the conductor must be (remember that the vertical portions are sometimes longer than the horizontal portion) in order to meet the required maximum **voltage drop.**

The formula

The following formula may be used to calculate the minimum wire size in Circular Mils (CM) required to connect any two points knowing current, distance and the desired drop for a specific cable:

$$CM = 11.1 \times I \times D/V$$

where: CM = wire size required in Circular Mils

I = current in amps (use the maximum expected)

D = distance in feet

V = Allowable voltage drop.

Typical wire values

The following are typical values for circular mils and nominal maximum current for some of the more common wire sizes.

Table 20
Wire characteristics

Wire gauge	CircMils	A max
4	41,750	90
6	26,250	65
8	16,510	50
10	10,380	35
12	6,530	25

Note: Maximum amperage is affected by many factors induding temperature and insulation. Consult a wire handbook for precise tables.

Table 21
Maximum allowable voltage drops

Conductor	From	To	V drop
- BAT	Pedestal	Dist. DisChg	1.0
+ BR	Pedestal	Dist. Corn	1.0
-BAT	Dist.	(-) Battery term	0.25
+ BR	Dist.	(+) Battery term	0.25
-BAT	Rectifier	Dist. Chg	0.5
+ BR	Rectifier	Dist. Corn	0.5

Mote 1: Dist. is an abbreviation for Battery Distribution Box (i.e. QBL15, CtBLl2).

CAUTION

Although 0.25/0.5/1.0 volts is the maximum drop allowed, the insulation and temperature rating vs current will often dictate a wire size that will create smaller voltage drops on short lengths. After using the formula, consult wire tables to ensure that the temperature rise is acceptable.

Examples

The following three examples show how to make wire size calculations.

1. A Bat or BR conductor from the QBL15 to a pedestal is 18 feet long and must carry a maximum of 36 Amps:

   Using CM= 11.1 x Ix D/V CM = 11.1 x 36 x 18/0.5 = 14385.6

   Choosing a standard gauge equal to or larger than this will mean 8 AWG which has a cross section of 16510 CM.

   Up to 40 amps is allowable with 8 AWG even when the insulation is rated only 20 degrees C above the expected maximum ambient temperature.

2. A Bat or BR conductor from the QBL15 to the Battery is 25 feet long and must carry a maximum of 70 Amps:

Using CM= 11.1 x Ix D/V CM = 11.1.x 70 x 25/0.5 = 38850

Choosing a standard gauge equal to or larger than this will mean 4 AWG which has a cross section of 41740 CM.

3. Example of the "Caution Note" for short distances - a Bat or BR conductor from the QBL15 to the Rectifier is only 4 feet long and must carry a maximum of 25 Amps:

Using CM= 11.1 x Ix D/V CM= 11.1 x 25 x 4/0.5 = 2220

Choosing a standard gauge equal to or larger than this will mean 16 AWG which has a cross section of 2600 CM.

But, 16 AWG is nominally rated for only 13 Amps. In this case, 12 AWG which is rated at 25 Amps (but with only a 0.17 V drop over the 4 feet) is required.

Sense lead wire size

The loop resistance of the wire used to connect the ± Sense terminals to the TBC of the QBL12 to the ± terminals of the customer-provided batteries must not exceed 2.5 ohms.

Simplified chart

Table 22 provides a simple means for determining the wire size between the distribution box and the pedestal.

Table 22 takes into account the two constraints of wiring into the pedestal.

- The loop voltage drop from the distribution point to the pedestal cannot exceed 2 V.
- The five wires (two BAT/BR pairs plus a logic return) must physically fit inside a 3/4 inch conduit.

Additionally, the table assumes that the worst case current drain does not exceed 60 Amps per column. Other wire gauges can/should be used if the column draws more or less than 60 Amps. Consult a wire handbook for precise calculations.

There are four options available for bringing wire into the pedestal:

Single conduit One 3/4 inch conduit access.

Dual conduit Two 3/4 inch conduit accesses.

Junction box (single 4 AWG) A junction box can be used to interface to one of the 3/4 inch conduit access points in the pedestal. Single runs of #4 AWG per feed are used between the junction box and the distribution point.

Junction box (double 4 AWG) This is the same as the case above, but double runs of #4 AWG per feed are used between the junction box and the distribution point.

Table 22
Pedestal wire guage requirements with two 30 A feeds (five'wiresj

Length	Wire AWG			
	Single conduit	Dual conduit	Junction box with single #4 AWG*	Junction box with double #4 AWG*
	8	6	4	4
0 - 10 ft	Yes	Yes	Yes	Yes
0-20ft	Yes	Yes	Yes	Yes
o-3oft	Yes	Yes	Yes	Yes
0 - 40 ft	Yes	Yes	Yes	Yes
0 - 50 ft	Yes	Yes	Yes	Yes
0-60ft	No	Yes	Yes	Yes
0 - 70 ft	No	Yes	Yes	Yes
0-80ft	No	Yes	Yes	Yes
0 - 90 ft	No	No	Yes	Yes
0 - 100 ft	No	No	Yes	Yes
0 - 200 ft	No	No	No	Yes
200 + ft	No	No	No	No

Note 1: Two 30 A feeds are typically adequate for a full column of 4 modules (two 30 A feed pairs plus Logic return).

Note 2: When using dual conduit, the wires must be run in BAT/BR pairs. One pair in one conduit and one pair plus LRTN in the other conduit.

• A single or double run of 4 AWG wire from the distribution point to a junction box near the pedestal. 10 AWG wire is run from the junction box into the pedestal PDU terminal board.

Legend: Yes = Wire size is adequate for the distance.
No = Wire size has too high a voltage drop and is inadequate for the distance.

List of terms

AC	Alternating Current
ACEG	AC Equipment Ground
AWG	American Wire Gauge
BAT	Battery
BR	Battery Return
bkr	breaker (abbreviation)
BRTN	Battery Return
CE	Common Equipment
CEC	Canadian Electrical Code
ckt	circuit (abbreviation)
CPC	Common Product Code
CSA	Canadian Standards Association
DC	Direct Current
DisChg	Discharge
EPE	Existing PE
FGND	Frame Ground

HZ	Hertz (cycles per second)
IG	Isolated Ground
inverter	DC to AC converter
LR	Logic Return
LRE	Logic Return Equalizer
MPDU	Module (UEM) Power Distribution Unit
mS	millisecond
NEC	National Electrical Code (USA)
PBX	Private Branch Exchange
Pcord	Power Cord (abbreviation)
PDU	Power Distribution Unit (in pedestal)
PE	Peripheral Equipment (line card equipment)
PEC	Product Engineering Code
PFTU	Power Fail Transfer Unit
Pwr	Power (abbreviation)
QBL12	75 Amp external power distribution unit
QBL15	150 Amp external power distribution unit
QCA13	50 - 200 Amp rectifier/distribution (cabinet]
QRF12	25 Amp rectifier
RPE	Remotely located PE
SPG	Single Point Ground
telco	telephone company (abbreviation)

UEM	Universal Equipment Module
UL	Underwriters Laboratories
UPS	Uninterruptible Power System
VAC,Vac	Volts AC
VDC.Vdc	Volts DC
Vpk	Volts peak

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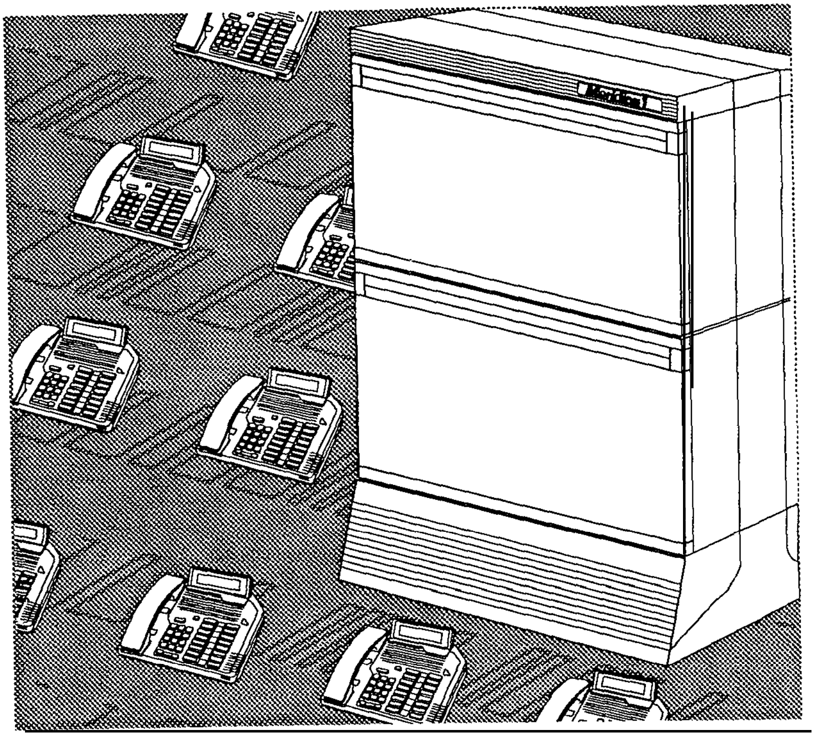
Standard



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Meridian 1
Communication Systems

SL-1

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Spares planning

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About this document

General information

The Spares planning guide provides all the information necessary for the calculation and planning of spares (replaceable) items and provides failure rates for the SL-1 hardware.

The success of a maintenance program depends largely on the availability of an adequate stock of replaceable items. To ease maintenance and system reliability, follow the procedures given here for calculating spares stocks.

Spares requirements can be calculated to service SL-1 systems from a single depot (repair house) or a centralized depot serving subdepots. Read on for more information.

This document has been updated to include new naming conventions. Since the SL-1 is available in both AC and DC versions, the Product Engineering Code (PEC) is given, in some cases, for both AC and DC power options. The failure rates of some items may not appear in this release.

> Note: Running the SL-1 system at lower temperature levels will increase the life expectancy of the components and improve overall system reliability.

References

See the SL-1 planning & engineering guide for

— ***Muster index*** (553-3001-000)

— ***System overview*** (553-3001-100)

— ***Installation planning*** (553-3001-120)

- *System engineering* (553-3001-151)
- *Power engineering* (553-3001-152)
- *Sparesplanning* (553-3001-153)
- *Equipment identification and ordering* (553-3001-154)

See the list of line and trunk circuit descriptions in ***the Master index*** **(553-3001-000)** for specific references to lines and trunks.

See the SL-1 installation and maintenance guide for

- *System installation procedures* (553-3001-210)
- *Circuit pack installation and testing* (553-3001-211)
- *Installation procedures for telephone sets and attendant consoles* (553-2201-215)
- *Extended systems installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-251)
- *General maintenance information* (553-3001-500)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

See the SL-1 XII software guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- *X11 software management* (553-3001-300)
- *X11* features ***and services*** (553-3001-305)

See the SL-1 X11 input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Contents

Spares planning

Definitions and assumptions

Failure rate-Failure rate equals the estimated number of failures for that item during one million (10^6) hours of operation. The only exception is to measurements for cabling or other items with low failure rates. Rates are also measured in Failures in Time (FIT) measurements. One FIT equals one billion (10^9) hours of operation.

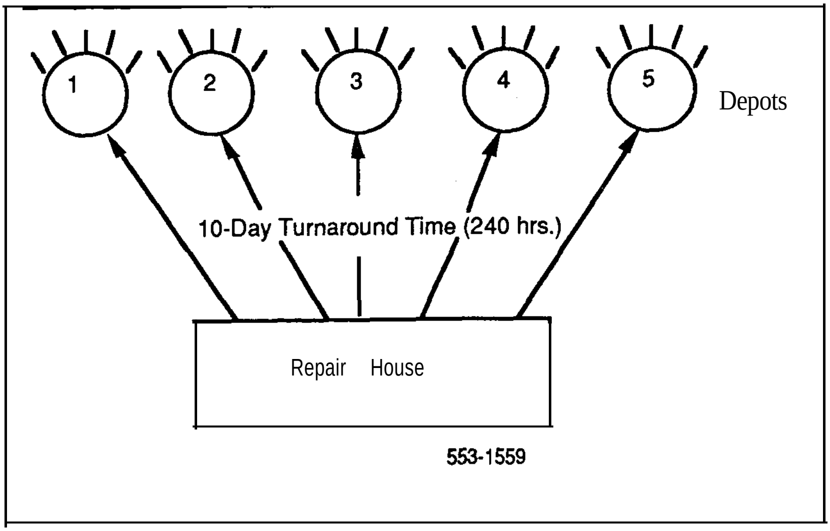
Sparing interval-The sparing interval is the period of time that stocks of replaceable items should last without being replenished. This period is assumed to be one year following the installation of the system.

Stock confidence level-The stock confidence level is the allowed probability of not being out of stock when the sparing interval of one year is greater than 99.9 percent.

Pack ambient temperature-The pack ambient temperature is the average temperature of the air immediately surrounding the circuit pack (usually higher than the ambient room temperature). Pack failure rates in this document are based on a pack ambient temperature of 40° C.

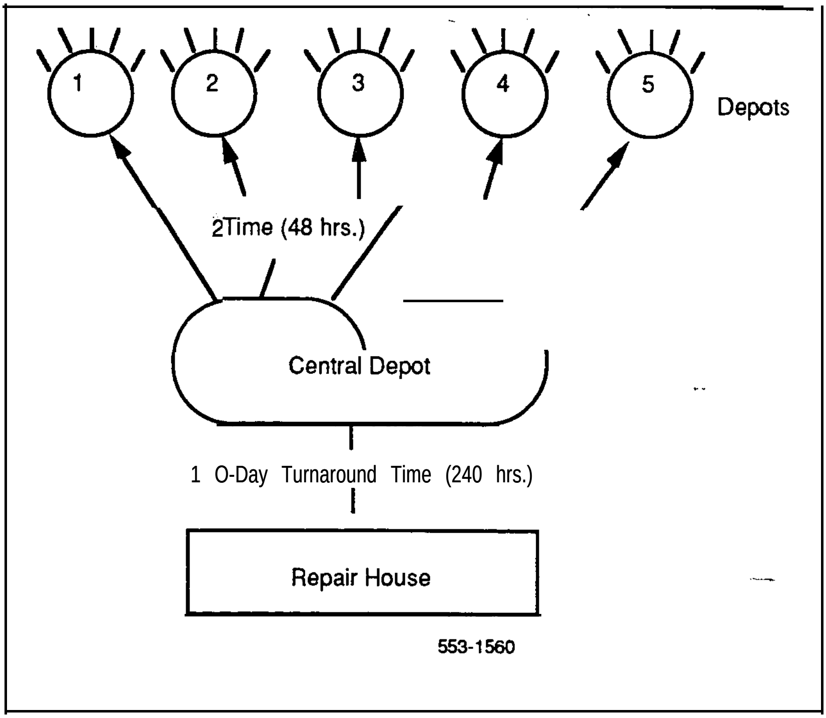
Turnaround time for rep&r-The turnaround time for the return to stock of a failed item is about 10 working days (240 hours) from a repair house. (See Figure 1.)

Figure 1
Single depot or repair house service



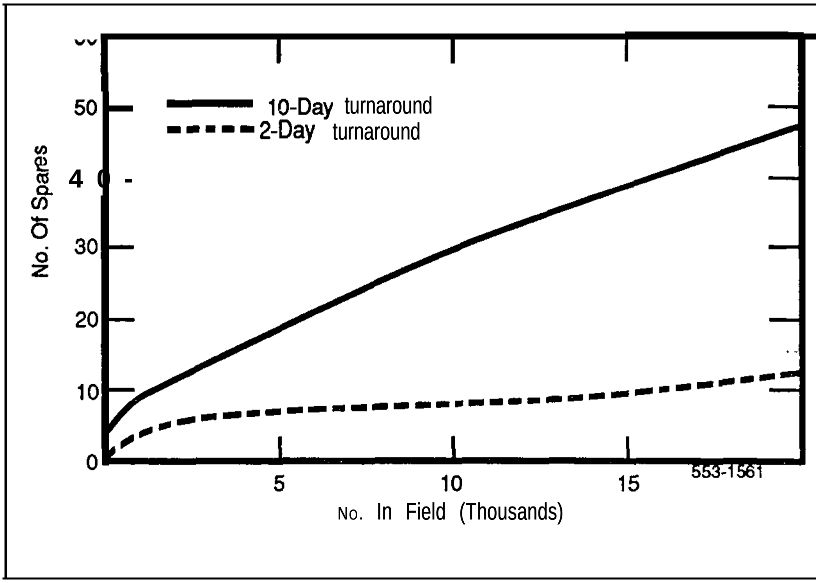
The turnaround time for the return to stock of a failed item is about two days from a centralized depot, (See Figure 2.)

Figure 2
Centralized depot service



Actual turnaround periods Will vary in the field. As the number of systems served increases, the percentage of replaceable items required for stock is reduced. (See Figure **3.)**

Figure 3
Effect of turnaround on spares stock



Population range-Population range is the quantity of each type of SL-1 switch in the area served by the depot.

Spare stock size-The quantity of spares for a given stock item depends on the sparing interval, stock confidence level, failure rate, turnaround time for repair, and population range.

Calculating spares requirements

Replaceable items and their associated failure rates are listed in this document. Quantities of spares required to stock a depot for the one-year sparing interval can be calculated by following the procedures. Table 1 translates the NFT values to the number of spares required for that item. The following values are used:

N-The number of a spares item in use.

F-The failure rate for a particular spares item.

T-The turnaround time for repairing a failed spares item in hours.

Procedure 1 explains how to calculate the quantities of spares required to stock a depot for the one-year sparing interval:

Procedure 1
Determining spares quantities to stock a depot for the one-year sparing interval

1 Determine the number (N) of in-service specified circuit packs serviced by the depot.

2 Determine the pack failure rate (F) for the specified circuit pack in the Spares planning guide. (See Note 1 below.)

3 Determine turnaround time (T) in hours. (See Note 2 below.)

4 Calculate the NFT value by multiplying N x F x T.

5 Determine the number of spares required by using the NFT values in Table 4.

Note *1:* Pack failure rates are expressed in terms of the number of failures per million hours.

Note 2: For a single depot or repair house service, turnaround time is typically 10 working days or 240 hours. For a centralized depot service, it is typically two days or 48 hours.

For example:

A single depot services 10,000 Peripheral Equipment Power Supply (PE Pwr Sup) (AC-NT8D06AA) (DC-NT6D41AB) packs. From the failure rates listed in Table 2, the failure rate for this pack is 1.84 failures per one million hours. If the turnaround time for a single depot is 48 hours, then:

$$NFT = 10{,}000 \times \frac{1.84}{1{,}000{,}000} \times 48 = 0.8832$$

From the NFT values in Table 1, the number of spares required for NFT value 0.8832 = 6. See Table 1.

Tables: NFT values

Table 1
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
0	0.0010	1	6.37	6.99	17
0.0010	0.0452	2	6.99	7.62	18
0.0452	0.1890	3	7.62	8.26	19
0.189	0.425	4	8.26	8.91	20
0.425	0.734	5	8.91	9.57	21
0.734	1.090	6	9.57	10.20	22
1.09	1.50	7	10.2	10.90	23
1.50	1.95	8	10.9	11.50	24
1.95	2.43	9	11.5	12.20	25
2.43	2.94	10	12.2	12.90	26
2.94	3.46	11	12.9	13.60	27
3.46	4.01	12	13.6	14.30	28
4.01	4.58	13	14.3	15.00	29
4.58	5.16	14	15.0	15.80	30
5.16	5.76	15	15.8	16.50	31
5.76	6.37	16	16.5	17.20	32

-continued-

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
17.2	17.9	33	29.2	30.0	49
17.9	18.7	34	30.0	30.8	50
18.7	19.4	35	30.8	31.6	51
19.4	20.1	36	31.6	32.4	52
20.1	20.9	37	32.4	33.2	53
20.9	21.6	38	33.2	33.9	54
21.6	22.4	39	33.9	34.7	55
22.4	23.1	40	34.7	35.5	56
23.1	23.9	41	35.5	36.3	57
23.9	24.6	42	36.3	37.1	58
24.6	25.4	43	37.1	37.9	59
25.4	26.2	44	37.9	38.7	60
26.2	26.9	45	38.7	39.5	61
26.9	27.7	46	39.5	40.3	62
27.7	28.5	47	40.3	41.1	63
28.5	29.2	48	41.1	41.9	64
—continued—					

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
41.9	42.7	65	55.0	55.8	81
42.7	43.5	66	55.8	56.6	82
43.5	44.3	67	56.6	57.5	83
44.3	45.2	68	57.5	58.3	84
45.2	46.0	69	58.3	59.1	85
46.0	46.8	70	59.1	60.0	86
46.8	47.6	71	60.0	60.8	87
47.6	48.4	72	60.8	61.6	88
48.4	49.2	73	61.6	62.5	89
49.2	50.0	74	62.5	63.3	90
50.0	50.9	75	63.3	54.1	91
50.9	51.7	76	64.1	65.0	92
51.7	52.5	77	65.0	65.8	93
52.5	53.3	78	65.8	66.6	94
53.3	54.2	79	66.6	67.5	95
54.2	55.0	80	67.5	68.3	96

-continued-

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
68.3	69.2	97	81.9	82.7	113
69.2	70.0	98	82.7	83.6	114
70.0	70.9	99	83.6	84.4	115
70.9	71.7	100	84.4	85.3	116
71.7	72.5	101	85.3	86.2	117
72.5	73.4	102	86.2	87.0	118
73.4	74.2	103	87.0	87.9	119
74.2	75.1	104	87.9	88.7	120
75.1	75.9	105	88.7	89.6	121
75.9	76.8	106	89.6	90.4	122
76.8	77.6	107	90.4	91.3	123
77.6	78.5	108	91.3	92.2	124
78.5	79.3	109	92.2	93.0	125
79.3	80.2	110	93.0	93.9	126
80.2	81.0	111	93.9	94.7	127
81.0	81.9	112	94.7	95.6	128

—continued—

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
95.6	96.5	129	109.5	110.3	145
96.5	97.3	130	110.3	111.2	146
97.3	98.2	131	111.2	112.1	147
98.2	99.1	132	112.1	113.0	148
99.1	99.9	133	113.0	113.8	149
99.9	100.8	134	113.8	114.7	150
100.8	101.7	135	114.7	115.6	151
101.7	102.5	136	115.6	116.4	152
102.5	103.4	137	116.4	117.3	153
103.4	104.3	138	117.3	118.2	154
104.3	105.1	139	118.2	119.1	155
105.1	106.0	140	119.1	119.9	156
106.0	106.9	141	119.9	120.8	157
106.9	107.7	142	120.8	121.7	158
107.7	108.6	143	121.7	122.6	159
108.6	109.5	144	122.6	123.5	160
—continued—					

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
123.5	124.3	161	137.5	138.4	177
124.3	125.2	162	138.4	139.3	178
125.2	126.1	163	139.3	140.2	179
126.1	127.0	164	140.2	141.1	180
127.0	127.8	165	141.1	141.9	181
127.8	128.7	166	141.9	142.8	182
128.7	129.6	167	142.8	143.7	183
129.6	130.5	168	143.7	144.6	184
130.5	131.4	169	144.6	145.5	185
131.4	132.2	170	145.5	146.4	186
132.2	133.1	171	146.4	147.3	187
133.1	134.0	172	147.3	148.1	188
134.0	134.9	173	148.1	149.0	189
134.9	135.8	174	149.0	149.9	190
135.8	136.6	175	149.9	150.8	191
136.6	137.5	176	150.8	151.7	192

—continued—

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
151.7	152.6	193	165.9	166.8	209
152.6	153.5	194	166.8	167.7	210
153.5	154.4	195	167.7	168.6	211
154.4	155.2	196	168.6	169.5	212
155.2	156.1	197	169.5	170.4	213
156.1	157.0	198	170.4	171.3	214
157.0	157.9	199	171.3	172.2	215
157.9	158.8	200	172.2	173.1	216
158.8	159.7	201	173.1	174.0	217
159.7	160.6	202	174.0	174.9	218
160.6	161.5	203	174.9	175.8	219
161.5	162.4	204	175.8	176.7	220
162.4	163.3	205	176.7	177.5	221
163.3	164.1	206	177.5	178.4	222
164.1	165.0	207	178.4	179.3	223
165.0	165.9	208	179.3	180.2	224

—continued—

Table 1 continued
Stock quantity of spares

NFT values		Number of spares	NFT values		Number of spares
180.2	181.1	225	194.6	195.5	241
181.1	182.0	226	195.5	196.4	242
182.0	182.9	227	196.4	197.3	243
182.9	183.8	228	197.3	198.2	244
183.8	184.7	229	198.2	199.1	245
184.7	185.6	230	199.1	200.0	246
185.6	186.5	231	200.0	200.9	247
186.5	187.4	232	200.9	201.8	248
187.4	188.3	233	201.8	202.7	249
188.3	189.2	234	202.7	203.6	250
189.2	190.1	235	203.6	204.5	251
189.2	190.1	236	204.5	205.4	252
191.0	191.9	237	205.4	206.3	253
191.9	192.8	238	206.3	207.2	254
192.8	193.7	239	207.2	208.1	255
193.7	194.6	240	208.1	209.0	256

Failure rates

This section lists replaceable items used in SL-1s and provides their associated failure rates. Some failure rates are not available (N/A) at this time but will be offered in a supplement to this document. The replaceable items are grouped according to equipment types as follows:

- universal equipment modules
- cooling equipment
- circuit packs
- station equipment
- power equipment
- mass storage equipment

Note: The failure rates are based on a circuit pack ambient temperature of 40° C. This temperature is usually higher than the surrounding room temperature.

Table 2
Failure rates of modules

PEC/NT Code	Description	Failure Rate per 10^6 hrs
NT6D39AA NT6D39DC	CPU/Network Module	1.1
NT8D11AA NT8D11DC	Common/Peripheral Equipment Module	0.7
NT8D13AA NT8D13DC	Peripheral Equipment Module	0.5
NT8D34AA NT8D34DC	CPU Module	0.6
NT8D35AA NT8D35DC	Network Module	0.9
NT8D36AA	InterGroup Module	1.7
NT8D37AA NT8D37DC	Intelligent Peripheral Equipment Module	0.8
NT8D47AA NT8D47DC	Remote Peripheral Equipment Module	N/A

Table 3
Failure rates of cooling equipment

PEC/NT Code	Description	Failure Rate per 10^6 hrs
A0367754	Top Cap Fan	N/A
NT7D00AA	UEM Top Cap (AC)	.14
NT7D00BA	UEM Top Cap - Option 21A	.14
NT7D00DC	UEM Top Cap (DC)	.14
NT7D17AC	Fan Unit (AC)	6.14
NT7D17DC	Fan Unit (DC)	6.04
NT8D52AA	Blower Unit (AC)	2.00
NT8D52DC	Blower Unit (DC)	N/A

Table 4
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
NT8D01AD	Controller-2	6.5
NT8D01AC	Controller-4	7.0
NT8D02AA	Digital Line Card	1.8
NT8D03AB	Analog Line Card	5.1
NT8D04AA	Superloop Network Card	5.1
NT8D09AB	Message Waiting Line Card	5.8
NT8D14AA	Universal Trunk Card	3.4
NT8D15AA	E&M Trunk Card	3.7
NT8D16AA	Digitone Receiver Card	2.7
NT8D17AA	Conference/Tone and Digit Switch (TDS) Card	5.1
NT8D18AA	Network/DigitoneReceiver Card	7.3
NT8D19AA	Memory/Peripheral Signaling Card	4.2
NT8D41AA	Serial Data Interface Paddle Board (Dual Port)	N/A

—continued—

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC43	Peripheral Signaling	1.73
QPC62	1.5M Baud Converter	9.60
QPC63	Local Carrier Buffer	7.04
QPC65	Remote Peripheral Switch	13.38
QPC66	2M Baud Converter	11.00
QPC67	Carrier Maintenance	9.20
QPC71	E&M/DX Signaling and Paging Trunk	3.10
QPC99	Carrier Interface	12.51
QPC130	CDR Tape Control	10.30
QPC139	Dual Serial Data Interface	1.67
QPC162	AIOD C25 Data Trunk	7.30
QPC164	Bus Terminating Unit	0.45
QPC192	Off-Premises Extension Line	12.97
QPC197	Tone and Digit Switch	
	—prior to vintage D	12.52
	—vintage D and later	5.04
QPC215	Segmented Bus Extender	2.20
QPC234	CDR ROM1	9.03
QPC235	CDR ROM2	8.34
QPC237	4-Wire E&M Trunk	1.50
QPC250	Release Link Trunk	7.73
QPC251	Tone and Digit Switch	2.33
QPC252	Tone and Digit Switch	14.66
QPC253	Tone and Digit Switch (μ-Law)	14.66
QPC254	Tone and Digit Switch (A-Law)	14.66
--continued-		

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC266	ACD Interface	0.37
QPC267	500 Line Message Waiting	11.33
QPC268	Control Interface and Memory (7 PROMS)	10.37
QPC271	Control and Timing	24.02
QPC272	CO and FX Trunk	10.90
QPC280	Conference (A-Law)	13.95
QPC284	500 Line Circuit (A-Law)	8.53
QPC285	SL- 1 Line Circuit (A-Law)	5.45
QPC286	500 Line Message Waiting (A-Law)	8.61
QPC287	E&M, DX, Paging Trunk (A-Law)	6.97
QPC288	Loop Signaling Trunk (A-Law)	7.09
QPC289	Recorded Telephone Dictation Trunk (A-Law)	8.19
QPC290	Recorded Announcement Trunk (A-Law)	5.61
QPC291	DIGITONE Receiver (A-Law)	6.68
QPC292	OPX 500 Line Circuit (A-Law)	12.75
QPC293	CO, FX Trunk Circuit (A-Law)	6.44
QPC294	Recorded Telephone Dictation Trunk (A-Law)	7.22

—continued—

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC295	CO, FX, MR DET Trunk Circuit (A-Law)	10.46
QPC296	4-Wire E&M Trunk (A-Law)	8.38
QPC297	Attendant Console Monitor (µ-Law)	7.85
QPC301	CDR ROM	10.05
QPC302	Ground Button Recall Line	10.10
QPC311	Data Line Card	
	—prior to vintage F	13.91
	—vintage F and later	8.26
QPC319	RPE Processor (2 Mb/s RPE)	12.31
QPC320	Carrier Interface Circuit (2 Mb/s RPE)	7.93
QPC321	Phase Locked Loop	4.65
QPC322	Path Switch	2.78
QPC326	Daughter Board for Data Line Card	1.54
QPC327	MFC Sender/Receiver	20.07
QPC330	Buffered Message Register Trunk	9.78
QPC331	Buffered Message Register Trunk (A-Law)	16.64

—continued—

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC353	Modem Pool Line Card (μ-Law)	8.23
QPC342	Attendant Console Monitor (A-Law)	10.50
QPC343	Ground Button Recall Line (A-Law)	12.50
QPC354	Modem Pool Line Card (A-Law)	6.26
QPC357	Italian DID Trunk	12.64
QPC371	Codec Switched	0.45
QPC376	Dual Network	
	—vintage A	9.80
	—vintage B	8.01
QPC411	System Clock Generator	2.00
QPC412	Intergroup Switch	2.14
QPC414	Network Card	3.00
QPC417	Junctor Card	1.70
QPC422	Tone Detector	17.40

-continued-

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC432	Four Port Data Line Card	8.15
QPC441	Three-Port Extender	2.00
QPC443	Control and Timing	9.62
QPC444	Conference Card	3.20
QPC446	µ-Law Conference (Warning Tone)	11.20
QPC449	Loop/DID Signaling Trunk	2.27
QPC450	µ-Law CO/FX/Wats Trunk	3.34
QPC451	SL-1 Line (µ-Law)	5.15
QPC452	500/2500 Line (µ-Law)	
	—prior to vintage C	8.70
	—vintage C and later	5.20
QPC464	Peripheral Buffer	9.00
QPC471	Clock Controller	2.44
QPC472	Digital Trunk Interface	6.00
QPC473	DTI Carrier Interface	6.60
QPC475	Digitone Receiver	3.10
QPC477	Bus Terminating Unit	0.64
-continued-		

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC494	500/2500 Message Waiting	8.00
QPC496	Extender	0.69
QPC500	PE Backplane	3.24
QPC501	PE Backplane	3.24
QPC503	CE Backplane	3.24
QPC513	Enhanced Serial Data Interface Card	6.00
QPC526	PPM CO Trunk (A-law)	16.82
QPC527	CO/FX/WATS trunk (A-law)	12.37
QPC528	CO/IX/WATS trunk - (EIA)	14.23
QPC532	Grd Button Line Card	13.93
QPC536	Digital Trunk Interface	12.36
OPC540	Tone Detector	6.49

—continued—

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QPC578	Integrated Services Digital Line	2.72
QPC579	CPU Function	2.60
QPC580	CPU Interface	3.36
QPC581	Changeover and Memory Arbitrator	2.80
QPC583	Memory	2.93
QPC585	Power Converter	2.63
QPC591	Double Density Line	6.22
QPC594	16-Port 500/2500 Line	3.70
QPC595	Dual DT Receiver (A-law)	6.28
QPC602	Read-Only Memory	3.2
QPC609	Tone and Digit Switch	2.33
QPC611	Tone and Digit Switch with Centralized Attendant Service (CAS)	10.67
QPC628	CO Loop Start Supervisory Trunk	7.41
QPC659	Dual Loop Peripheral Buffer	2.75
—continued—		

Table 4 continued
Failure rates of circuit packs

PEC/NT Code	Description	Failure Rate per 10^6 hrs
Ql'C673	512K RAM Memory Card	5.04
QPC674	256K Memory with Error Correction	5.80
QPC706	Half PE Expansion Power Converter, 1st tier	1.14
QPC710	μ-Law Digitone Receiver	5.20
QPC720	Primary Rate Interface Card	6.00
QPC723	RS-232 Interface Line Card	N/A
QPC757	D-Channel Handler Interface Card	N/A
QPC775	Clock Controller Card	2.44
QPC789	16-Port 500/2500 Line (Message Waiting)	N/A
QPC814	Memory	N/A
QPC841	Four-Port Serial Data Interface Card	2.2
QPC918	High-Speed Data Card	N/A
QPC939	Read-Only Memory	N/A
QPC940	Read-Only Memory	N/A

Table 5
Failure rates of station equipment

PEC/NT Code	Description	Failure Rate per 10^9 hrs
	Ml250 Console	N/A
	M2250 TCM Console	N/A
	M2006 Digital Telephone	N/A
	M2008 Digital Telephone	3.10
	M2016S Digital Telephone	3.90
	M2216 Digital Telephone	N/A
	M2616 Digital Telephone	N/A
	M3000 Touchphone	N/A
NE-500/2500	500/2500 Telephone Set	N/A
NE-DGQC-35	Line Cord	3.50
NE-G3AR-35	Handset	0.50
NE-G3DRN-3	Console Handset	0.50
NE-T1	Transmitter	0.50
NE-U1	Receiver	0.50
NT1F05AA	M2009 Digital Tel Set	12.22
NT1F06AA	M2012 Digital without hands free	12.44
NT1F06AA	M2112 Digital with hands free	14.04
NT1F07AA	M2018 Digital	13.36
NT1F11AA	M3000 Touch Phone	21.01

—continued—

Table 5 continued
Failure rates of station equipment

PEC/NT Code	Description	Failure Rate per 10^6 hrs
QKK1	Handsfree Interface/Remote Powering Kit	0.33
QKK3	Automatic Handsfree Interface Kit	0.82
QKN1	Headset Kit	0.25
QMT1	10-Button Key Lamp Expansion Module	2.89
QMT2	20-Button Key Lamp Expansion Module	4.73
QMT3	Lamp Field Array Module	13.99
QMT4	Handset Module	0.50
QMT11	Asynchronous/Synchronous Interface Module	6.34
QMT12	Add-On Data Module	9.92
QMT15	Amplified Handset Module	N/A
QMT21	High-Speed Data Module	N/A
QPF23	Terminating Plug	0.16
QSAM2/3	Group Listening Switch Kit	0.50
QSR2	Venture 1 Headset	N/A
QSU1E	SL-1 Telephone Set (Phase I)	14.64
QSU1F	SL-1 Telephone Set (Phase II)	13.09
QSU1G	SL-1 Telephone Set (Phase III)	11.48
QSU3C	SL-1 Telephone Set (16-Digit Display)	19.16
QSU3D	SL-1 Telephone Set (16-Digit Display)	19.16
QSU6	ACD Telephone Set	13.57
QSU7	ACD 16-Digit Display Telephone Set	14.37
QSU60	SL-1 Telephone Set (U.S. Model)	13.18

Table 6
Failure rates of power equipment

PEC/NT Code	Description	Failure Rate per 10^6 hrs
NT5C03BJ	Switched Mode Rectifier -48V/50A	. N/A
NT6D40AA	DC Peripheral Equipment Power Supply	1.6
NT6D41AA	DC Common Equipment Power Supply	0.6
NT6D52AA	Switched Mode Rectifier -48V/30A	1.2
NT7D03AA	DC Ringing Generator	1.81
NT7D04AA	DC Common/Peripheral Equipment Power Supply	3.14
NT7D10AA	DC Power Distribution Unit	N/A
NT7D12AA	Rectifier Rack	N/A
NT7D14AA	AC Common/Peripheral Equipment Power Supply	2.34
NT7D15AA	System Monitor - Option 21A	N/A
NT8D06AA	AC Peripheral Equipment Power Supply	2.1
NT8D21AA	AC Ringing Generator	2.02
NT8D22AB	System Monitor	1.0
NT8D29AA	AC Common Equipment Power Supply	1.27
NT8D39AA	Power Failure Transfer Unit	5.7
NT8D53AB	AC Power Distribution Unit	N/A
NT8D53AD	Power Distribution Unit • Option 21 A	N/A
NT8D56AA	Module Power Distribution Unit	N/A
NT8D56AB	Module Power Distribution Unit	N/A
NT8D57AA	Module Power Distribution Unit	N/A

—continued—

Table 6 continued
Failure rates of power equipment

PEC/NT Code	Description	Failure Rate per 10^6 hrs
NT8D62AA NT8D62DC	Temperature Sensor Panel	N/A
QBL12	Battery Distribution Box	1.10
QBL15	Power/Battery Distribution Box	2.81
QCA13	DC Power Plant	N/A
QCA321	Junction Box	N/A
QPC188	Battery Monitor	N/A
QRF12	48V Rectifier	1.20
QRF12	I-52V Rectifier	N/A

Table 7
Failure rates of mass storage equipment

PEC/NT Code	Description	Failure Rate per 10^6 hrs
NT8D68AA	Floppy Disk Unit	46.00
NT8D69AA	Multi-Disk Unit	65.00
QMT102	Disk Drive Controller	3.23
QMT103	Hard Disk Drive (Winchester)	16.31
QMT104	Floppy Disk Drive	22.83
QPC584	Mass Storage Interface	2.26
QPC742	Floppy Disk Interface	3.23

Note: There are many replacement cables (not fisted here) in lengths appropriate for various configurations available from Northern Telecom. The approximated failure rates for most cables are the same (0.50); the measurement is based on failures in time per billion hours (FIT) or 10^9. For a detailed listing of the cables available from Northern Telecom, see ***Equipment identification and ordering*** (553-3001-154).

SL-1

System options 21, 51, 61,71

Spares planning

Release 1.O
Standard
January 29, 1990
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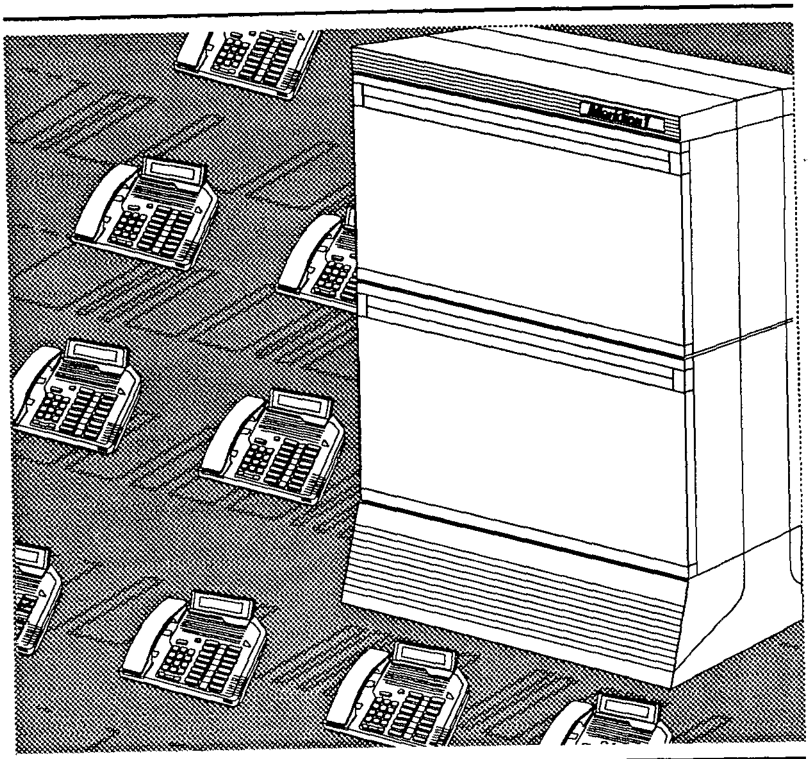
553-3001-154

SL-1

System options 21, 51, 61, 71

Equipment identification and ordering information

Standard



northern telecom

Meridian 1
Communication Systems

SL-1

System options 21, 51, 61, 71

Equipment identification and ordering information

Publication number: 553-3001-154
Document release: 1 .O
Document status: Standard
Date: January 29, 1990

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Standard, release 1.0

About this document

This document identifies equipment of the Meridian 1 System options 21, 51, 61, 71 that can be ordered individually. The items are described in terms of purpose, quantity required, and system hardware (system option), as appropriate.

References

See the SL-1 planning & engineering guide for

- *Master index* (553-3001-000)
- *System overview* (553-3001-100)
- *Installation planning* (553-3001-120)
- *System engineering* (553-3001-151)
- *Power engineering* (553-3001-152)
- *Sparesplanning* (553-3001-153)

See the list of line and trunk circuit descriptions in *the Master index* (553-3001-000) for specific references to lines and trunks.

See the *SL-1 installation and maintenance guide* for

- *System installation procedures* (553-3001-210)
- *Circuit pack installation and testing* (553-3001-211)
- *Installation procedures for telephone sets and attendant consoles* (553-3001-215)
- *Extended systems installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-251)

— *General maintenance information* (553-3001-500)

— *Fault clearing* (553-3001-510)

— *Hardware replacement* (553-3001-520)

See the SL-1 X11 software guide for an overviewbf software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

— *X11 software management* (553-3001-300)

— *X11 features and services* (553-3001-305)

See the SL-I X11 input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Contents

General

The selection of a system option that best meets individual requirements is determined by the following factors:

— Number and type of terminal devices required

— Number and type of trunks required

— Traffic requirements for lines, trunks and consoles

— Special features required

— Growth forecast in terms of ports and features

Refer to *System engineering* (553-3001-151) and *Power engineering* (553-3001-152) to determine the proper system requirement.

Equipment packages

There are various equipment packages available to provide basic systems. Information on these packages can be obtained from a Northern Telecom sales office.

Conversion and expansion packages

In addition to the basic equipment packages, there are conversion and expansion packages available to upgrade existing systems. Contact a Northern Telecom sales office for details.

Equipment availability

The equipment listed in this Northern Telecom Publication is available through Northern Telecom. Equipment may not be available in all market areas and may be discontinued at any time. Contact a Northern Telecom sales office for equipment availability.

Special features

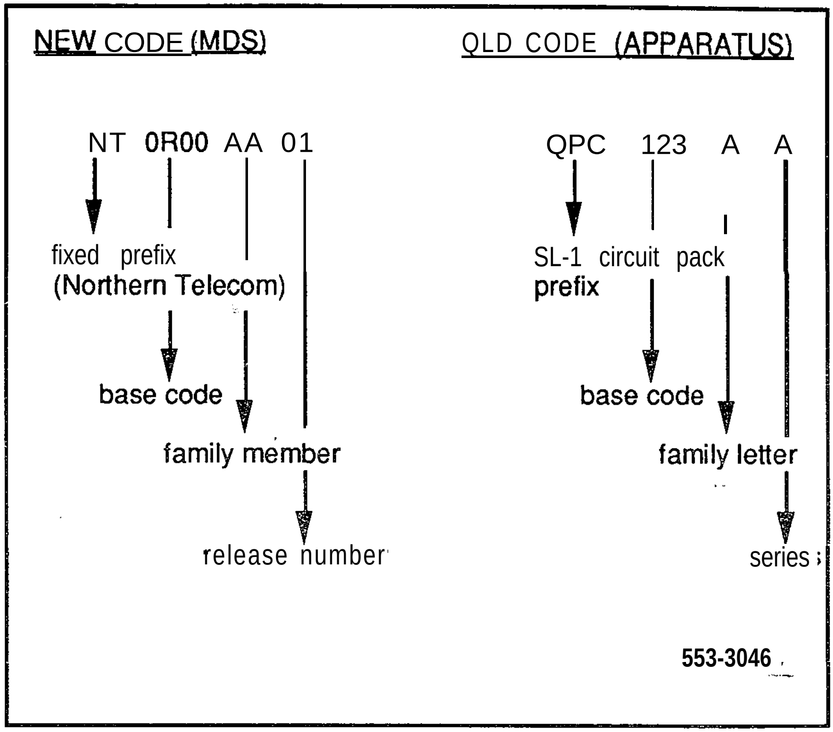
Special features are purchased as options to the basic system. These features may consist of software or hardware only, or both. Those special features that include hardware (e.g., the Data Feature, Call Detail Recording, Caller's Name Display and Remote Peripheral Equipment) are described in separate Northern Telecom Publications which include ordering information.

Product coding

With the application of Modular Documentation System (MDS) by Northern Telecom, the product code takes on a new form but does contain similar attributes as the apparatus system (QPC code). Figure l-l provides a comparison of the old and the new product codes.

The primary difference between the two systems is that the modular code is of a constant length (eigth characters) and the suffix is defined as family member. The "release number" and "series" are incremented as change is applied to the product.

Figure I-I
Modular and apparatus coding comparison



Universal Equipment Modules and packaging

Universal Equipment Modules (UEMs) are self-contained equipment modules which house system components such as card cages, circuit cards, power units, mass storage units, and cabling.

Each UEM is approximately 80 cm (31.5 in.) wide, 52.1 cm (20.5 in.) deep (55.9 cm (22.0 in.) with covers), and 43.2 cm (17 in.) high. The weight of a UEM is approximately 21.8 kg (48 lbs) empty, including the top, bottom, sides, side trim panels, card cage, Input/Output (I/O) panel, and miscellaneous hardware.

All UEMs are equipped with a card cage assembly and a cover assembly. Refer to *Circuit puck installation and testing* (553-3001-211) for the identification and location of the different cards within each UEM.

A UEM that is populated with various hardware components is referred to as a module. The different types of modules available are described in this chapter.

Also described in this chapter are the main components of a system option which can be ordered as a separate package. These components are the Top Cap, the card cages, the pedestal, the Spacer Kit, and the Module Covers.

NT6D39AA, NT6D39DC CPU/Network Module

System hardware-System option **51/61**

Purpose-The NT6D39 CPU/Network Module (hereafter referred to as NT6D39 CPU/NET) houses a Central Processor Unit (CPU) and network cards.

This module is available in two versions:

- NT6D39AA for AC systems
- NT6D39DC for DC systems

The NT6D39 CPU/NET card cage contains 18 card slots which support the following:

- network cards
- Clock Controller
- Serial Data Interface (SDI)/Enhanced Serial Data Interface (ESDI)
- Peripheral Signaling
- 3-Port Extender (3PE)
- mass storage unit
- CPU Function
- CPU Interface
- Changeover Memory Arbitrator (CMA)
- Memory
- D-Channel Handler Interface (DCHI)
- Primary Rate Interface (PRI)/Digital Trunk Interface (DTI)

The NT6D39 CPU/NET Module is powered by a Common Equipment Power Supply.

Quantity-One per System option 51 system; two per System option 61 system

NT6D44AA, NT6D44DC Meridian Mail Module

System hardware-System option 21/51/51/71

Purpose-The NT6D44 Meridian Mail Module is a self-contained unit, complete with power converters and cooling units. It is designed to integrate with Meridian 1 Communication Systems but is also available as a stand-alone system.

This module is available in two versions:

- NT6D44AA for AC systems
- NT6D44DC for DC systems

The Meridian Mail Module is powered by two Common Equipment Power Supplies.

Refer to the Meridian Mail suite of documents (553-7041-xxx) for detailed information.

Quantity-Maximum of five per system

NT8D11 AC, NT8D11 DC CE/PE Module

System hardware—System option 21 and 21A

Purpose—The NT8D11 Common/Peripheral Equipment Module (hereafter referred to as NT8D11 CE/PE) supports CPU, network, and Intelligent Peripheral Equipment (IPE) cards in a single module.

This module is available in two versions:

- NT8D11AC for AC systems
- NT8D11DC for DC systems

The NT8D11 CE/PE card cage contains 20 card slots which support the following:

- Floppy Disk Interface (FDI)/Floppy Disk Unit (FDU)
- CPU
- Memory
- SDI/ESDI
- network
- network/Digitone Receiver (DTR)
- DCHI
- DTI/PRI
- IPE

The NT8D11 CE/PE Module is powered by a Common/Peripheral Equipment (CE/PE) Power Supply.

Quantity-One per system

NT8D13AA, NT8D13DC Peripheral Equipment Module

System hardware—System option 21/51/61/71

Purpose-The NT8D13 Peripheral Equipment Module (hereafter referred to as NT8D13 PE) supports the Dual Loop Buffer (DLB), and 10 card slots.The PE Buffer is situated near the center of the module, with five cards to the left and five cards to the right.

This module is available in two versions:

— NT8D13AA for AC systems

— NT8D13DC for DC systems

The NT8D13 PE Module is powered by a Peripheral Equipment Power Supply, and a Ringing Generator when 500/2500 sets are supported by the module.

Quantity-As required; refer to *System engineering* (553-3001-151)

NT8D34AA, NT8D34DC CPU Module

System hardware-System option 71

Purpose-The NT8D34 CPU Module (hereafter referred to as NT8D34 CPU) houses the CPU, memory cards, and the mass storage.

This module is available in two versions:

— NT8D34AA for AC systems

— NT8D34DC for DC systems

The NT8D34 CPU card cage contains 15 card slots which support the following:

— Memory

— CMA

- CPU Interface
- CPU Function
- SDI/ESDI
- MSI
- Segmented Bus Extender (SBE)
- DCHI
- PRI/DTI
- Clock Controller
- Mass Storage Unit (MSU) or Floppy Disk Unit (FDU)

The NT8D34 CPU Module is powered by a Common Equipment Power Supply.

Quantity-Two per system

NT8D35AA, NT8D35DC Network Module

System hardware-System option 71

Purpose-The NT8D35 Network Module (hereafter referred to as NT8D35 NET) provides the signal interface between the Common Equipment (CE) cards located in the module.

This module is available in two versions:

- NT8D35AA for AC systems
- NT8D35DC for DC systems

The NT8D35 NET card cage contains 15 card slots which support the following:

- 3PE
- Intergroup Switch (IGS) (for System option 71 only)
- peripheral signaling
- network cards
- SDI/ESDI

— PRI/DTI

The NT8D35 NET Module is powered by a Common Equipment Power Supply.

Quantity-A maximum of 10 per system (five network groups)

NT8D36AA Inter Group Module

System hardware--System option 71

Purpose-The NT8D36AA Inter Group Module provides a path for the switching of traffic between the network groups in the system. Faceplate cables from the Clock Controller (CC) and Intergroup Switch (IGS) circuit cards are connected to the Inter Group Module. This module uses a QPC417 Junctor Board.

This module is used in both AC and DC systems.

Quantity—One per system

NT8D37AA, NT8D37DC Intelligent PE Module

System hardware-System option 21/51/61/71

Purpose-The NT8D37 Intelligent Peripheral Equipment Module (hereafter referred to as NT8D37 IPE) supports a Controller card and 16 IPE cards. The Controller card is situated near the center of the module, between slot 7 and slot 8.

This module is available in two versions:

— NT8D37AA for AC systems

— NT8D37DC for DC systems

The card slots in the NT8D37 IPE card cage support the following:

— Universal Trunk

— E&M Trunk

— Digitone Receiver

— Analog Line card (ALC)

- Digital Line card (DLC)
- Analog Message Waiting Line card (MLC)

The NT8D37 IPE Module is powered by a Peripheral Equipment Power Supply, and a Ringing Generator when 500/2500 sets are supported by the module.

Quantity-As required; refer to *System* engineering (553-3001-151)

NT8D47AA, NT8D47DC Remote PE Module

System hardware-System option 21/51/61/71

Purpose-The NT8D47 Remote Peripheral Equipment Module (hereafter referred to as NT8D47 RPE) is an interface module used to extend the interconnection distance between local and remote sites.

The same module is used for both local and remote applications. On the local side, it interfaces to the QPC4 14 Network card for up to two network loops; on the remote side, it supports the NT8D13 PE Module.

This module is available in two versions:

- NT8D47AA for AC systems
- NT8D47DC for DC systems

The NT8D47 RPE card cage contains 12 card slots which support the following:

- 1.5 Mb converter
- 2 Mb converter
- carrier interface
- remote peripheral
- local carrier buffer
- carrier interface
- 2 Mb converter
- 1.5 Mb converter
- carrier maintenance

- PRI/DTI (optional)

The NT8D47 RPE Module is powered by a Common Equipment/Peripheral Equipment Power Supply.

Quantity-Since each NT8D47 RPE Module serves two network loops, the number of modules required per system depends on the number of stations in the remote site.

NT8D49 Spacer Kit

System Hardware-All

Purpose-Bolts modules together for side-by-side expansion. The Spacer Kit includes:

- expansion spacer
- RF gasketing
- eight bushings

NT8D55AA Universal Equipment Module cover

System Hardware-All

Purpose-This is the front or rear cover that is part of the UEM. Two covers are required for each UEM.

Universal Equipment Module side panel

System Hardware-All

Purpose-This is the side panel (P0699724) that is part of the UEM. A maximum of eight panels are required for multi-column systems.

Card cage assemblies

A card cage assembly consists of a sheet metal case and an associated backplane. The card cage provides the physical framework that houses the circuitry and power supplies within the UEM.

The following is a list of all the card cage assemblies available and their corresponding UEMs:

- NT6D3903 NT6D39AA/DC CPU/Network Module
- NT8D1103 NT8D1 1AC/DC Common/Peripheral Equipment Module
- NT8D1303 NT8D13AA/DC Peripheral Equipment Module
- NT8D3403 NT8D34AA/DC CPU Module
- NT8D3503 NT8D35AA/DC Network Module
- NT8D3703 NT8D37AA/DC Intelligent Peripheral Equipment Module
- NT8D4703 NT8D47AA/DC Remote Peripheral Equipment Module

Top Cap

System Hardware-All

Purpose-The top cap is mounted on the highest module of each column. The top cap is approximately 80 cm (31.5 in.) wide by 55.9 cm (22 in.) deep by 7.6 cm (3 in.) high and weighs 3.6 kg (8 lbs). It consists of a front and a rear air exhaust grill and thermal sensors. System option 21A contains a small fan to cool the power supply.

Three versions of the top cap are available:

- NT7D00AA AC systems
- NT7D00BA DC systems
- NT7D00AC System option 21A only

Pedestal

System Hardware-All

Purpose-The Pedestal is a base unit made of die-cast construction. It is approximately 80 cm (31.5 in.) wide by 64.8 cm (25.5 in.) deep by 25.4 cm (10 in.) high and weighs 13.6 kg (30 lbs) empty. Leveling feet are provided for up to four tiers, while a caster option is provided for up to two tiers.

The pedestal is available in three versions:

- NT8D27AB for AC systems

— NT8D27AC for System option 21A only

— NT7D09AA for DC systems

The pedestal for AC and DC systems (except System option 21A) can house any of the following field replaceable assemblies:

— Power Distribution Unit	NT8D53AB or NT7D10AA
— Blower Unit	NT8D52AA or NT8D52DC
— Fan Unit	NT7D17AC or NT7D17DC
— Leveling foot	A03 18207
— Air grill (molded)	PO699797
— Air filter	PO699798

The pedestal for System option 21A is basically the same as the one used for other system options except it can only house the following field replaceable assemblies:

— Power Distribution Unit	NT8D53AD
— Leveling foot	A03 18207
— Air grill (molded)	PO699797

Power and cooling equipment

A0367754 Top Cap Fan

System Hardware-System option 21A

Purpose-The A0367754 Top Cap Fan is **located in the** Fan and Sensor Panel. It provides cooling for the NT7D14AA CE/PE power Supply AC. There is no speed or temperature control provided with it. Power. to the Top Cap Fan is controlled by the circuit breaker located on the back panel of the pedestal.

Quantity-One per system

NT5C03BJ Switched Mode Rectifier -48V/50A

System Hardware-System option 71 (DC version)

Purpose-Solid state, switched-mode rectifier. Converts 208/240 VAC (nominal) to -48 VDC (nominal), with a 50A output. Used in the QCA13 power plant, with up to ten rectifiers in parallel.

Quantity-As required by system power consumption

NT6D40AA Peripheral Equipment Power Supply DC

System Hardware-All

Purpose-The Peripheral Equipment Power Supply DC is used to provide power to all peripheral equipment modules in DC systems. It converts -48V DC to +5V, +8.5V, ±10V, ±15V, and -48V DC voltages used to power peripheral equipment logic cards and to supply talk battery to lines and trunks. This power supply is located in the far left hand card slot labeled "PE Pwr Sup".

Quantity—One Peripheral Equipment Power Supply DC is used in each of the following DC modules:

— Intelligent Peripheral Equipment Module (NT8D37DC)

— Peripheral Equipment Module (NT8D13DC)

NT6D41AA Common Equipment Power Supply DC

System Hardware-All

Purpose—The Common Equipment Power Supply DC is used in the common equipment modules in DC systems. It is located in the first slot on the left in the module labeled "CE Pwr Sup". It converts -48V DC to +5V and ±12 V DC to provide all required voltages for CE and network circuit cards.

Quantity-One Common Equipment Power Supply DC is used in each of the following DC modules:

— CPU Module (NT8D34DC)

— Network Module (NT8D35DC)

— CPU/Network Module (NT6D39DC)

Two Common Equipment Power Supply DC is used in the Meridian Mail Module (NT6D44DC).

NT6D52AA Switched Mode Rectifier -48V/30A

System Hardware-System option 21/51/61 (DC versions)

Purpose-The Switched-Mode Rectifier is a QRF12 rectifier shielded to limit electromagnetic interference. It converts 208/240 VAC (nominal) to -48 VDC (nominal), with a 30A output. It connects to the system through the QBL15 Battery Distribution Box.

Quantity-Generally one rectifier per every two fully loaded modules. Exact quantity depends on system configuration and power requirements.

NT6D53AA Junction Box

System Hardware-All **(DC** version)

Purpose-The Junction Box is **required** when the distance from the rectifier to the pedestal is over 0.74 m (8 ft), which requires wire larger than 10 AWG. It provides a set of connection terminals for the 4-AWG wire that comes from the rectifier, and a set of connection terminals for the 10-AWG wire that goes into the pedestal.

Refer to *Power* engineering (553-3001-152) for more information.

Quantity—One per DC pedestal

NT6D5303 Logic Return Equalizer

System Hardware-System option 71 (DC version)

Purpose-The Logic Return Equalizer (LRE) mounts on top of the QCA13 cabinet. It is used as the single point ground for System option 7 1.

Quantity--One per system

NT7D0003 Fan and Sensor Panel

System Hardware-System option 21A

Purpose-The NT7D0003 Fan and Sensor Panel contains a 230 VAC tubeaxial fan (A0367754) and a thermal sensor for a high temperature/shutdown alarm to the option 21A System Monitor. The fan provides cooling for the NT7D14AA Common/Peripheral Equipment Power Supply. It is on continously and receives power directly from the Power distribution Unit via the module power harness.

The NT7D0003 Fan and Sensor Panel consists of the following:

— a perforated top shield (P0703062)

— a Top Cap Fan (A0367754)

— a fan power harness (NT7D0004)

— a thermostat harness (NT8D46AC)

Quantity—One per system

NT7D03AA Ringing Generator DC

System Hardware-All

Purpose-The Ringing Generator DC operates from a nominal -48V DC input and provides selectable AC ringing voltage outputs superimposed on -48 VDC. The frequency and voltage options are 20/25/50 Hi and 70/80/86 VAC. It also supplies -150V DC Message Waiting lamp 500/2500 set applications. The Ringing Generator DC mounts in the PE modules to the right of the Peripheral Equipment Power Supply DC.

Quantity—One Ringing Generator DC is used in each of the following, when these DC modules support 500- or 2500-type analog sets:

— Intelligent Peripheral Equipment Module (NT8D37DC)

— Peripheral Equipment Module (NT8D13DC)

NT7D04AA CE/PE Power Supply DC

System Hardware-All (DC versions)

Purpose-The Common/Peripheral Equipment Power Supply DC converts -48V DC to +5V, +8.5V, ±15V, ±12V, -48V, and -150V DC voltages used to power peripheral and common equipment, supply talk battery, and light Message Waiting lamps on 500/2500 sets. It provides selectable AC ringing voltage outputs superimposed on -48 VDC. The frequency and voltage options are 20/25/50 Hz and 70/80/86 VAC. It is located to the left of the module, in the slot labeled "CE/PE Pwr Sup".

Quantity-One Common/Peripheral Equipment Power Supply DC is used in each of the following DC Modules:

— Common/Peripheral Equipment Module (NT8D 11DC)

— Remote Peripheral Equipment Module (NT8D47DC)

NT7D10AA Power Distribution Unit DC

System Hardware-All

Purpose-The NT7D10AA Power Distribution Unit DC distributes power to the entire column. It is located in the rear of the pedestal. It houses five circuit breakers (one for each Module and one for the Blower Unit) and the System Monitor.

Quantity-One p&pedestal/column in DC systems

NT7D12AA Rectifier Rack

System Hardware—21/51/61 (DC versions)

Purpose-This is a 48.3-cm (19-in.) open relay rack which is approximately 1.5 m (5 ft) high. It supports up to three NT6D52AA Rectifiers in a single column.

Quantity-One rack per every three NT6D52AA Rectifiers, up to a maximum of three racks per system

NT7D14AA CE/PE Power Supply AC

System Hardware-All

Purpose-The Common/Peripheral Equipment Power Supply AC converts 208/240V AC to +5V, +8.5V, ±15V, ±12V, -48V, and -150V DC voltages used to power peripheral and common equipment, supply talk battery, and light Message Waiting lamps on 500/2500 sets. It provides selectable AC ringing voltage outputs superimposed on -48 VDC. The frequency and voltage options are 20/25/50 Hz and 70/80/86 VAC. It is located to the left of the module, in the slot labeled "CE/PE Pwr Sup".

Quantity-One Common/Peripheral Equipment Power Supply AC is used in each of the following AC modules:

— Common/Peripheral Equipment Module (NT8D1 1AC)

— Remote Peripheral Equipment Module (NT8D47AA)

NT7D15AA System Monitor - System option 21A

System Hardware-System option 21A

Purpose--The NT7D15AA System Monitor - System option 21A provides an interface to communicate and monitor the NT7D14AA CE/PE Power Supply AC, the CPU, and the thermal switches. In the event of failure, the System Monitor - System option 21A is notified and the appropriate alarm is set. A system alarm LED located below the top cap lights to indicate CPU failure.

Quantity-One per system

NT7D17AC Fan Unit AC

System Hardware-System option 21 with up to two tiers

Purpose-The NT7D17AC Fan Unit AC is housed within the pedestal and provides cooling for the entire column. It consists of three fans and a circuit breaker located in the front.

Quantity-One per pedestal

NT7D17DC Fan Unit DC

System Hardware-System option 21 with up to two tiers

Purpose-The NT7D17DC Fan Unit DC is the same as the NT7D17AC Fan Unit AC except that it is used for DC systems. It has an on/off switch in the front and its own separate circuit breaker located on the Power Distribution Unit.

Quantity--One per pedestal

NT7D1201 Rectifier Baffle/Mounting Kit

System Hardware-System option 21/51/61 (DC versions)

Purpose-The Rectifier Baffle/Mounting Kit consists of a set of support brackets for mounting the NT6D52AA Rectifier to an NT7D12AA Rack, and a heat baffle plate. The baffle directs exhaust air from the lower rectifier away from the inlet to the upper rectifier, thereby allowing cooling by natural convection.

Quantity-One per NT6D52AA Rectifier

NT8D06AA Peripheral Equipment Power Supply AC

System Hardware-All

Purpose-The Peripheral Equipment Power Supply AC is used to provide power to all peripheral equipment modules in AC systems. It converts 208/240V AC to +5V, +8.5V, ±10V, ±15V, and -48V DC voltages used to power peripheral equipment logic cards and to supply talk battery to lines and trunks. This power supply is located in the far left-hand card slot labeled “PE Pwr Sup”.

Quantity--One Peripheral Equipment Power Supply AC is used in each of the following AC modules:

— Intelligent Peripheral Equipment Module (NT8D37AA)

— Peripheral Equipment Module (NT8D13AA)

NT8D21AA Ringing Generator AC

System Hardware-All

Purpose-The Ringing Generator AC operates from a nominal 208/240 VAC input and provides selectable AC ringing voltage outputs superimposed on -48 VDC. The frequency and voltage options are 20/25/50 Hz and 70/80/86 VAC. It also supplies -150V DC Message Waiting lamp 500/2500 set applications. The Ringing Generator AC mounts in the PE modules to the right of the Peripheral Equipment Power Supply.

Quantity-One Ringing Generator AC is used in each of the following, when these AC Modules support 500- or 2500-type analog sets:

— Intelligent Peripheral Equipment Module (NT8D37AA)

— Peripheral Equipment Module (NT8D13AA)

NT8D22AB System Monitor

System Hardware-All except System option 21A

Purpose-The NT8D22AB System Monitor monitors the status of all internal power and cooling related components, as well as external DC rectifiers, batteries, and Uninterruptable Power Supplies (UPS). The System Monitor is mounted in the Power Distribution Unit, within the Pedestal.

The System Monitor that handles the communication with the system CPU (via SDI port) is the master; all others function as slaves. There is a serial communication link between the master and the slave System Monitors. In addition to CPU status reporting, the System Monitor also controls all external visual status indications.

Quantity-One master and up to 63 slave System Monitors are allowed per system.

NT8D29AA Common Equipment Power Supply AC

System Hardware--System option 51/61/71

Purpose-The Common Equipment Power Supply AC is used in the common equipment modules in AC systems. It is located in the first slot on the left in the module labeled “CE Pwr Sup”. It converts 208/240V AC to +5V and ±12 V DC to provide all required voltages for CE and network circuit cards.

Quantity-One Common Equipment Power Supply AC is used in each of the following AC Modules:

- CPU Module (NT8D34AA)
- Network Module (NT8D35AA)
- CPU/Network Module (NT6D39AA)

Two Common Equipment Power Supply AC is used in the Meridian Mail Module (NT6D44AC).

NT8D39AA Power Failure Transfer Unit

System Hardware-All

Purpose-Provides an interface between CO lines, Private Branch Exchange (PBX), and 500/2500 phones (rotary dial and pushbutton). The Power Failure Transfer Unit allows eight phones to be connected to the CO lines in the event of a PBX power failure or malfunction. The Power Fail Transfer Unit is invisible to the switch and CO lines during normal PBX operations.

The Power Fail Transfer Unit is approximately 22.8 cm (9 in) long by 22.8 cm (9 in) wide by 8.8 cm (3.5 in) deep. It is screw-mounted to the Distribution Frame and connects to the Main Distribution Frame and switch by two 25-pair cables.

> Note: The Power Fail Transfer Unit is not recommended for use in international applications.

Quantity-One per system

NT8D52AA Blower Unit

System Hardware-All

Purpose-The Blower Unit is part of the system cooling assembly and provides forced-convection cooling. Housed within the pedestal, it contains two backward-curved impellers (rotor blades) which are cylindrically shaped, approximately 22.8 cm (9.in) in diameter, and 6.9 cm (2.75 in) thick. A circuit breaker is located on the front of the blower chassis to turn the unit on and off. Each unit weighs about 1.5 kg (3.5 lbs).

The unit communicates with the power distribution section by engaging a connector in the rear of the pedestal.

Quantity-One per pedestal in AC systems

NT8D52DC Blower Unit

System Hardware-All

Purpose—This Blower Unit is the same as the NT8D52AA Blower Unit except that it is used for DC systems. It has its own separate circuit breaker located on the Power Distribution Unit. Also, for maintainability in the field, a switch is located on the front of the blower chassis to turn the unit on and off.

Quantity-One per pedestal in DC systems

NT8D53AB Power Distribution Unit AC

System Hardware-All

Purpose-The Power Distribution Unit AC distributes power to the entire column. It is located in the rear of the pedestal. It houses a main circuit breaker and the System Monitor.

Quantity-One per pedestal/column in AC systems

NT8D53AD Power Distribution Unit - System option 21A

System Hardware-System option 21A

Purpose—The Power Distribution Unit - System option 21A is a panel located in the pedestal. It contains a circuit breaker, a terminal block, and an EM1 filter. The power cable enters the pedestal and connects to the circuit breaker. From the circuit breaker, the AC voltage goes to the terminal block through the EM1 filter and back to the terminal block where it is distributed to the NT7D 14AA CE/PE Power Supply AC and the fan located in the top cap.

Quantity-One per system

NT8D56AA Module Power Distribution Unit

System Hardware-All

Purpose-The NT8D56AA Module Power Distribution Unit protects the power supply and distributes power within a module. It houses a single breaker and is used in conjunction with the NT8D29AA CE Power Supply AC.

Quantity--One per NT8D35AA NET, NT6D39AA CPU/NET, or NT8D34AA CPU Module

NT8D56AB Module Power Distribution Unit

System Hardware-All

Purpose-The NT8D56AB Module Power Distribution Unit protects the power supply and distributes power within a module. It houses a single breaker and is used in conjunction with the NT7D14AA CE/PE Power Supply AIC.

Quantity-One per NT8D47AA RPE Module

NT8D57AA Module Power Distribution Unit

System Hardware-All

Purpose-The NT8D57AA Module Power Distribution Unit protects the power supply and distributes power within a module. It houses a dual breaker and is used in conjunction with the NT8D06AA PE Power Supply AC and the NT8D21AA Ringing Generator AC.

Quantity-One per NT8D13AA PE or NT8D37AA IPE Module

NT8D62AA, NT8D62DC Temperature Sensor Panel

System Hardware-AN except System option 21A

Purpose-The NT8D62 Temperature Sensor Panel communicates with the System Monitor in the event of overheating. It contains hvo temperature sensors which protect against thermal damage by detecting extreme temperature.

The Temperature Sensor Panel is available in two versions:

— NT8D62AA for AC systems

— NT8D62DC for DC systems

The Temperature Sensor Panel consists of the following:

— a perforated shield panel (P0703062)

— an LED bracket (P0703061)

— a thermostat harness (NT8D46AC)

— an air probe harness (NT8D46AM or NT8D46DC)

— an air probe connector bracket (PO703064 or PO708 186)

Quantity-One per top cap

QBL1 2 Battery Distribution Box

System Hardware-All (DC versions)

Purpose—Connects customer-provided power supplies to the system. Allows connection of up to 24 modules.

Quantity-One per system

QBL15 Power/Battery Distribution Box.

System Hardware-System option 21/51/61 (DC versions)

Purpose-Allows the parallel connection of up to three NT6D52AA Rectifiers, for connection to the system and to reserve batteries. Includes main fuses, diode blocking, test points, QPC188 battery monitor card, and sense lead fusing on connections from each rectifier.

Quantity-One per every three NT6D52AA Rectifiers, up to a maximum of two QBL15s per system

QCA13 DC Power Plant

System Hardware-System option 71 (DC version)

Purpose—Consists of a primary power cabinet with fusing and distribution hardware, monitoring and control, and up to four NT5C03 50A Rectifiers. Up to two supplemental cabinets can be added, with up to four rectifiers in the first supplemental cabinet and up to two rectifiers in the second cabinet, for a total of 10 rectifiers and a total system capacity of 500A. (This power system is also referred to as the J2412 power plant; QCA13 is actually the cabinet designation, but is the more commonly used name.)

Quantity-As required by system power consumption

QPC188 Battery Monitor

System Hardware—All

Purpose-Located in each Battery Distribution Box to monitor rectifier and battery voltages. Generates low float alarm, low voltage trip alarm and sense lead fuse conditions.

Quantity-One circuit card in QBL12 or QBL15

QRF12 -52 V Rectifier

System Hardware--System option 21/51/61 (DC version)

Purpose—Converts 115 V AC and 220 V AC to -52 V DC (nominal). QRF12B voltage conversions from 90V to 129V, and 190V to 25OV. Connects to the columns through the QBL15 Power/Battery Distribution Box.

Quantity-One for every two modules

Common Equipment cards

NT8D04AA Super-loop Network

System Hardware-All

Purpose- Provides 120 time slots (one superloop) interface between Network and Intelligent Peripheral Equipment. Utilizes the equivalence of four network loops. May be connected to one or two NT8D01 Controller card(s).

The Superloop Network card is equipped with a Motorola 68000-type microprocessor which performs network diagnostics and signaling control, and communicates with the Intelligent Peripheral Controller.

Quantity-As required. Refer to *System* engineering (553-3001-151) for engineering details.

NT8D17AA Conference/lone and Digit Switch (TDS)

System Hardware—All

Purpose-Provides both Conference and TDS functions. This card accesses two network loops, one for each function.

The Conference circuitry has a warning tone option and supports broadcast mode. Up to 15 simultaneous conferences can be controlled with the restriction that the total number of conferees in all conferences is not greater than 30.

The TDS circuitry provides tones for different countries (up to 256 tones and cadences).

Quantity-As required. Refer to *System* engineering (553-3001-151) for engineering details.

NT8D18AA Network/Digitone Receiver

System Hardware-System option 21 and 21A

Purpose-Combines the functionality of the Network Controller and Digitone Receiver cards in a mother/daughterboard assembly. The motherboard plugs into a dedicated slot on the backplane. The daughterboard attaches to the motherboard through an SDI/ESDI connector and does not connect to the backplane.

Quantity—One per NT8D11 CE/PE Module

NT8D19AA Memory/Peripheral Signaling

System Hardware-System option 21 and 21A

Purpose-Combines the functionality of the Memory and Peripheral Signaling cards, as well as miscellaneous CPU functions.

The CPU functions include interrupt and fault monitoring.

The Peripheral Signaling function provides:

- signaling interface between CPU and Peripheral Equipment for up to 32 network loops
- clock and timing signals for real-time transmission functions

Quantity—One per NT8D1 1 CE/PE Module

NT8D41AA Serial Data Interface paddle board (Dual Port)

System Hardware-System option 21/51/61

Purpose-Provides two serial ports between the SL-1 **processor and an** external device. Each port supports

- RS-232-C interface
- **8-bit** ASCII data with parity and stop bit
- asynchronous, start-stop operation

- data rates of 300, 600, 1200, 2400, 4800, and 9600 baud
- Data Terminal Equipment (DTE) mode
- Data Communication Equipment (DCE) mode

Quantity-Three maximum per NT8D11 CE/PE Module; two maximum per NT6D39 CPU/NET Module

NT8D68AA Floppy Disk Unit

System **hardware—System** option 21/51/61/71

Purpose--The Floppy Disk Unit (FDU) is used to load the programs and office data into the system memory. The FDU contains two 3.5-inch floppy drives and is controlled by the QPC742 Floppy Disk Interface (FDI). Each floppy drive has a formatted capacity of 1.44 MB.

The FDU occupies two adjacent card slots in the CPU, Network, or PE Module. It is powered through the cable connecting it to the FDI. The FDU can be connected to one or two FDIs as required by the system.

Quantity-One per system

NT8D69AA Multi Disk Unit

System hardware-System option 51/61/71

Purpose-The Multi Disk Unit (MDU) is used to load the programs and office data into the system memory. The MDU contains the following:

- two 3.5-inch floppy drives which are connected to the SCSI interface through the SCSI/floppy controller; each drive has a formatted capacity of 1.44 MB
- a 3.5-inch hard disk drive which has a built-in SCSI interface and a capacity of 20 MB
- an SCSI/floppy controller

The MDU occupies three adjacent card slots in the CPU, CPU/NET, or Network Module and requires 5V and 12V from the module. The MDU is controlled by the QPC584 Mass Storage Interface (MSI). The MDU can be connected to one or two MSIs as needed.

Quantity-One per system

QMM42 Security Data Cartridge

System Hardware-All

Purpose-This is a security measure that allows a customer access only to software packages purchased for his system. This security data cartridge is mounted on either the QPC584 Mass Storage Interface or QPC742 Floppy Disk Interface card.

Quantity-One per MSI/FDI card

QPC43 Peripheral Signaling

System Hardware-System option 51/61/71

Purpose--Provides a signaling interface between the CPU and PE via the Network cards. Provides basic bit rate 2.048 MHz clock and timing signals for real-time functions.

Quantity—One per NT8D35 NET or NT6D39 CPU/NET Module

QPC215 Segmented Bus Extender

System Hardware-System option 71

Purpose-The Segmented Bus Extender (SBE) extends CPU bus signals (address, data, and control) to the Network Module. It also allows recovery of calls by isolating bus faults to a single network group.

Note: QPC215C or later vintage is required.

Quantity—One circuit card in each CPU per network group, with a maximum of five per CPU

QPC412 Intergroup Switch

System Hardware-System option 71

Purpose-Provides space switching between network groups in multigroup systems.

Quantity-Two per Network Module (use vintage C when two or more groups are installed)

QPC414 Network

System Hardware-All

Purpose—Provides 30 time slots interface per each of two network loops. Provides speech path switching, signaling and control circuits for two network loops. Interfaces between network and NT8D13 PE, NT8D47 RPE, and Meridian Mail Modules, and PRI/DTI cards,

Quantity-As required; refer to *System engineering* (553-3001-151)

QPC417 Junctor Board

System Hardware-System option 71

Purpose-Provides space switching paths between network groups in multigroup systems for up to five groups.

Quantity-One per system

QPC441 Three-Port Extender

System Hardware-System option 61/71

Purpose-Extends CPU **data, address and control signals between one** NT8D35 NET Module and a QPC215 Segmented Bus Extender on a CPU Module in System option 71. In System option **61,** interfaces between two NT6D39 CPU/NET Modules.

Quantity-One per NT8D35 NET or NT6D39 CPU/NET Module

QPC471 Clock Controller

System Hardware-All

Purpose-The Clock Controller (CC) is used in System option 71 to synchronize the Meridian 1 network to an external source clock and to generate and distribute clock to the Meridian 1 system. It is also used with PRA/DTI in all system options.

Note: QPC471C or later vintage is required.

Quantity-Two for System option 71, and one per CPU when DTI or PRA is required in other options.

QPC477 Bus Terminating Unit

System Hardware-System option 51/61/71

Purpose-Bus Terminating Units (BTUs) are installed in the CE Modules. They provide a logical termination to the CPU and network buses. They are paddle boards installed in dedicated slots, between circuit cards from the front of the module.

Quantity-The following vintages are required for the modules listed:

- QPC477-A9
  One required for each NT6D39 **CPU/NET** and each NT8D35 NET
- QPC477-A10
  One required for each NT6D39 **CPU/NET** and each NT8D35 NET
- QPC477-A20
  One required for each NT8D34 CPU
- QPC477-A21
  One required for each NT8D34 CPU
- QPC477-A22
  One required for each NT6D39 CPU/NET

QPC513 Enhanced Serial Data Interface

System Hardware-All

Purpose-Provides two serial data interface circuits that can be configured for either synchronous or asynchronous data communications at rates of up to 64 kbps (synchronous) or 19.2 kbps (asynchronous).

> ***Note:*** Use QPC5 13D with Meridian Mail option and other applications requiring Integrated Services Digital Network (ISDN) Application Protocol.

Quantity-As required per application

QPC579 CPU Function

System Hardware-System option 51/61/71

Purpose—The CPU Function card works in conjunction with the CPU Interface card (QPC580). It contains the main CPU logic circuitry. The CPU provides a 24-bit data bus. The CPU Function card contains a QPC939 system ROM.

Quantity-One per CPU Module

QPC580 CPU Interface

System Hardware-System option 51/61/71

Purpose-Contains the logic required to interface the CPU with the external address bus and detects, identifies and isolates bus faults. Works in conjunction with QPC579 CPU Function card.

Quantity-One per CPU Module

QPC581 Changeover and Memory Arbitrator

System Hardware-System option 51/61/71

Purpose-The Changeover and Memory Arbitrator (CMA) card controls CPU access to the duplicated memory in dual CPU systems, automatically disables faulty memory cards and controls CPU changeover. The CMA switches from one CPU to the other in the event of a CPU fault.

Quantity-Two CMA cards are required per system (one per CPU/Memory configuration).

QPC583 Memory

System Hardware-System option 51/61/71

Purpose-Provides 768K of Random Access Memory (RAM).

Quantity-One per CPU for System option 51/61; two **maximum per System** option 71

QPC584 Mass Storage Interface

System Hardware-System option 51/61/71

Purpose-Interface between the Multi Disk Unit (MDU) and CPU(s). Provides address matching, disk drive control, data buffering and interrupt control circuits.

The MSI is used with the MDU and contains:

-two high capacity floppy disk drives or

-one Winchester disk drive with two high capacity floppy drives as backup

Note: QPC584D or later vintage is required.

Quantity-One MSI circuit card for each CPU/MDU.

QPC687 CPU with SDI/RTC

System Hardware-System option 21 and 21A

Purpose—This is a stand-alone CPU card with error correction, real-time clock, and one SDI port

Note: QPC687B or later vintage is required.

Quantity-One per system

QPC720 Primary Rate Interface

System Hardware-All

Purpose-The ISDN Primary Rate Interface (PRI) card allows twenty three 64 Kbps clear channel operation with a single 64 Kbps common signaling channel. It is used in conjunction with DCHI to provide PRA. The PRI circuit card provides the physical DS-1 interface and is also used for DTI applications.

Quantity-One per Primary Rate Access (PRA) or DTI link

QPC742 Floppy Disk Interface

System Hardware-All

Purpose—Interface between the Floppy Disk Unit (FDU) and one CPU. Provides address matching, disk drive control, data buffering and interrupt control circuits.

Quantity-One per CPU

QPC757 D-Channel Handler Interface

System Hardware-All

Purpose-The D-Channel Handler Interface (DCHI) card processes the LAPD protocol for ISDN primary rate signaling channel and ISDN Signaling Link (ISL). It also provides a single asynchronous Serial Data Interface (SDI) port.

Quantity-One per 16 PRI links to the same location (eight maximum per system)

QPC841 Four-Port Serial Data Interface

System Hardware-All

Purpose-Provides four serial ports between the system processor and an external device. Each port supports

- RS-232-C interface
- 8-bit ASCII data with parity and stop bit
- asynchronous, start-stop operation
- data rates of 300, 600, 1200, 2400, 4800, and 9600 baud
- Data Terminal Equipment (DTE) mode
- Data Communication Equipment (DCE) mode

Quantity-Up to four per system

QPC939 Read-Only Memory

System Hardware-System option 5 1/61/71

Purpose-Read-Only Memory (ROM) daughterboard on the QPC579 CPU Function card.

Quantity-One per CPU

QPC940 Read-Only Memory

System Hardware-System option 21

Purpose-ROM daughterboard on the QPC687 CPU with SDI/RTC card.

Quantity-One per CPU

Peripheral Equipment cards

NT8D01 AD Controller-2

System Hardware-All

Purpose-Provides a primary interface and control function between the Superloop Network card and the IPE Module over up to two 10.24Mbs superloops. Each Controller-2 card serves up to 16 IPE cards.

The Controller-2 card interfaces with up to two NT8D04AA Superloop Network cards. It is equipped with a Motorola 68000-type microprocessor which performs some local call processing and maintenance diagnostics, thus off-loading the system CPU.

Quantity-One per NT8D37 IPE Module

NT8D01 AC Controller-4

System Hardware-All

Purpose-Provides a primary interface and control function between the Superloop Network card and the IPE Module over up to four 10.24Mbs superloops. Each Controller-4 card serves up to 16 IPE cards.

The Controller-4 card interfaces with up to four NT8D04AA Superloop Network cards. It is equipped with a Motorola 68000-type microprocessor which performs some local call processing and maintenance diagnostics, thus off-loading the system CPU.

Quantity-One per NT8D37 IPE Module

NT8D02AA Digital Line card

System Hardware-All

Purpose—Provides interface to up to 16 digital integrated voice and data sets for a total of 32 ports. It is equipped with an Intel 8051-type microprocessor which performs several functions; some of which are as follows:

- control of card operation
- card identification
- self-test
- status reporting to the Controller
- maintenance diagnostics

Quantity-Up to sixteen cards per NT8D37 IPE Module

NT8D03AB Analog Line card

System Hardware-All

Purpose-Provides interface to up to 16 analog sets (500/2500). It is equipped with an Intel 8051-type microprocessor which performs several functions, some of which are as follows:

- control of card operation
- card identification
- self-test
- status reporting to the Controller
- maintenance diagnostics

Quantity-Up to sixteen cards per NT8D37 IPE Module

NT8D09AB Analog Message Waiting Line card

System Hardware—All

Purpose-Provides interface to up to 16 analog sets (500/2500) with Message Waiting lamp feature. It is equipped with an Intel 805 l-type microprocessor which performs several functions, some of which are as follows:

- control of card operation
- card identification
- self-test
- status reporting to the Controller
- maintenance diagnostics

Quantity-Up to sixteen cards per NT8D37 IPE Module

NT8D14AA Universal Trunk

System Hardware-All

Purpose-Provides interface connecting the trunk facility to the NT8D37 IPE Module. It is equipped with an Intel 8052-type microprocessor which performs several functions, some of which are as follows:

- control of card operation
- card identification
- self-test
- status reporting to the Controller
- maintenance diagnostics

This card interfaces eight 600 or 900 Ω trunks with the system in A-Law or µ-Law application. Each of these eight ports can be individually configured to operate as:

- Central Office (CO) trunk
- Direct Inward Dialing (DID) trunk
- 2-way Tie, Dial Repeating (2DR)
- 2-way Tie, Outgoing Automatic Incoming Dial (OAID) trunk
- Outgoing Automatic Number Identification (OANI) trunk
- Recorded Announcement (RAN) trunk
- Music trunk

— Paging trunk

The Universal Trunk card is software selectable and complies with CSA Standard C82.2 No. 0.7 - Ml985 and EIA Standard 464A.

Quantity-Up to sixteen cards per NT8D37 IPE Module

NT8D15AA E&M Trunk

System Hardware-All

Purpose-Used in both A-Law and µ-Law applications. Provides interface connecting the trunk facility to the NT8D37 IPE Module. It is equipped with an Intel 8052-type microprocessor which performs several functions, some of which are as follows:

- control of card operation
- card identification
- self-test
- status reporting to the Controller
- maintenance diagnostics

The E&M Trunk provides four analog trunks, each of which can be individually configured to operate as:

- E&M signaling trunk
- two-wire Tie trunk
- four-wire Tie trunk
- Paging trunk

The E&M Trunk card is software selectable and complies with CSA Standard C82.2 No. 0.7 • Ml985 and EIA Standard 464A.

Quantity-Up to sixteen cards per NT8D37 IPE Module

NT8D16AA Digitone Receiver

System Hardware-All

Purpose--Provides a total of eight channels of Dual Tone Multi Frequency (DTMF) detection. These channels are assigned on the DS30X loop. There is one 8 Kbps signaling channel provided for maintenance messaging and tone reporting.

The NT8D16AA Digitone Receiver allows access to the filters for parameter alterations in order to service different environments (e.g. international applications).

Quantity-Refer ***to System engineering*** (553-3001-151) for engineering details.

QPC62 1.5 Baud Converter

System Hardware-System option 21/51/61/71

Purpose-Used for Remote Peripheral Equipment (RPE) applications. Converts an Sl-1 loop into two carrier loops. Used with 1.5 Mb/s Remote Peripheral Equipment (RPE). Contains switch-selectable line equalizers.

> ***Note:*** QPC62F or later vintage is required.

Quantity-Two for each network loop, one in the local module and one in the remote module

QPC63 Local Carrier Buffer

System Hardware-System option 21/51/61/71

Purpose-Used for RPE applications. Performs the following functions:

- Generates from the 2.048 MHz clock a 1.544 MHz clock
- Decodes and provides enables for outgoing and incoming data
- Delays the data incoming from the carrier so that its frame relative to the outgoing data frame is equivalent to that returning from a peripheral buffer

- Relays line status information to the processor
- Decodes line control information from the processor

Note: QPC63F or later vintage is required.

Quantity-One for each network loop connected to the RPE Module at the local equipment location

QPC65 Rernote Peripheral Switch

System Hardware-System option 21/51/61/71

Purpose-Used for RPE applications. Performs the following functions:

- Module, card, and line enables plus the bypass bit to the modules it serves at the remote site,
- Cyclic scanning of the terminals it serves for incoming signaling messages
- Monitoring of time slot 0 for outgoing messages
- Assembling incoming messages

Note: QPC65G or later vintage is required.

Quantity—One per network loop

QPC66 2M Baud Converter

System Hardware-System option 21/51/61/71

Purpose-Used for RPE applications. Converts two carrier loops in to an Meridian 1 loop.

Note: QPC66E or later vintage is required.

Quantity-Two required for each network loop, one in the local module and one in the remote module.

QPC67 Carrier Maintenance

System Hardware-System option 21/51/61/71

Purpose—Used for RPE applications. Contains an M-type (3017 Hz) **fault-**locate filter. Provides DC detection circuitry for the fault-locate pair, and carrier loopback relays to facilitate software maintenance testing. Terminates and gives access to the order wire pair via a jack and binding posts on the faceplate.

Note: QPC67E or later vintage is required.

Quantity—One per RPE Module

QPC71 E&M/DX Signaling and Paging Trunk

System Hardware-All

Purpose-Used in μ-Law applications in one of the following ways to interface with appropriate types of trunk facilities:

— E&M signaling, 2-way dial repeating trunk

— 2-wire DX signaling, 2-way dial repeating trunk

— 4-wire DX signaling, 2-way dial repeating trunk (a 24V4 repeater, externally mounted, converts the trunk from 2- to 4-wire) --

— paging trunk or externally mounted loudspeaker

Refer to ***E&M/DX signaling and paging trunk- Circuit description*** (553-2001-187) for more details.

Each card contains two separate, identical trunk circuits. Trunk usage option is selected by switches on the circuit card.

Note: QPC7 1F or later vintage is required.

Quantity-One per two trunk circuits

QPC99 Carrier Interface

System Hardware-System option 21/51/61/71

Purpose-Used for RPE applications. Contains two carrier line receivers with **7.5 dB pads built-in. Converts bipolar line signals into TTL level** signals. Provides facilities for carrier looping. Monitors **system** and invokes emergency transfer if carrier fails.

Note: QPC99F or later vintage is required.

Quantity-Two per network loop

QPC1 92 Off-Premises Extension Line

System Hardware-All

Purpose---The Off-Premises Extension (OPX) line circuit interfaces with 500/2500-type sets in µ-Law applications. The loop range from the PE Module to station apparatus is 1400 Ω excluding the set. This trunk may also be used when the line-to-line loss required is less than 5 dB. Refer to ***50012500 line packs-Description and operation*** (553-2201-183) for more information.

Quantity-One per two OPX lines

QPC237 4-wire E&M/DX signaling trunk

System Hardware-All

Purpose!-Used in µ-Law applications in one of the following modes to interface with appropriate types of trunk facilities:

- E&M Signaling, 2-way dial repeating trunk
- 4-wire DX signaling, 2-way dial repeating trunk (QPC237A/B only)

Each trunk card has two separate, identical trunk circuits with a balanced terminating impedance of 600 Ω. Trunk usage options are selected by option switches on the pack. Refer ***to Four-wire E&M/DX trunk circuit description*** (553-2001-190).

Note: QPC237D or later vintage is required.

Quantity-Maximum of 10 cards per NT8D13 PE Module

QPC250 Release Link Trunk

System Hardware-All

Purpose-Used to interface a remote system, arranged for the Centralized Attendant Service (CAS) option, with the main system where CAS attendant is located. Refer to ***Centralized Attendant Service (CAS) — Feature description and engineering*** (553-2681-100) **and *Release Link Trunk- Description, operation, and installation*** (553-2681-180) for more information.

The card contains two separate, identical trunk circuits, with balanced terminating impedance of 900 **Ω.**

Note: QPC250B or later vintage is required.

Quantity-One per two Release Link Trunks

QPC297 Attendant Console Monitor

System Hardware—All

Purpose-Interfaces attendant consoles (including add-on modules) when the supervisory console feature is used. Allows the supervisory attendant to monitor calls being handled by attendants within the customer group.

Quantity-One per M1250/QCW4 console in systems using Supervisory Console feature

QPC422 Tone Detector

System Hardware-All

Purpose--Identifies tones and reports to CPU appropriately. Each card contains two tone detector circuits controlled by two microprocessors. Refer to ***Tone Detector — Circuit description*** (553-2001- 191) for more information.

Quantity-One per system

QPC430 Asynchronous Interface Line

System Hardware-All

Purpose-Provides four asynchronous line ports. Used in the SL- 1 Data Feature to interface to data equipment conforming to the EIA RS-422 standard. Refer ***to SL-1 Data Feature-General-description and provisioning*** (553-2731-100) for more information.

> ***Note:*** QPC430F or later vintage is required.

Quantity-One per four data lines

QPC432 4-Port Data Line

System Hardware-All

Purpose-Provides four data-only ports for the SL-1 Dam Feature. Refer to ***SL-1 Data Feature — General description and provisioning (553-273*** 1-100) for more information.

> ***Note:*** QPC432C or later vintage is required.

Quantity—One per four data ports

QPC449 Loop Signaling Trunk

System Hardware!-All

Purpose-Interfaces the following 600 or 900 Ω trunks in p-Law applications:

- Direct Inward Dialing (DID)
- 2-way Tie, Dial Repeating (2DR)
- 2-way Tie, Outgoing Automatic Incoming Dial (OAID)
- Outgoing Automatic Number Identification (OANI)

The card contains four separate identical trunk circuits. Trunk usage option is selected by switches on the circuit card. Refer ***to Circuit pack option settings*** (553-3001-211) for more information.

Quantity-One per four loop signaling trunks

QPC450 CO/FX/WATS Trunk

System Hardware-All

Purpose-Interfaces four 600 or 900 Ω CO, FX or WATS trunks with the system in µ-Law applications. The card can also detect ringing on either the tip or ring leads and has provision to extend the normal loop range from 1200 Ω to 2600 Ω using balanced battery boost from the Central Office. Refer to ***CO/FX/WATS trunk engineering description (*** 553-2201-185) for more information.

The card contains four separate identical trunk circuits. Trunk usage option is selected by switches on the circuit card.

Note: QPC450E or later vintage is required.

Quantity-One per four CO/IX/WATS trunks

QPC578 Integrated Services Digital Line

System Hardware-All

Purpose-Interfaces the Digital telephone sets and the associated ASCII terminals on Time Compression Multiplexing (TCM) loops to the system. Each card contains 16 separate line circuits, 8 Data circuits and 8 Voice-circuits.

Quantity--One per 16 digital lines

QPC594 16-Port 500/2500 Line

System Hardware-All

Purpose-Allows for 16 circuits per card (quad density) using p-law.

Quantity-One per 16 500/2500 lines

QPC659 Dual Loop Peripheral Buffer

System Hardware-All

Purpose-Interfaces one or two network loops. Also, a Digitone daughterboard can be used to convert multifrequency dialing signals from a

DIGITONE station to dc pulses suitable for processing in the system control.

Quantity-One per NT8D13 PE Module

QPC723 RS-232 4-Port Interface Line

System Hardware-All

Purpose-This card provides four direct interfaces to RS-232 asynchronous ASCII computer equipment, such as asynchronous hosts, modems, standard off-the-shelf X.25 Packet Assembler/Disassembler (PAD), data PABXs and multiplexers.

Quantity-One per NT8D13 PE Module

QPC789 16-Port 500/2500 Line (Message Waiting)

System Hardware-All

Purpose--Provides interface to up to 16 analog sets (500/2500) with Message Waiting lamp feature.

Quantity-One per 16 500/2500 **Message** Waiting lines

QPC91 8 High-Speed Data Card

System Hardware-All

Purpose-Supports two data ports that operate independently of each other in synchronous/ssynchronous mode. Interfaces with any port on the QPC432 4-Port Data Line Card.

The High-Speed Data Card (HSDC) provides an interface to high speed synchronous devices, such as front end processors or video conferencing ports, through the Multi-Channel System (MCDS) and the PBX. In synchronous mode, it supports data speeds of up to 64 kbps. Refer to *QPC918 High-Speed Data Card -Description, installation, and operation* (553-2731-108) for more information.

Quantity-As required

Station equipment

Meridian Modular Telephanes

The Meridian Modular Telephones are designed to provide cost effective integrated voice and data communication capability.

The following Meridian Modular Telephones are available:

- **M2006—a** single line telephone with 6 programmable keys
- **M2008—a** multi-line set with 8 programmable keys
- **M2616—a** high performance multi-line set with 16 programmable keys and integrated **Handsfree** unit
- **M2016S—a** Telephone Security Group Class II approved telephone designed to provide on-hook security. It is similar to the M2616, with 16 programmable keys, but has no handsfree capability.
- **M2216ACD-1—a** multi-line set for ACD operations. It has 15 programmable function keys, a special ACD Display Module and two FU-32 jacks for modular **electret** headsets
- **M2216ACD-2—a** multi-line set for ACD operations. It has 15 programmable function keys, and a special ACD Display. It is similar to model 1, but with one PJ-327 jack for a carbon agent headset and one RJ-32 jack for an **electret** supervisor headset

The following hardware options can be add on to Meridian Modular Telephones:

- External Alerter Interface Board
- Display Module
- Programmable Data Adapter

— Key Expansion Module

Table 1 lists the ordering codes for the Meridian Modular Telephones, alone and with hardware options installed.

Table 2 lists the hardware options that can be purchased separately, and Table 3 lists miscellaneous items.

Refer to ***Meridian Modular Telephones-Description and specifications*** (553-2201-116) for additional information.

Table **1**
Order codes **for Meridian Modular Telephones and factory installed options**

Description	Ordering code
M2006 (Basic)	
Black	NTZK06AA-03
Chameleon Ash	NTZK06AA-35
Dolphin Gray	NTZK06AA-93
M2006 (with MPDA)	
Black	NTZK06AB-03 (with power board)
Chameleon Ash	NTZK06AB-35 (with power board)
Dolphin Gray	NTZK06AB-93 (with power board)
M2008 (Basic)	
Black	NTZK08AA-03
Chameleon Ash	NTZK08AA-35
Dolphin Gray	NTZK08AA-93

-continued —

Table 1
Order codes for Meridian Modular Telephones and factory installed options (continued)

Description	Ordering code
M2008 (with MPDA)	
Black	NTZK08AB-03 (with power board)
Chameleon Ash	NTZK08AB-35 (with power board)
Dolphin Gray	NTZK08AB-93 (with power board)
M2008 (with Display)	
Black	NTZK08BA-03 (with power board)
Chameleon Ash	NTZK08BA-35 (with power board)
Dolphin Gray	NTZK08BA-93 (with power board)
M2008 (with MPDA and Display)	
Black	NTZK08BB-03 (with power board)
Chameleon Ash	NTZK08BB-35 (with power board)
Dolphin Gray	NTZK08BB-93 (with power board)
M2616 (basic)	
Black	NTZK16AA-03
Chameleon Ash	NTZK16AA-35
Dolphin Gray	NTZK16AA-93
M2616 (with MPDA)	
Black	NTZK16AB-03 (with power board)
Chameleon Ash	NTZK1 6AB-35 (with power board)
Dolphin Gray	NTZK16AB-93 (with power board)

-continued —

Table 1
Order codes for Meridian Modular Telephones and factory installed options (continued)

Description	Ordering code
M2616 (with Display)	
Black	NTZK16BA-03
Chameleon Ash	NTZK16BA-35
Dolphin Gray	NTZK16BA-93
M2616 (with MPDA and Display)	
Black	NTZK16BB-03 (with power board)
Chameleon Ash	NTZK16BB-35 (with power board)
Dolphin Gray	NTZK16BB-93 (with power board)
M2016S (basic)	
Black	NTZK20AA-03 (with power board)
Chameleon Ash	NTZK20AA-35 (with power board)
Dolphin Gray	NTZK20AA-93 (with power board)
M2016S (with MPDA)	
Black	NTZK20AB-03 (with power board)
Chameleon Ash	NTZK20AB-35 (with power board)
Dolphin Gray	NTZK20AB-93 (with power board)

-continued —

Table 1
Order codes for Meridian Modular Telephones and factory installed options (continued)

Description ,	Ordering code
M2016S (with Display)	
Black	NTZK20BA-03 (with power board)
Chameleon Ash	NTZK20BA-35 (with power board)
Dolphin Gray	NTZK20BA-93 (with power board)
M2016S (with MPDA and Display)	
Black	
Chameleon Ash	NTZK20BB-03 (with power board)
Dolphin Gray	NTZK20BB-35 (with power board)
	NTZK20BB-93 (with power board)
M2216ACD-1 (basic-with ACD Display)	
Black	NTZK22AA-03
Chameleon Ash	NTZK22AA-35
Dolphin Gray	NTZK22AA-93
M2216ACP1 (with MPDA and ACD Display)	
Black	NTZK22AB-03 (with power board)
Chameleon Ash	NTZK22AB-35 (with power board)
Dolphin Gray	NTZK22AB-93 (with power board)

-continued —

Table 1
Order codes for Meridian Modular Telephones and factory installed options (continued)

Description	Ordering code
M2216ACP2 (basic-with ACD Display)	
Black	NTZK23AA-03 (with power board)
Chameleon Ash	NTZK23AA-35 (with power board)
Dolphin Gray	NTZK23AA-93 (with power board)
M2216ACD-2 (with MPDA)	
Black	NTZK23AB-03 (with power board)
Chameleon Ash	NTZK23AB-35 (with power board)
Dolphin Gray	NTZK23AB-93 (with power board)

Table 2
Ordering codes for optional hardware

Description	Ordering code	Additional requirements
Meridian Progfammabie Data Adapter	NT2K64WA	Power Supply Board
Display Module		Power Supply Board (M2008)
Black	NT2K24WA-03	
Chameleon Ash	NT2K24WA-35	
Dolphin Gray	NT2K24WA-93	
ACD Display Module		Power Supply Board (M2008)
Black	NT2K25YH-03	
Chameleon Ash	NT2K25YH-35	
Dolphin Gray	NT2K25YH-93	
Top cover filler plate		
Black	PO778303-03	
Chameleon Ash	PO77833535	
Dolphin Gray	PO778393-93	
22 Key Expansion Module		Power Supply Board
Black	NT2K22WA-03	
Chameleon Ash	NT2K22WA-35	
Dolphin Gray	NT2K22WA-93	
Single Key Module Footstand		
Black	PO7801 03-03	
Chameleon Ash	PO7801 35-35	
Dolphin Gray	PO7801 93-93	

-continued -

Table 2
Ordering codes for optional hardware (continued)

Description	Ordering code	Additional requirements
Double Key Module Footstand		
Black	PO780203-03	
Chameleon Ash	PO78023535	
Dolphin Gray	PO780293-93	
External Alerter Interface	NT2K40WA	Power Supply Board
Power Supply Board	NT2K1OWA	Transformer or closet power
120 V Transformer	A0367335	Power Supply Board
240 V Transformer	A036791 4	Power Supply Board

Table 3
Ordering codes for miscellaneous items

Description	Ordering code
Card, Directory Number	
Black	PO665352
Chameleon Ash	PO665352
Dolphin Gray	PO652746
Card, key labels	PO657709
Lens, Directory Number	PO652720
Handset	
Black	A0338908
Chameleon Ash	A0329 173
Dolphin Gray	A03291 74
Handset cord, 2.7m. (9 ft)	
Black	A0334590
Chameleon Ash	A031 8327
Dolphin Gray	A031 8330
Handset cord, 3.6 m. (12 ft)	
Black	A0274233
Chameleon Ash	A0274243
Dolphin Gray	A031 4423
Line cord	A0346862

-continued —

Table 3
Ordering codes for miscellaneous items (continued)

Description	Ordering code
Set User Guide (regular)	PO703991
Set Reference Card	PO704094
Display Module Reference Card	PO704096
Display Installation Sheet	PO706836
Meridian Programmable Data Adapter User Guide	PO705986
M2216ACD User Guide	PO704747
ACD Reference Card	PO705952

M2000 series digital telephones

The following types of M2000 digital telephones are available for integrated voice and data communications:

- The M2009 (NT1F05) has 9 keys for features and lines
- The M2018 (NT1F07) has 18 keys for features and lines
- The M2112 (NT1F07) has 12 keys which are as follows:
  - 11 keys for features and lines
  - one key to control the built-in handsfree feature
- The M2317 has 17 keys which are as follows:
  - 11 programmable keys
  - one key to control the built-in handsfree feature
  - five soft keys which are programmable for software features

An asynchronous data option circuit board (NT1F09) and data option power supply (NPS50220-04L1) are available for the M2000 series digital telephones to provide for connecting data terminals to the sets.

For additional information on these telephones, refer to *M2000 Digital Telephones • Description, Installation, Operation, and Maintenance* (553-2201-110).

M3000 Touchphone

The M3000 (NT1F1 1) Touchphone is a digital integrated voice and data telephone with a touch sensitive Liquid Crystal Display (LCD) screen for feature implementation. Refer to *Meridian M3000 Touchphone — Description, installation, operation, and maintenance* (553-2201-115) for additional information.

An asynchronous data option circuit board (NT1F10) and data option power supply (TEC 00020) are available to provide for connecting data terminals to the sets.

NE-500/2500 telephone set

These are standard single line 500-type rotary dial sets and 2500-type Digitone pushbutton dial sets that may be used with the Meridian 1 system.

Standard 48-V talk battery and 20-Hz ringing voltage are available so that conventional equipment such as telephone answering, dictation, data sets, modems, key telephones, can be used with the Meridian 1 system.

If the message waiting lamp feature is required, use NE-500YR, NE-2500YQA sets.

Ml250 and 2250 attendant consoles

The Ml250 and M2250 incorporate design improvements based on the Attendant Console QCW4E and are functionally compatible with the QCW4. The Ml250 is driven and powered by analog line cards and is compatible with QCW4 console cabling schemes. The M2250 is driven and powered by a digital line card and has a modified cabling scheme. The following list describes the applications for SL-1 System attendant consoles.

- The Ml250 is designed to work in analog mode and functions through an analog line card when connected to a digital switch.

- The M2250 is a digital version of the M1250, offering additional features. A digital link connects the M2250 to the switch.

Refer to *M1250* and *M2250* Attendant ***Consoles description*** (553-2201-117) for additional information.

Attendant administration overlay template

This plastic overlay is placed over the attendant console to indicate the key functions when using the Attendant Administration feature. Order number is PO613887. Refer ***to X11 features and services*** (553-3001-305) for more details.

QMT1 and QMT2 key/lamp expansion modules

These modules allow the expansion of key/lamp field of QSU-type telephone sets or QCW-type attendant consoles for additional directory number and feature activation facilities. These modules require a local 24 V plug-in transformer or a QUT1 centralized power unit.

- QMT1 - consists of one Xl-button nonlocking key strip
- QMT2 - consists of two lo-button nonlocking key strips.

QMT3 lamp field array module

This is an add-on module for QSU-type telephone sets or QCW-type attendant consoles to display the busy-idle status of 150 consecutive stations. It requires a local 15 V plug-in transformer or a QUT1 centralized power unit. Refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml000 Series Telephones description*** (553-2001-l 10) for more information.

QMT4 handset module

This module is used as a handset cradle to hold the attendant console handset. No active components are contained inside the module.

This module includes the NE-G3 handset. It may be attached to the console or left freestanding. It contains two jacks to accommodate a standard headset or handset plug when module is attached to the console. It also allows hearing aids to be coupled with telephone adaptors to the handsets. Refer to ***Attendant Consoles and Add-On Modules-Description*** (553-2001-l 15) for more information.

If QCW4E or later vintage is used, either a QMT4C must be used or the QMT4A or QMT4B must be used as standalone cradles.

QMT1 1 asynchronous/ synchronous interface module

The Asynchronous/Synchronous Interface Module (ASIM) is similar to the QMT9 but provides added dialing capabilities and six data feature keys and associated lamps and data control switches. Refer ***to SL-1 Data Feature — General description andprovisioning*** (553-2731-100) for more information.

QMT12 add-on data module

The synchronous ADM provides a CCITT V.35 interface between the Meridian 1 system and customer-supplied dam equipment. Refer to ***SL-1 Data Feature-General description and provisionin*** (553-2731-100) for more information.

Each ADM requires a local supplementary power supply such as the PO593922 or PO610756 transformer.

QMT1 5 amplified handset module

This module is similar to the QMT4 module, with addition of an amplifier for the hearing impaired. It includes a volume control, 2 headset plugs on the right side of the module which plug into the headset jacks on the console. It also has 2 headset/handset plugs on the left side. One (attendant jack) is under control of the amplifier; the second (supervisor jack) cannot have its volume adjusted.

QMT21 high-speed data module

This module is similar to the QMT11 module. It provides RS-232/V.35 interface and allows synchronous data transmission of up to 64 kbps. It provides connectivity to the Data Terminal Equipment (DTE) for intra-switch communications, as well as wide area communications over DTI/PRI links to other Northern Telecom switches. Refer to ***QMT21 High-Speed Data Module -Description, installation, and operation*** (553-2731-107) for more information.

QUS1 logic handsfree unit

This unit provides handsfree voice switching facilities on the SL-1 telephone. Refer to 512-6251-200 for a complete description.

QKK1 handsfree remote powering kit

This kit is used to modify SL- 1 telephone sets for use with the QUS 1 Logic handsfree unit and to extend the SL-1 set operating range from 1830 m (6000 ft) to 2438 m (8000 ft). It requires a 24 V ac local transformer (ordered separately).

This kit is field-installable inside a set. Refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml000 Series Telephones description*** (553-2001-l 10) for more information.

QKK3 automatic handsfree interface kit

This kit is the same as QKK1 for systems with the Automatic Answer feature. It automatically answers calls after a single ring (see QKK8 and refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml000 Series Telephones description*** (553-2001-l 10)).

QKK8 automatic handsfree interface kit

This kit is the same as QKK3 but for QSU71 sets only.

QKM13 light probe kit

This kit enables a sight-impaired person to use existing consoles and SL-1 sets. The probe consists of a small hand-held box with a light sensor. When the sensor is placed over an LED that is on, a tone is heard in the handset or headset, Refer to ***Attendant Consoles and Add-On Modules description*** (553-2001-l 15) for more information. Two PO590352 connector kits are required to install the light probe into an SL-1 set.

QKN1 headset kit

This kit is used to modify QSU-type telephone set for NE-52-type Venture 1 or equivalent headset operation. Refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml 000 Series Telephones description*** (553-2001-l 10) for more information.

This kit provides the following features:

- field-installable inside a set
- jack and ON-OFF switch are located in the filler plate position on the left-hand side of the set

— no supplementary power is required

QSR2 venture 1 headset

This set is used in conjunction with the QKN1 headset kit to provide head telephone set operation. Refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml 000 Series Telephones description*** (553-2001-110) for more information.

This headset provides the following features:

lightweight (17 g)

— ear-mounted — left or right

— six different sizes of eartips

— acoustic, noise-canceling transmitter held close to user's mouth by a thin, plastic covered, stainless steel arm attached to the headset capsule

QSAM2A and QSAM3A group listening switch kit

This kit allows the speech of both parties to be heard through the speaker of the SL-1 set. Refer to ***QSU-Telephone Sets, Add-On Modules, interface kits and Meridian Ml000 Series Telephones description*** (553-2001-l 10) for more information.

An ON/OFF switch is mounted in the left-hand filler plate of a QSU-type set. When ON, the speech of the SL-1 set user and the connected party are heard through the speaker of the SL-1 set. When OFF, the SL-1 set functions normally.

— QSAM2A used on phase I SL-1 sets

— QSAM3A used on phase II SL-1 sets, (QSU1F and later vintage)

Asynchronous data options

These microprocessor-controlled devices provide the interface (RS-232 compatible) through which ASCII Data Terminal Equipment (DTE) may be connected to the Meridian 1 network. Two types of asynchronous data options are available for use with the following digital telephones:

— NT1F09AA printed circuit board for use with M2009, M2018 and M2112 digital telephones. Refer to ***Meridian M2000 Digital***

Telephones -Description, installation, operation, and maintenance (553-2201-l 10) for more information.

— NT1F10AA printed circuit board assembly and housing for M3000 digital touchphone. Refer to *Meridian M3000 Touchphone — Description, installation, operation, and maintenance* (553-2201-l 15) for additional information.

The following features are available:

— Automatic data rate detection at all rates using the ASCII "Carriage Return" character

— Keyboard dialing for originating data calls to local and remote hosts or DTE from the terminal keyboard

— Break detection and generation

Meridian programmable data adapter

This adapter provides the interface (RS-232 compatible) through which ASCII Data Terminal Equipment (DTE) may be connected to the Meridian 1 network. It is available with the M2006, M2008, M2016S, and M2616 Meridian Modular Telephones

Some of the features available are as follows:

— keyboard dialing for originating data calls to local or remote hosts or DTE

— telephone keypad dialing for originating and releasing data calls

— parameter setting from telephone keypad

— voice call origination from terminal keyboard

— script file capabilities to pre-program resource locations via mnemonic address names

Teledapt™

Teledapt standardized telephone connectorization for QSU-type sets provides an alternative to the conventional spade tip form of set termination.

QSU-type sets possessing the Teledapt capability are designated by " QM" suffix on the set code (i.e., the QSU1EQM). while "QM" sets use a 2 m (7 ft) cord, the NE-D6QF Teledapt cord assembly may be ordered separately in 2 m (7 ft), 4 m (14 ft), or 7.5 m (25 ft) lengths for conversion of existing SL-1 sets. These assemblies are compatible only with the Teledapt jacks designed for the system.

Station equipment replaceable items

Table 4 lists the individual parts of the station equipment that are field-replaceable. These parts may be ordered by using the given apparatus number.

Table 4
Station equipment replaceable items

Equipment	Replaceable items	Apparatus number
QCW-Type Attendant Consoles	Cover Assembly	PO538435
	Attendant Administration Overlay	PO61 3887
	Console Caps Package	PO58631 2
	Bezel	PO567037
	Bezel	PO578254
QCW1, QCW2 only	Dial Pad	PO536503
	LED Assembly (1 strip)	PO548801
	LED Assembly (2 strips)	PO548799
	LED Assembly (3 strips)	PO548800
	Line Cord	NE-D50QE-35
	8-Digit Display (QCW2)	PO578270
QCW3, QCW4 only (see Note)	Key button strip PCB (QCW3 only)	QPC246
	Key button strip PCB	QPC247
	Key button strip PCB	QPC248
M2006, M2008, M2016S, M2216, and M2616 sets	Directory Number Card	P0665352, PO652740
	Key Label Card	PO657709
	Directory Number Lens	PO652720
	Handset	
	Black	A0338908
	Chameleon Ash	A03291 73
	Dolphin Gray	A0329 174
	Handset Cord (2.7 m/g ft)	
	Black	A0334590

-continued -

Table 4
Station equipment replaceable items (continued)

Equipment	Replaceable items	Apparatus number
	Chameleon Ash	AO318327
	Dolphin Gray	A031 8330
	Handset Cord (3.6 m/l 2 ft)	
	Black	A0274233
	Chameleon Ash	A0274243
	Dolphin Gray	A031 4423
	Line Cord	A0346862
All Sets and Consoles	Card Holder	PO535652
	Filler Plate	PO523535

Note: **The QCW3 houses one QPC246, one QPC247 and one QPC248. The QCW4 houses one QPC247 and two QPC248 PCBs (right and left).**

Cabling

The cables are differentiated by the cabling method used. Two types of cables are available.

Intra-UEM cables are cables that connect to different cards within a UEM, or cables that go to the I/O connector panels at the rear of the UEM.

Intra-UEM cables are not shielded. These cables arc typically round and use bail locks or screws to prevent accidental removal.

Inter-UEM cables are cables that are routed internally between UEMs. These cables are used primarily for interconnecting the following subsystems together:

— CPU to CPU

— CPU to Network

— Network to Network

— Network to Peripheral Equipment

All of the faceplate connectors use a 90-degree cable egress and all of the backplane connectors use a 180-degree cable egress.

NT7D1 1AE module-to-module power harness

Purpose-This power wiring harness is used in DC modules to connect the input DC power and speed control signals vertically through the column. It is constructed in a modular form, and can be disconnected when necessary to allow for the removal and/or replacement of modules. The DC power harness is larger than that of the AC system since it requires the use of more input wires in order to handle the lower voltage and its associated higher current.

NT8D40AA AC power cord

Purpose-This cable conducts AC power into the pedestal for AC systems. It is 9.1 m (30 ft) long.

NT8D40AM module-to-module power harness

Purpose--This power wiring harness is used in AC modules to connect the input AC power and speed control signals vertically through the column. It is constructed in a modular form, and can be disconnected when necessary to allow for the removal and/or replacement of modules.

NT8D40AY AC power cord

Purpose-This cable conducts AC power into the pedestal for System options 21A. It is 2.7 m (9 ft) long.

NT8D40BJ System Monitor to backplane cable

Purpose--This cable is used for System option 21A. It connects the System Monitor to the common/peripheral equipment backplane to allow control and monitoring of the system.

NT8D40BK System Monitor trip cable

Purpose-This internal cable is used for System option 21A. It connects the System Monitor to the power distribution unit. It allows the System Monitor to trip the circuit breaker.

NT8D46AA System Monitor column cable

Purpose!-This cable is used to connect the monitoring signals vertically through the column. It is constructed in a modular form, and can be disconnected when necessary to allow for the removal and/or replacement of modules.

NT8D46AC Thermostat harness

Purpose-The thermostat harness is part of the Temperature Sensor Assembly. It contains two thermal sensors and a fault LED. At 70degree Celsius, the thermal sensors trip and cause system shutdown. The thermostat harness plugs into the backplane of the top module.

NT8D46AD System Monitor SDI cable

Purpose—This cable is used to connect **an** SDI card to the System **Monitor.** It replaces the NT8D46AA System Monitor column cable when the SDI is in the same UEM.

NT8D46AG System Monitor to SDI paddle board cable

Purpose-This cable is used to connect the System Monitor to the NT8D41AA SDI paddle board (dual port). It replaces the NT8D46AA System Monitor column cable when the NT8D41AA SDI paddle board (dual port) is in the same UEM.

NT8D46AH System Monitor to MDF cable

Purpose-This cable is used to connect the System Monitor Power Fail Transfer Unit to the MDF.

This cable is 9.7 m (32 ft) long.

NT8D46AJ System Monitor to UPS (Best) cable

Purpose-This cable is used to connect the System Monitor to the Best Uninterruptable Power Supply (UPS). It is used for UPS monitoring.

This cable is 13.7 m (45 ft) long.

NT8D46AL System Monitor Serial Link cable

Purpose-This cable is used to connect the System Monitor from one column to another.

This cable is 2.1 m (7 ft) long.

NT8D46AM Air Probe harness AC

Purpose-The Air Probe harness AC is part of the Temperature Sensor Assembly and is used in AC systems. It uses a 24-pin connector. It senses exit air temperature and relates the information to the blower unit.

NT8D46AP Extended System' Monitor Serial Link cable

Purpose-This cable is used to connect the System Monitor from one column to another.

This cable is 7.6 m (25 ft) long.

NT8D46AQ System Monitor to UPS (Exide) cable

Purpose—This cable is used to connect the System Monitor to the Exide UPS. It is used for UPS monitoring.

This cable is 13.7 m (45 ft) long.

NT8D46AS System Monitor inter-CPU cable

Purpose--This cable is used to connect the dual CPUs in Meridian 1 System option 71 together for System Monitor monitoring. It replaces the NT8D46AA System Monitor column cable in both CPU modules.

NT8D46AT System Monitor to QBL15 cable

Purpose-This cable connects the System Monitor to the QBL15 power/battery distribution box. It is used to monitor the DC power plant.

This cable is 9.7 m (32 ft) long.

NT8D46AU System Monitor to UPS (Alpha) cable

Purpose-This cable is used to connect the System Monitor to the Alpha UPS. It is used for UPS monitoring.

This cable is 13.7 m (45 ft) long.

NT8D46AV System Monitor to QCA13 cable

Purpose—This cable connects the System Monitor to the QCA13 DC power plant. It is used to monitor the DC power plant.

This cable is 9.7 m (32 ft) long.

NT8D46AW System Monitor to QBL12 cable

Purpose—This cable connects the System Monitor to the QBL12 battery distribution box. It is used to monitor the DC power plant.

This cable is 9.7 m (32 ft) long.

NT8D46DC Air Probe harness DC

Purpose-The Air Probe harness DC is part of the Temperature Sensor Assembly and is used in DC systems. It uses a 36-pin connector. It senses exit air temperature and relates the information to the blower unit.

NT8D73 Inter-cabinet Network cable

Purpose--This cable is used to interconnect QPC414 Network cards:

— from Network Module to PE Module via the I/O connector panels

— from QCA55 cabinet to PE Module

This cable is available in the following lengths:

— NT8D73AD 1.8 m (6 ft)

— NT8D73AF 3.6 m (12 ft)

— NT8D73AL 6 m (20 ft)

— NT8D73AS 9.1 m (30 ft)

NT8D74 Clock Controller to Inter Group cable

Purpose-This cable is used to connect the QPC47 1 Clock Controller card to the NT8D36AA Inter Group Module.

This cable is available in the following lengths:

— NT8D74AC 1.2 m (4 ft)

— NT8D74AD 1.8 m (6 ft)

— NT8D74AE 2.4 m (8 ft)

— NT8D74AF 3 m (10 ft)

— NT8D74A.I 4.8 m (16 ft)

NT8D75 Clock Controller to Clock Controller cable

Purpose-This cable is used to interconnect QPC471 Clock Controller cards.

This cable is available in the following lengths:

- NT8D75AC 1.2 m (4 ft)
- NT8D75AD 1.8 m (6 ft)

NT8D76 Intergroup Switch to Inter Group cable

Purpose-This cable is used to connect the QPC412 Intergroup Switch card to the NT8D36AA Inter Group Module.

This cable is available in the following lengths:

- NT8D76AC 1.2 m (4 ft)
- NT8D76AD 1.8 m (6 ft)
- NT8D76AE 2.4 m (8 ft)
- NT8D76AF 3 m (10 ft)
- NT8D76AG 3.6 m (12 ft)
- NT8D76A.l 4.8 m (16 ft)
- NT8D76AL 6 m (20 ft)
- NT8D76AP 7.6 m (25 ft)

NT8D77 FDI to FDU cable

Purpose!-This cable is used to connect the QPC742 FDI card to the NT8D68AA FDU card.

This cable is available in the following lengths:

- NT8D77AB 0.6 m (2 ft)
- NT8D77AA 0.9 m (3 ft)
- NT8D77AC 1.2 m (4 ft)
- NT8D77AD 1.8 m (6 ft)

NT8D78AA CPU cable

Purpose-This cable is used to connect the QPC580 CPU Interface card to QPC579 CPU Function card.

This cable is 5 cm (2 in.) long.

NT8D79 PRI/DTI to Clock Controller cable

Purpose--This cable is used to connect the PRI/DTI card to the QPC471 Clock Controller card.

This cable is available in the following lengths:

— NT8D79AB 0.6 m (2 ft)

— NT8D79AC 1.2 m (4 ft)

— NT8D79AD 1.8 m (6 ft)

— NT8D79AE 2.4 m (8 ft)

— NT8D79AF 3 m (10 ft)

NT8D80 CPU interface cable

Purpose-This cable is used to connect the following:

— QPC581 CMA card to QPC581 CMA card in a dual CPU configuration

— QPC584 MSI card to NT8D69AA MDU

— QPC215 Segmented Bus Extender in CPU to Network via QPC441 3PE

— QPC441 3PE in Network 0 to QPC441 3PE in Network 1 (Meridian 1 System option 61 only)

This cable is available in the following lengths:

— NT8D80AB 0.6 m (2 ft)

— NT8D80AC 1.2 m (4 ft)

— NT8D80AZ 1.5 m (5 ft)

— NT8D80AD 1.8 m (6 ft)

— NT8D80AE 2.4 m (8 ft)

- NT8D80AF 3 m (10 ft)
- NT8D80AG 3.6 m (12 ft)
- NT8D80AJ 4.8 m (16 ft)
- NT8D80AL 6 m (20 ft)
- NT8D80AP 7.6 m (25 ft)

NT8D81AA Tip and Ring cable

Purpose-This cable is used to connect a line card to the I/O connector panel.

This cable is 50 cm (20 in.) long.

NT8D82 SDI to I/O cable

Purpose-This cable is used to connect the the following cards to the I/O connector panel:

- QPC757 D-Channel Handler Interface
- QPC513 Enhanced Serial Data Interface
- QPC84 1 Four-Port Serial Data Interface
- QPC687 CPU with SDI/ RTC

This cable is available in the following lengths:

- NT8D82AC 1.2 m (4 ft)
- NT8D82AD 1.8 m (6 ft)

NT8D83 PRI/DTI to I/O cable

Purpose-This cable is used to connect the PRI/DTI card (T1 port) to the I/O connector panel.

This cable is available in the following lengths:

- NT8D83AC 1.2 m (4 ft)
- NT8D83AD 1.8 m (6 ft)

NT8D84AA SDI paddle board (dual. port) to I/O cable

Purpose-This cable is used to connect the NT8D41AA SDI paddle board (dual port) to the I/O connector panel.

This cable is 45.7 cm (18 in.) long.

NT8D85 Network to PE cable

Purpose-This cable is used to connect the following:

- QPC58 1 CMA card to QPC58 1 CMA card in dual CPU configuration
- QPC414 Network card to PRI/DTI card
- QPC414 Network card to QPC659 Dual Loop Peripheral Buffer card (for internal cabling only)
- QPC659 Dual Loop Peripheral Buffer card to QPC659 Dual Loop Peripheral Buffer card when connecting two NT8D13 PE Modules together

This cable is available in the following lengths:

- NT8D85AB 0.6 m (2 ft)
- NT8D85AC 1.2 m (4 ft)
- NT8D85AZ 1.5 m (5 ft)
- NT8D85AD 1.8 m (6 ft)
- NT8D85AE 2.4 m (8 ft)
- NT8D85AF 3 m (10 ft)
- NT8D85AJ 4.8 m (16 ft)
- NT8D85AL 6 m (20 ft)
- NT8D85AP 7.6 m (25 ft)
- NT8D85AT 10.6 m (35 ft)
- NT8D85AV 13.7 m (45 ft)

NT8D86 Network to I/O cable-

Purpose!-This cable is used to connect the following to the I/O connector panel:

- QPC414 Network card
- PRI/DTI card
- QPC659 Dual Loop Peripheral Buffer card
- NT8D47 RPE

This cable is available in the following lengths:

- NT8D86AC 1.5 m (5 ft)
- NT8D86AD 1.8 m (6 ft)

NT8D87 Conference/TDS to music trunk cable

Purpose-This cable is used to connect the NT8D17AA Conference/IDS card to the music trunk or I/O connector panel.

This cable is available in the following lengths:

- NT8D87AC 1.2 m (4 ft)
- NT8D87AD 1.8 m (6 ft)

NT8D88 Network to I/O cable

Purpose--This cable connects the NT8D04AA Superloop Network card to the I/O connector panel.

This cable is available in the following lengths:

- NT8D88AC 1.5 m (5 ft)
- NT8D88AD 1.8 m (6 ft)

NT8D90AF SDI multiple-port cable - internal

Purpose-This is a multiple-port extension cable for QPC841 Four-Port SDI card. This cable is used to connect from the I/O connector panel to the NT8D96AB cable.

This cable is 3 m (10 ft) long.

NT8D91 Network to Controller cable

Purpose-This cable is used for internal cabling to connect NT8D04 Superloop Network card to NT8D01AD Controller-2 or NT8D01AC Controller-4 card.

This cable is available in the following lengths:

— NT8D91AC	1.2 m (4 ft)
— NT8D91AD	1.8 m (6 ft)
— NT8D91AE	2.4 m (8 ft)
— NT8D91AF	3 m (loft)
— NT8D91AG	3.6 m (12 ft)
— NT8D91AJ	4.8 m (16 ft)
— NT8D91AP	7.6 m (25 ft)
— NT8D91AT	10.6 m (35 ft)
— NT8D91AV	13.7 m (45 ft)

NT8D92AB Controller to I/O cable

Purpose-This cable is used to connect the NT8D01 Controller card to the I/O connector panel. This method of cabling is used only when the Network loop is cabled externally to the UEM.

This cable is 50 cm (20 in.) long.

NT8D93 SDI paddle board (dual port) I/O to DTE/DCE cable

Purpose-This cable is used to connect the NT8D41AA SDI paddle board (dual port) to the DTE or DCE via the I/O connector panel.

This cable is available in the following lengths:

— NT8D93A.l	4.8 m (16 ft)’
— NT8D93AW	14.6 m (48 ft)

NT8D95 SDI I/O to DTE/DCE cable

Purpose--This cable is used to connect the following cards to the DTE or DCE via the I/O connector panel:

- QPC513 Enhanced Serial Data Interface
- QPC841 Four-Port Serial Data Interface
- QPC687 CPU with SDI/ RTC

This cable is available in the following lengths:

— NT8D95AJ	4.8 m (16 ft)
— NT8D95AT	10.3 m (34 ft)
— NT8D95AW	14.6 m (48 ft)

NT8D97AX PRI/DTI I/O to MDF cable

Purpose-This cable connects the PRI/DTI card to the MDF via the I/O connector panel.

This cable is 15.2 m (50 ft) long.

NT8D98 Inter-cabinet Network cable

Purpose—This cable is used to interconnect NT8D04AA Superloop Network cards:

- from Network Module to IPE Module via the I/O connector panels
- from QCA55 cabinet to IPE Module

This cable is available in the following lengths:

— NT8D98AD	1.8 m (6 ft)
— NT8D98AF	3.6 m (12 ft)
— NT8D98AL	6 m (20 ft)
— NT8D98AS	9.1 m (30 ft)
— NT8D98AT (not for QCA55 cabinet application)	11.5 m (38 ft)

NT8D99 CPU to Network cable

Purpose-This cable is used to:interconnect NT8D35 NET Modules in full group configuration

This cable is available in the following lengths:

— NT8D99AB 0.6 m (2 ft)

— NT8D99AC 1.2 m (4 ft)

— NT8D99AD 1.8 m (6 ft)

NT9J93AD PRI/DTI Echo Canceler to I/O cable

Purpose-This cable is used to connect the PRI/DTI Echo Canceler port to the I/O connector panel.

This cable is 1.8 m (6 ft) long.

NT9J94AB RPE to I/O cable

Purpose-This cable is used to connect the NT8D47 RPE to the I/O connector panel.

This cable is 0.6 m (2 ft) long.

NT9J96 Intra-cabinet Network cable

Purpose-This cable is used to connect the QPC414 Network card to the I/O connector panel within an existing SL-1 cabinet (QCA55).

This cable is available in the following lengths:

— NT9J96AC 1 m (40 in.)

— NT9J96AD 1.8 m (70 in.)

— NT9J96AE 2.2 m (85 in.)

— NT9J96AG 3.6 m (12 ft)

NT9J96AH 4.3 m (14 ft)

— NT9J96AJ 4.9 m (16 ft)

NT9J97 Intra-column Network cable

Purpose-This cable is used to connect the NT8D04AA Superloop Network card to the I/O connector panel in a QCA55 cabinet.

This cable is available in the following lengths:

- NT9J97AC 1 m (40 in.)
- NT9J97AD 1.8 m (70 in.)
- NT9J97AE 2.2 m (85 in.)
- NT9J97AG 3.6 m (12 ft)
- NT9J97AH 4.3 m (14 ft)
- NT9J97AJ 4.9 m (16 ft)

NT9J98 Intra-cabinet Network cable

Purpose-This cable is used to connect the QPC414 Network card to the I/O connector panel of the QCA108 or QCA136 cabinet.

This cable is available in the following lengths:

- NT9J98AC 1 m (40 in.)
- NT9J98AD 1.8 m (70 in.)
- NT9J98AE 2.2 m (85 in.)

NT9J99 Intra-cabinet Network cable

Purpose-This cable is used to connect the NT8D04AA Superloop Network card to the I/O connector panel of the QCA108 or QCA136 cabinet.

This cable is available in the following lengths:

- NT9J99AC 1 m (40 in.)
- NT9J99AD 1.8 m (70 in.)
- NT9J99AE 2.2 m (85 in.)

QCAD1 28 connector cable

Purpose-Connects QPC472 DTI Carrier Interface (J5) connector to the cabinet filter panel. It is a 15-conductor flat ribbon cable with a 15-pin D-type female connector at one end and a 15-pin D-type male connector at the other.

QCAD274A AC power cord

Purpose-This cable conducts AC power to the NT6D52AA rectifier. It is 2.7 m (9 ft) long.

Miscellaneous equipment

Field Wiring Kit

System Hardware-All

Purpose-The NT6D54AA Field Wiring Kit is used in conjunction with the System Monitor to QBL15 cable. It provides the necessary hardware to connect four NT6D52AA rectifiers to a System Monitor.

Blank Faceplates

System Hardware-All

Purpose-An NT7D05AA blank faceplate is required in a slot reserved for the Ringing Generator when the Ringing Generator is not in place. Although not required, other unoccupied slots can be covered by any of the following blank faceplates, depending on the width of the slot:

— 2.2 cm (0.875 in.) NT8D31AA

— 2.5 cm (1 in.) NT8D31AB

NT8D63AA Overhead Cable Tray Kit

System Hardware-All

Purpose-Holds I/O cables that go from the system to the Main Distribution Frame **(MDF).** Provides support for overhead cabling tray. Mounts to the highest module in each column. Each kit consists of the following:

— support brackets

— front and rear top cap air grills with cut-outs

Note: This kit does not include the cable tray.

Earthquake Bracing Kit

System Hardware-All

Purpose-Provides a means to hold together all modules that are stacked up in vertical expansion so that in the case of an earthquake, the whole column will move as a unit. Used only for non-raised floor. Each kit contains the following:

— four threaded rods

— two tie bars

— miscellaneous hardware (nuts and washers)

Three different Earthquake Bracing Kits are available:

— two-tier NT8D64AA

— three-tier NT8D64AB

— four-tier NT8D64AC

QRY551 Channel Service Unit

Purpose-When required under FCC regulations (FCC 03), provides a 24-channel digital interface between a PRI/DTI and T1 line when connecting to registered common carrier trunks.

TELLABS 251 24-Channel Digital Echo Canceller

Purpose-For use with PRI/DTI when echo control is required on voice calls.

BIX Cross-Connect System

Purpose-The BIX In-Building Cross-Connect System provides modular terminations and cross-connections for Meridian 1 system. (See 63 1-451 l-100 for ordering information for the BIX system and Table 5 for designation label ordering information.)

Table 5
Order Numbers for BIX Designation Labels for NT8D13 PE Modules

Description	Color	Order number
Basic 500/2500 set labels (eight circuits per card). A set of four labels for each PE shelf is used	White	PO641 810
SL-1 set (eight circuits)	Blue	PO641 813
CO/FX/WATS trunk (four circuits)	Green	PO641812
CO/FX/WATS trunk (two circuits)	Green	P0587230
Loop Signaling trunk (four circuits)	Red	PO641 811
Loop Signaling trunk (two circuits)	Red	P0587231
E&M/DX and Paging trunk (two circuits)	Yellow	P0587233
Recorded Telephone Dictation trunk (two circuits)	Orange	P0587232
Recorded Announcement trunk (two circuits)	Purple	P0587234
Four-Wire E&M/DX Type I trunk (two circuits)	Yellow	PO631 858
Four-Wire E&M/DX Type II trunk (two circuits)	Yellow	PO631 859
Power Fail Transfer cables (P10, PFJ1, PFJ2)	Yellow	PO641 814
Power Fail Transfer cables (P1 0, PFJ1) QUA6 Power Fail Transfer Unit	Yellow	PO686506
Blank labels for sets	Yellow	P0588401
	Blue	P0588403
	Silver	P0588404
Blank labels for trunks and riser cables	Green	P058841 5
	Blue	P058841 6

Northern Telecom Publications

Northern Telecom Publications are packaged in standard Northern Telecom binders to support the various Meridian 1 systems.

Title and description	Order number
Installation and maintenance guide — System options 21, 51, 61, 71	PO71 0530
Planning and engineering guide — System options 21, 51, 61, 71	PO71 0531
X1 1 software guide	PO71 0532
XI 1 input/output guide	PO71 0533
Special features guide	PO71 0534
Automatic Call Distribution reference guide	PO71 0535
Meridian Link general guide	PO71 0536

List of terms

ACD
Automatic Call Distribution

ASIM
Asynchronous/Synchronous Interface Module

BPS
Bits Per Second

BTU
Bus Terminating Unit

CAS
Centralized Attendant Service

CC
Clock Controller

CE
Common Equipment

CMA
Changeover Memory Arbitrator

CO
Central Office

CPU
Central Processing Unit

CRT
Cathode Ray Tube

DCE
Data Communication Equipment

DCHI
D-Channel Handler Interface

DID
Direct Inward Dialing

DTE
Data Terminal Equipment

DTI
Digital Trunk Interface

DTMF
Dual Tone Multi Frequency

DTR
Digitone Receiver

EIA
Electronics Industry Association

FDI
Floppy Disk Interface

FDU
Floppy Disk Unit

HSDC
High-Speed Data Card

IGS
Intergroup Switch

I/O
Input/Output

ISDLC
Integrated Services Digital Line card

ISDN
Integrated Services Digital Network

LRE
Logic Return Equalizer

MCDS
Multi-Channel System

MDF
Main Distribution Frame

MDU
Multi-Disk Unit

MSI
Mass Storage Interface

MSU
Mass Storage Unit

OAID
Outgoing Automatic Incoming Dial

OANI
Outgoing Automatic Number Identification

OPX
Off-Premises Extension

PAD
Packet Assembler/Disassembler

PBX
Private Branch Exchange

PCM
Pulse Code Modulation

PE
Peripheral Equipment

PRA
Primary Rate Access

PRI
primary Rate Interface

RAM
Random Access Memory

RAN
Recorded Announcement

ROM
Read-Only Memory

RPE
Remote Peripheral Equipment

SBE
Segmented Bus Extender

SCG
System Clock Generator

SDI
Serial Data Interface

TCM
Time Compression Multiplexing

TDS
Tone and Digit Switch

UEM
Universal Equipment Module

UPS

Uninterruptable Power Supply

3PE

3-Port Extender

SL-1

System options 21, 51, 61, 71

Equipment identification and ordering information

Information subject to change without notice.
Release 1 .0
Standard
January 29, 1990
Printed in U.S.A.

northern telecom

INTEGRATED SERVICES NETWORK

MERIDIAN . SERIES DIGITAL TELEPHONES

LINE ENGINEERING

CONTENTS

Note: The module indicated by a bullet (•) in the checklist has been revised. The reason for this revision is given in tbe first page of the affected module.

* MERIDIAN is a trademark of Northern Telecom

ITEM	ISSUE	DATE
CK 0000	Standard	86 06 05
TP 0010	Standard	86 06 05
DP 1001	Standard	86 01 27
DP 1002	Standard	86 01 27
DP 1003	Standard	86 01 27
DP 1004	Standard	86 01 27
DP 1005	Standard	86 01 27
DP 1006	Standard	86 01 27
DP 1007	Standard	86 01 27
IX 9999	Standard	86 01 27

NOTES

Note: This module is reissued to change the minimum loop length requirement to 100 ft, and to add metric equivalents.

(I) Cable pair selections must meet the following requirements:

- AC signal loss must be less than 12.9 dB at 256 kHz due to all sources
- DC loop resistance must be less than 175 Ohm
- Minimum loop length (mainframe bulkhead to telephone) of 30 m (100 ft)
- Near end crosstalk coupling loss >38 dB at Nyquist frequency of 256 kHz (not an issue for typical 22, 24, and 26 AWG twisted pair cable)
- No bridge taps are permitted
- No loading coils are permitted
- Protection devices of the carbon-block and gas-filled type are permitted if the off-state shunting impedance is better than 10 Megohm resistive, and less than 0.5 pF capacitive.

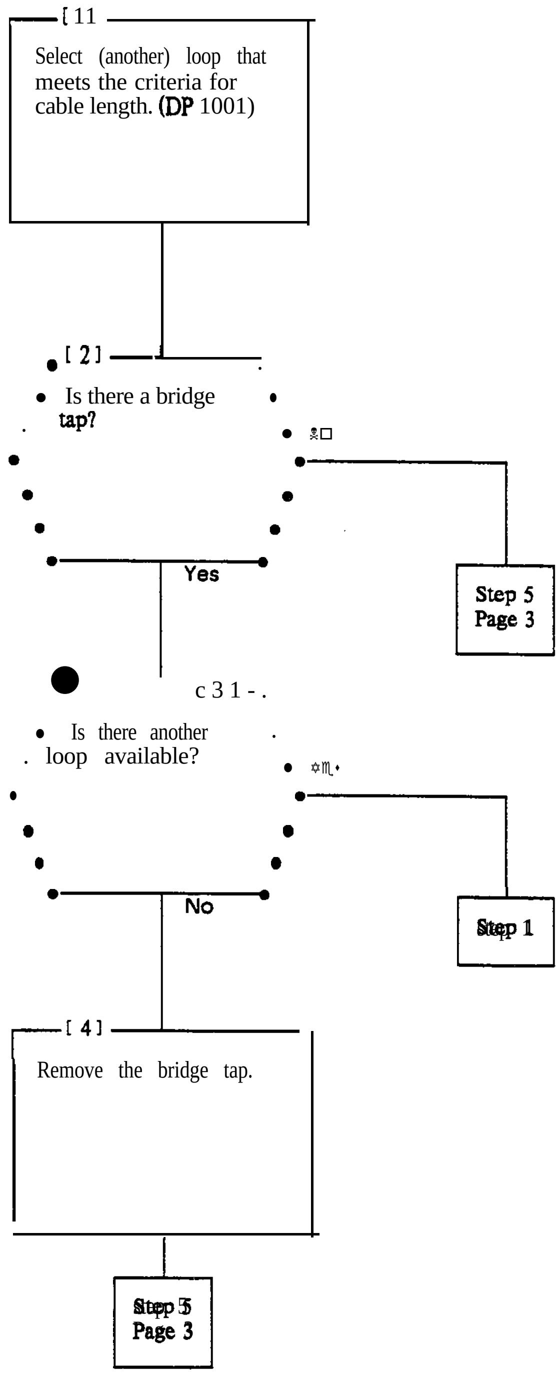
(2) The following criteria have to be met where undercarpet cabling is used.

- characteristic impedance at 256 kHz, 100 ± 10 Ohm
- insertion loss at 256 kHz, < 4.6 dB/kft.
- next pair-to-pair coupling loss at 256 kHz, > 40 dB

(3) For the typical system of 22, 24, or 26 AWG standard twisted pair cable, the requirements translate to the following allowable loops.

- up to 915 m (3000 ft) of 22 or 24 AWG cable
- up to 640 m (2100 ft) of 26 AWG cable

(4) If selected cable pair does not work satisfactorily. select another cable pair using the following flowchart (Page 2):



[1]
Select (another) loop that meets the criteria for cable length. (DP 1001)
[2]
Is there a bridge tap?
Yes
Step 5 Page 3
[3]
Is there another loop available?
No
Step 1
[4]
Remove the bridge tap.
Step 5 Page 3

[5] Is the loop length less than 2.1 kft?
No

[6] Is there any 26 AWG cable in the loop?
No

Step 9

[7] Calculate the loop resistance (DP 1002)

[8] Is the resistance less than 175 Ohm?
No

Yes

Step 9

Step 1
Page 2

[9] Is the PBX at the Central Office?
No

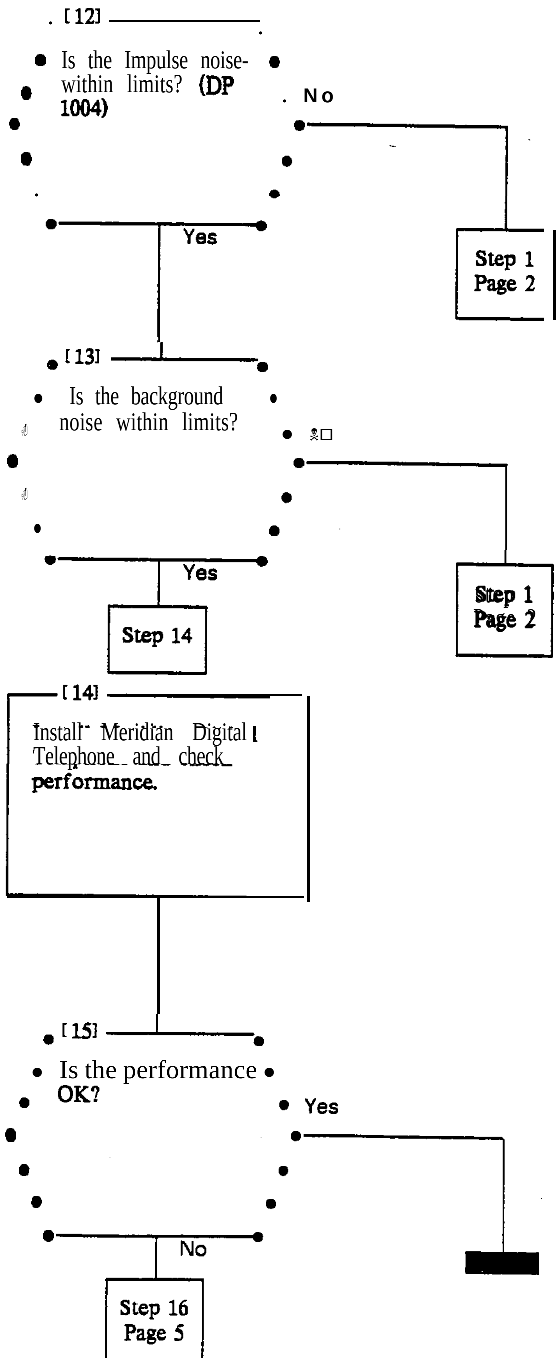
Step 14
Page 4

[10] Does the loop pass the loop diagnostic test? (DP 1003)
Yes

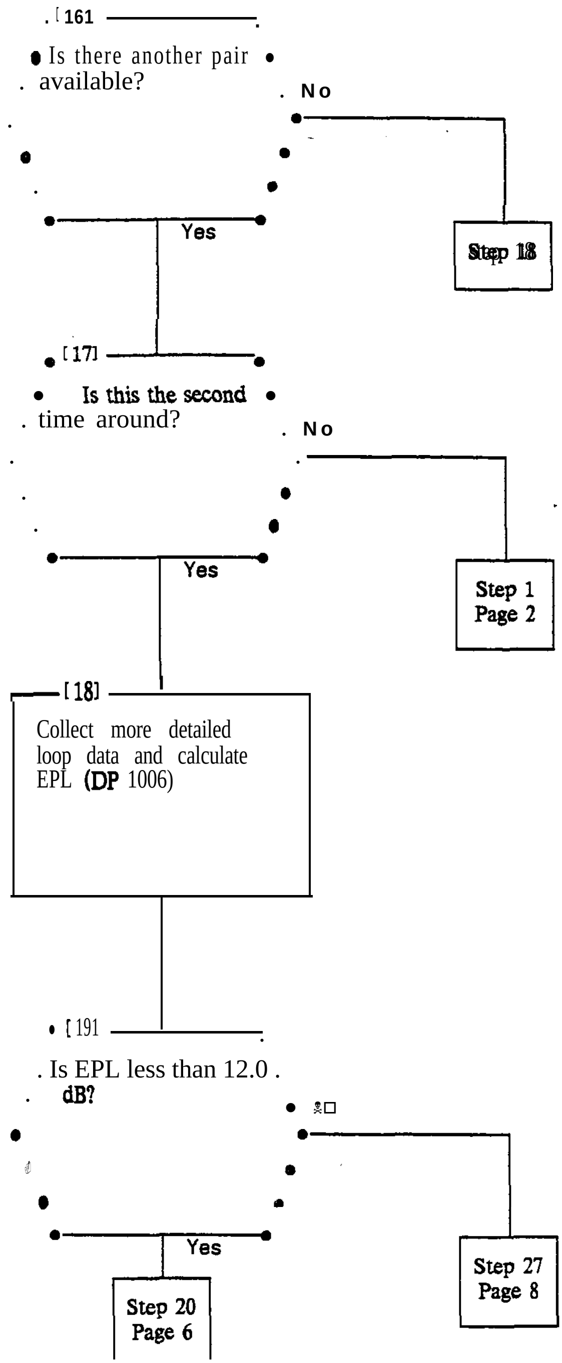
Step 12
Page 4

[11] Repair the problem.

Step 12
Page 4



[12]
Is the Impulse noise-within limits? (DP 1004)
No
Yes
Step 1 Page 2
[13]
Is the background noise within limits?
No
Yes
Step 14
Step 1 Page 2
[14]
Install Meridian Digital Telephone and check performance.
[15]
Is the performance OK?
Yes
No
Step 16 Page 5


[16]
Is there another pair available?
No
Step 18
Yes
[17]
Is this the second time around?
No
Step 1
Page 2
Yes
[18]
Collect more detailed loop data and calculate EPL (DP 1006)
[19]
Is EPL less than 12.0 dB?
Yes
Step 20
Page 6
Step 27
Page 8

[20]

Install Meridian Digital Telephone and check performance if not **already done.**

[21]

Is the performance OK?

Yes

Step 22

[22]

Are the loop diagnostics and noise measurement already done?

No

Step 27
Page 8

[23]

Perform loop diagnostics and noise measurements. **(DP** 1003, DP 1004 and **DP 1005)**

Step 24
Page 7

[24]

Are impulse noise and background noise within limits?

No

Step 27 Page 8

[25]

Is the problem fixed?

Yes

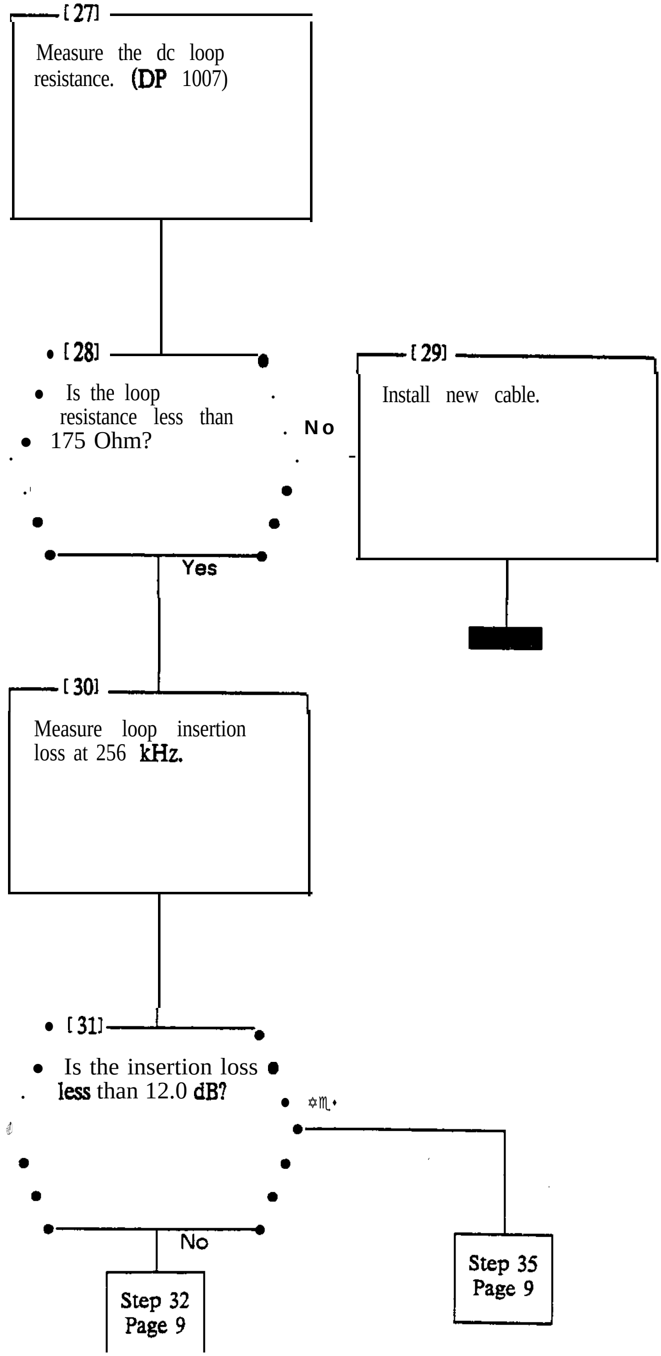
Step 27 Page 8

[26]

Is the performance OK?

Yes

Step 27 Page 8



[27]
Measure the dc loop resistance. (DP 1007)
[28]
Is the loop resistance less than 175 Ohm?
No
Yes
[29]
Install new cable.
[30]
Measure loop insertion loss at 256 kHz.
[31]
Is the insertion loss less than 12.0 dB?
No
Step 32 Page 9
Step 35 Page 9

[32]

Replace any under-carpet cable if insertion loss can be reduced.

[33]

Install Meridian Digital Telephone and check **performance.**

[34]

Is the performance OK?

[35]

At this point there may be other problems as listed in Table 0010-A

Table 0010-A
POSSIBLE FAULTS

- EM1
- Unrecorded bridge taps
- Under-carpet cable
- Split cable pairs
- Impulse noise - not recorded due to speed limitations of the impulse counter.
- Faulty telephone

NOTES

0.01 The requirements for a Meridian Digital Telephone are that the loop be without bridge taps, and be less than 175 Ohm dc resistance. and less than 12.0 dB loss at 256 kHz. For a single gauge cable, the-length limits are 3000 ft for 22 and 24 AWG cable and D inside wiring, and 2100 ft for 26 AWG cable.

0.02 The allowable loop length assumes that there is no under-carpet cable. If there is under-carpet cable of a type that is different from Western Electric 4-pair cable, reduce the allowable loop length using the following equation:

. LM = I12 —(UC x UL) 1 /LL

where

LM = loop length limit in km (kft) (excluding the length of the under-carpet cable).

LL = loop loss in dB/km (dB/Kft) at 256 kHz.

UC = length of the under-carpet cable in km (kft).

UL = loss of the under-carpet cable in dB/km (dB/kft) at 256 kHz. Refer to Table 1006-B for dB-values.

Chart 1002-l
CALCULATE DC LOOP RESISTANCE

STEP PROCEDURE

1 Calculate the dc loop resistance by adding the resistance of each cable section. Calculate the resistance of each cable section using the following formula (Cable resistances are given in Table 1002-A.):

$$LRi = CRi \times SLi$$

where:

- LRi = dc resistance for cable section "i"
- CRi = conductor resistance per unit length for the cable section "i"
- SLi = length of cable section "i"

2 Add the total of all cable sections. If the total of all sections exceeds 175 Ohm, select another loop.

Note: The loop resistance limit of 175 Ohm must be reduced by 1 Ohm for each 1% of the loop which is aerial cable.

Table 1002-A
CONDUCTOR RESISTANCE PER UNIT

Gauge	Ohm per loop kft	Ohm per loop km
26		
24	83 52	278 173
22	33	109
19	16	54

Chart 1
PERFORM LOOP DIAGNOSTIC TESTS

APPARATUS:

- 1 Volt-Ohmeter (VOM)
- 1 77 Cable Analyser or equivalent

STEP PROCEDURE

FOREIGN VOLTAGE TEST

1 Set the VOM range switch to a scale 60 Vdc/Vac or more.

2 Connect the VOM test probes to the loop at the line card or distributing frame.

3 Measure the dc and ac voltage between the following points under no-load conditions.

- T and R
- T and GND
- Rand GND

Requirement: Voltage readings should be less than 1 Vdc/Vac.

INSULATION RESISTANCE TEST

1 Set the VOM range switch to OhmX1O.OOO and adjust the meter to zero.

2 Connect the VOM test probes to the loop at the line card or distributing frame.

3 Measure the resistance between the following points under no-load conditions.

- T and R
- T and GND
- R and GND

Requirement: Resistance readings should be greater than 10 MOhm.

DC CONTINUITY TEST

1 Short circuit the T and R at the far end.

2 Using the VOM. measure the resistance between the T and R.

Requirement: Resistance measurement should be approximately equal to the calculated loop resistance per DP1002.

Chart 1 Continued
PERFORM LOOP DIAGNOSTIC TESTS

STEP PROCEDURE

CAPACITANCE UNBALANCE TEST

1 Using the 77 Cable Analyser or equivalent, measure the capacitance between the following points:

- T and GND
- R and GND

Requirement: Difference between the two readings should be <0.002 microfarads.

Chart 1004-l
MEASURE IMPULSE NOISE

STEP	PROCEDURE
1	Measure impulse noise on selected lines during busy hours. Use an NE-58B Noise measurement set, or equivalent. **Note:** The termination and weighting filter required are 135 Ohm and 100 kHz respectively. and the blanking interval 25 microseconds.
2	Using Figure 1004-L Determine that for a given loop loss and noise threshold, the impulse noise counts per 15 minutes are below the corresponding curve. **Note:** The values in Figure 1004-l were derived assuming the counter has a count rate of 512 pulses per second. **Note:** Due to the inaccuracy of the Noise Measuring Set, it is possible that additional errors may occur during the blanking interval and the reading will consequently be lower than actual.

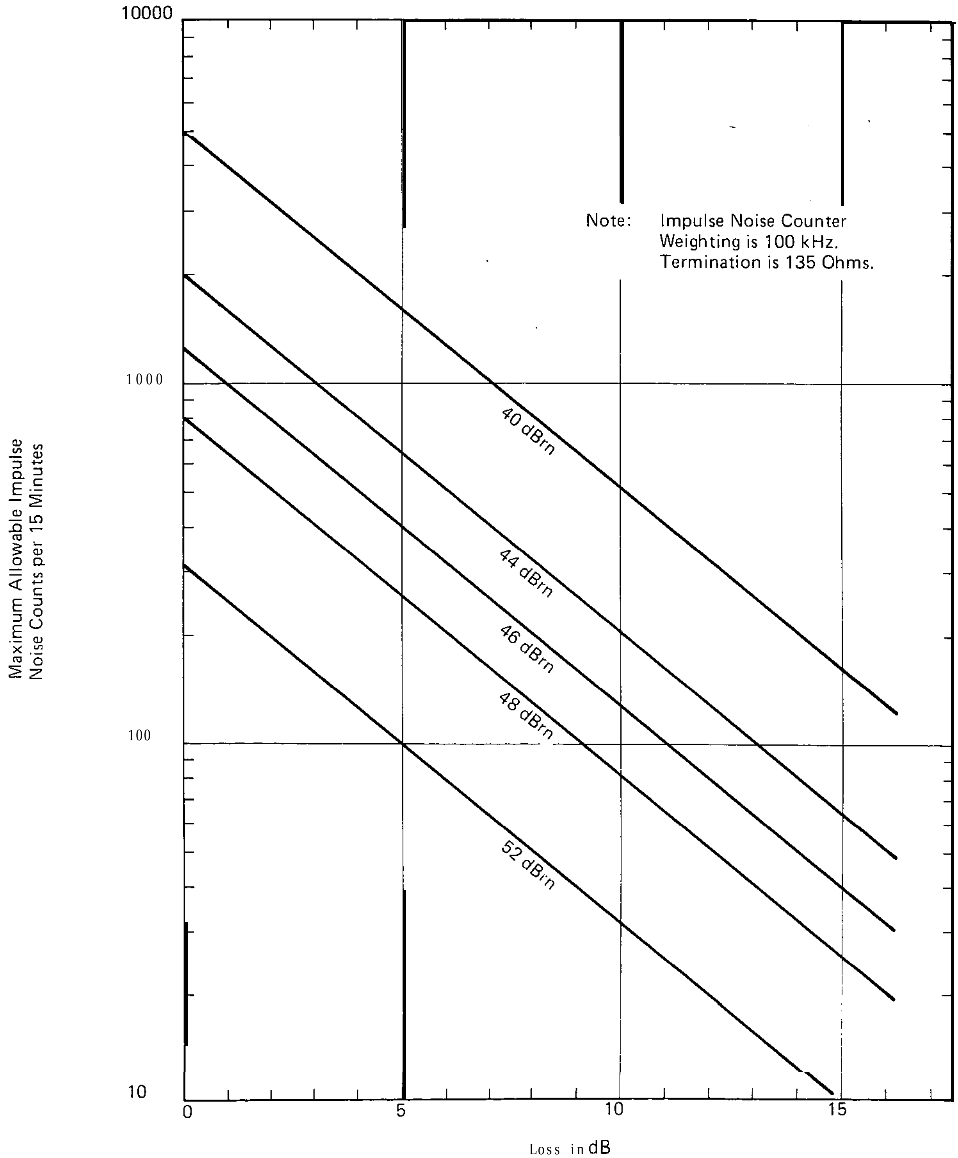


Fig. 1004-l
Maximum Allowable Impulse Noise Counts Versus Loop Loss

Chart 1005-I
MEASURE BACKGROUND NOISE

STEP	PROCEDURE
1	Measure background noise on the loop using an NE-58B noise measuring set. **Note:** The weighting and termination to be used are 100 kHz flat and 135 Ohm respectively.
2	Reject the loop being tested if the background noise measured is not less than 51dBrn.

Chart 1006-I
COLLECT LOOP MAKEUP DATA AND CALCULATE EPL (EXPECTED PULSE LOSS)

STEP PROCEDURE

1 Collect loop makeup data between the line card and the terminal, For each cable section, the data required is:

the cable type (PIC or pulp)

gauge

length

type of plant construction (underground. aerial, inbuilding)

Calculate individual cable section losses using the figures in Tables 1006-A. 1006-B, 1006-C. and the following equation.

CSLi = SLi x Li

- CSLi = cable section loss for section "i".
- SLi = section length of section "i".
- Li = loss per unit length for section "i".

3 Correct individual cable section losses for maximum cable temperature using the following equation.

TCLi = CSLi x TCFi

- TCLi = temperature corrected loss for section "i"
- TCFi = temperature correction factor for section "i"

CORRECTION FACTORS

Aerial Cable TCF = 1.1

Underground cable TCF = 1.04

Inbuilding cable TCF = 1

4 Determine junction loss. (Figure 1006-l)

> **Note:** Junction loss due to gauge discontinuity of outside plant cables and D-inside wire varies between 0.03 dB and 0.07 dB and can be ignored. However, AMP 25-pair under-carpet wiring has a characteristic impedance of 40 Ohm at 256 kHz and its junction loss is approximately 2 dB. This must be included in the calculation.

5 Calculate the EPL by finding the sum of the above items.

Chart 1006-l Continued
COLLECT LOOP MAKEUP DATA AND CALCULATE EPL
(EXPECTED PULSE LOSS)

STEP PROCEDURE

6 Reject loops whose expected pulse loss is not less than 12.0 dB.

EXAMPLE

Section 1:
Mainframe bulkhead to DF1 - 500m. 26 AWG PIC, underground

Section 2:
DF1 to DF2 - 200m, 26 AWG PIC, inside

Section 3:
DF2 to terminal - 24 AWG NT D-inside

Therefore:
SL1 = 0.5km, SL2 = 0.2km, SL3 = 0.1km

From Tables 1006A and 1006C:
L1 = 13.7 dB/km. L2 = 13.7 dB/km. L3 = 13.3 dB/km.

Using the equation in Step 2 we arrive at:
CSL1 = 6.85 dB, CSL2 = 2.74 dB, and CSL3 = 1.33 dB

Temperature Corrections:
Using correction factors of TCF1 = 1.04. TCF2 and TCF3 = 1, and
using the equation in Step 3 results in TCL1 = 7.12 dB.
TLC2 = 2.14 dB, and TCL3 = 1.33 dB.

EPL Value:
Neglecting any junction loss per explanation in Step 4.
Step 5 results in an EPL value of:
TSL1 + TSL2 + TSL3 + 0 = 11.19 dB.
This is under the I2 dB limit and meets the criteria.

Table 1006-A
CABLE ATTENUATION AT 256 KHZ AND 21.1 °C (70° F)

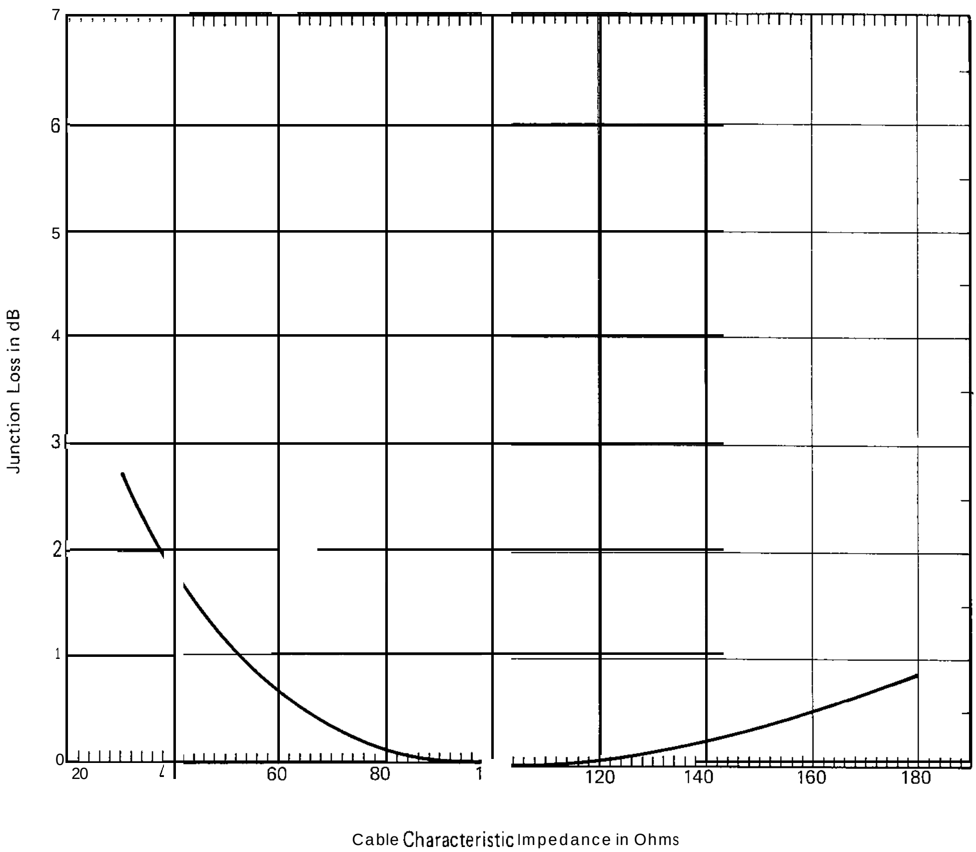
	26 AWG		24 AWG		22 AWG		19 AWG	
	dB/kft	dB/km	dB/kft	dB/km	dB/kft	dB/km	dB/kft	dB/km
PIC	4.2	13.7	3.1	10.2	2.5	8.1	1.7	5.6
PULP	4.3	14.3	3.5	11.4	2.1	9.0	2.0	6.6

Table 1006-B
ATTENUATION AT 256 KHZ FOR U/C CABLE

WE 4 pairs		AMP 25 pair	
dB/kft	dB/km	dB/kft	dB/km
3.6	15.3	19.0	63.3

Table 1006-C
ATTENUATION AT 256 KHZ FOR D INSIDE WIRING CABLE

NT		WE		SUPERIOR		GENERAL	
dB/kft	dB/km	dB/kft	dB/km	dB/kft	dB/km	dB/kft	dB/km
4.0	13.3	3.2	10.7	3.1	13.3	4.6	15.3



(Ill. 06440)

Fig. 1006-l
Junction Loss vs Cable Characteristic Impedance

Chart 1007-l
MEASURE LOOP RESISTANCE

STEP	PROCEDURE
1	Measure loop resistance using standard procedures.

Note: The dc loop resistance limit of 175 Ohm should be reduced by 1 Ohm for each 1% of the total loop that is aerial cable.

northern telecom

PRACTICE 553-2201-182
Issued: 85 06 15
Standard

INTEGRATED SERVICES NETWORK

MERIDIAN SL-1*

SUMMARY OF TRANSMISSION PARAMETERS

CONTENTS PAGE

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CONTENTS PAGE

Reason for Reissue: This practice is reissued to include transmission parameters for the Digital Trunk Interface. and to revise and add LO the parameters for the Meridian SL-1. Changes have been marked with bracketing arrows and arrowheads.

1. u-LAW TRANSMISSION PARAMETERS

1.01 The tables in this part provide the transmission requirements which Meridian SL-1 is designed to meet or exceed in μ-Law applications. The specified performance applies in the temperature range of 0 to 50° C.

1.02 Unless otherwise specified. all specifications are stated in terms of being met by 95% of connections.

Table 1-A
INSERTION LOSS AT 1020 Hz (Connections Between Analog Ports)

TYPE OF CONNECTION	NOMINAL INSERTION LOSS (dB)	LOSS VARIATION (dB)
Line-to-Line	5	± 1.0
Line-to-Trunk	1	± 0.7
Trunk-to-Trunk	1	± 0.7

Note: The above loss values apply to connections between analog ports. Port-to-port losses for connections involving a Digital Trunk Interface (DTI) port are given in Part 3.

Table 1-B
FREQUENCY RESPONSE (AMPLITUDE DISTORTION) - -

Frequency Response in dB at the specified frequencies (Hz) for line-to-line, line-to-trunk. or trunk-to-trunk connections.

FREQUENCY RESPONSE (dB) AT FREQ (Hz)

60 Hz MIN	60 Hz MAX	200 Hz MIN	200 Hz MAX	300 Hz MIN	300 Hz MAX	3000 Hz MIN	3000 Hz MAX	3200 Hz MIN	3200 Hz MAX	3400 Hz MIN	3400 Hz MAX
+20	-	0.0	+5.0	-0.5	$1.0	-0.5	+1.0	-0.5	+1.5	0.0	$3.0

Note: Values are stated relative to loss at 1000 Hz. The symbol + denotes more loss: the symbol – denotes less loss than that measured at 1000 Hz.

Table 1-C
OVERLOAD LEVELS

TYPE OF CIRCUIT	NOMINAL OVERLOAD LEVEL (dBm)	
	RECEIVE (A/D)	TRANSMIT (D/A)
Line	+7	+2
Trunk	+3	+6

Note: Receive and Transmit relate to Switch.

Table 1-D
TRACKING (LINEARITY)

INPUT SIGNAL (dB) BELOW OVERLOAD	TRACKING ERROR (dB)	
	MAXIMUM	AVERAGE
+3 to -40	±0.5	i-o.25
-40 to -53	±1.0	±0.5

Note 1: Signal at 1020 Hz.

Note 2: Maximum specification for 99% of all connections.

Table 1-E
TRANSHYBRID LOSS

TWO-WIRE PORT	TRANSHYBRID LOSS (dB) 200 to 3400 Hz	500 to 2500 Hz
Line	>17	>19
Trunk	>18	>21

Note 1: This parameter is for EIA-compatible trunks only.

Note 2: Measurement of transhybrid loss (THL) is made from equal-level (transmit and receive) four-wire port towards the two-wire port.

Note 3: Two-wire port compromise impedance: 600 Ω. or 350 Ω in series with 100 Ω. 0.21 μF.

Table 1-F
INPUT IMPEDANCE

CONNECTION FROM 4W TRUNK TO PORT	REFERENCE IMPEDANCE	FREQUENCY RANGE	MINIMUM RETURN LOSS
Line	600 Ω	200-500 Hz	20 dB
		500-3400 Hz	26 dB
Trunk	600 Ω	200-500 Hz	20 dB
		500-1000 Hz	26 dB
		1000-3400 Hz	30 dB

Note 1: This parameter is for EIA-compatible trunks only.

Note 2: A reference impedance of 600 Ω resistive is used.

Table 1-G
IDLE CHANNEL NOISE

CONNECTION TYPE	C-MESSAGE WEIGHTED (dBrnC)	3 kHz FLAT (dBrn)
Line-Line	<20	<29
Line-Trunk	<20 at line <23 at trunk	<29 at line <29 at trunk
Trunk-Trunk	<20	<29

Table 1-H
LONGITUDINAL BALANCE

FREQUENCY (Hz)	MINIMUM BALANCE (dB)	AVERAGE BALANCE (dB)
200	58	63
500	58	63
1000	58	63
3000	53	58

Note: Measured according to IEEE Standard 455-1983.

Table 1-I
IMPULSE NOISE

CONNECTION	NUMBER OF COUNTS ABOVE 55 dBrnC
All	0

Note: For test purposes. a five-minute counting interval is used.

Table 1-J
INTERMODULATION DISTORTION

CONNECTION TYPE	DISTORTION LIMITS (dB BELOW RECEIVED LEVEL) R2	R3	TEST SIGNAL INPUT LEVEL (dBm)
Line-to-Line	40	43	- 9
Line-to-Trunk	45	53	-9 at line -13 at trunk
Trunk-to-Trunk	45	53	-13

Note 1: Four-tone method is used.

Note 2: Test Signal Input Level is the composite power level of all four tones.

Table 1-K
ENVELOPE DELAY DISTORTION

BANDWIDTH (Hz)	ENVELOPE DELAY DISTORTION (μs) LINE-LINE	LINE-TRUNK/ TRUNK-TRUNK
800 to 2700	750	375
1000 to 2600	380	190
1150 to 2300	300	150

Table 1-L
QUANTIZATION DISTORTION

INPUT LEVEL BELOW OVERLOAD	SIGNAL/DISTORTION RATIO (dB)
+3 to -33	33
-33 to -43	27
-43 to -48	22

Note: Input signal is 1 kHz sinewave: output measured with C-message weighting. (See Table 1-C for overload definition.)

Table 1-M
CROSSTALK

CONNECTION	MINIMUM CROSSTALK ATTENUATION (dB)
Line-to-Line	>75
Line-to-Trunk	>75
Trunk-to-Trunk	>75

Note: Input frequency range of 200 to 3200 Hz, 0 dBm level.

Table 1-N
RETURN LOSS (Design Requirements)

CONNECTION	ECHO RETURN LOSS (dB)	SINGING RETURN LOSS (dB)
Line Interfaces:		
Line Side (Note)	>18	>12
4W Trunk Side (Note)	>25	>19
2W Trunk Interfaces:		
2W Trunk Side (Note)	>22	>17
4W Trunk Side (Note)	>28	>22

The design requirements in this table are intended to ensure the satisfaction of the in-service requirements in Table 1-0.

Note: Terminating impedances are:
- 600Ω for SL-1 line
- 600Ω for PBX line.

Table 1-O
RETURN LOSS (In-Service Requirements)

CONNECTION FROM 4W VNL TIE TRUNK TO THE FOLLOWING:	CIRCUIT TERMINATION	ECHO RETURN LOSS	LOW/HIGH SINGING RETURN LOSS	NOTES
4W VNL Tie Trunk (through balance)	4W legs of Hybrid terminated in 600/900Ω	27	20/20	1.3
4W Non-VNL Tie Trunk (terminal balance)	600/900Ω + 2.16 μF at distant PBX	22	15/15	1.3
2W Non-VNL Tie Trunk (terminal balance)	600/900Ω + 2.16 μF at distant PBX	18	10/10	1.5
CO or FX Trunk (terminal balance)	900R + 2.16 μF at CO	18	10/10	2.5
PBX Station Line (terminal balance)	600Ω + 2.16 μF	24	18/18	1.4
SL-1 Station Line (terminal balance)	600Ω	24	18/18	1.4
PBX Station Line (terminal balance)	Station off-hook	12	8/8	1.4

Note 1: Reference impedance is 600/900Ω + 2.16 μF.

Note 2: Reference impedance is 900Ω + 2.16 μF.

Note 3: Switchable pads set for nominal loss of 1 dB.

Note 4: Switchable pads set for nominal loss of 3 dB.

Note 5: If facility loss is less than 2 dB or adequate impedance correction is not provided. nominal loss has to be increased to 3 dB by switching in the 2 dB pad.

Table 1-P
HARMONIC DISTORTION

BANDWIDTH (Hz)	MAX. LEVEL OF DISTORTION PRODUCT (dB)	TEST SIGNAL INPUT LEVEL (dBm)
200 to 4600	≥28	0

4

2. A-LAW TRANSMISSION PARAMETERS

2.01 The tables in this part provide the transmission requirements which Meridian SL-1 is designed lo meet on 95% of all connections in A-Law applications.

Table 2-A
INSERTION LOSS AT 820 HZ

TYPE OF CONNECTION	NOMINAL INSERTION LOSS (dB) at 25°C	MAXIMUM INSERTION LOSS (dB) at 0° to 50°C	MINIMUM INSERTION LOSS (dB) at 0° to 50°C
Station line-to-line	5	6	4
Station line-to-trunk	1	2	0
Trunk-to-trunk	1	2	0

Table 2-B
MAXIMUM INBAND AMPLITUDE DISTORTION

CONNECTION	AMPLITUDE DISTORTION (dB) 0.2 kHz MIN	0.2 kHz MAX	3.4 kHz MIN	3.4 kHz MAX
Line-to-line	-0.5	3.5	0.0	3.5
Trunk-to-trunk	0.0	3.0	0.0	3.0
Trunk-to-line	0.0	4.0	0.0	3.0

Note: Performance limits quoted apply to 95% of all connections.

Table 2-C
RETURN LOSS (Design Requirements)

CONNECTION	ECHO RETURN LOSS (dB)	SFRL LOSS (dB) (300-3200 Hz)
Line Interfaces:		
Line Side (Note 1)	>18	>12
4W Trunk Side (Note 2)	>21	>19
2W Trunk Interfaces:		
2W Trunk Side (Note 2)	>22	>14
4W Trunk Side (Note 2)	>21	>19

The design requirements in this table are intended to ensure the satisfaction of the in-service requirements in Table 2-D.

Note 1: Terminating impedances are:	- 600Ω for SL-1 line - 600Ω and 2.16 μF for PBX.
Note 2: Terminating impedances are:	- 600Ω for SL-1 line - 600 or 900Ω and 2.16 μF for PBX line.

Table 2-D
RETURN LOSS (In-Service Requirements)

CONNECTION FROM 4W VNL TIE TRUNK TO THE FOLLOWING:	CIRCUIT TERMINATION	ECHO RETURN LOSS	LOW/HIGH SINGING RETURN LOSS	NOTES
4W VNL Tie Trunk (through balance)	4W legs of Hybrid terminated in 600Ω	27	20/20	1,3
4W Non-VNL Tie Trunk (terminal balance)	600R •k 2.16 μF at distant PBX	22	15/15	1.3
2W Non-VNL Tie Trunk (terminal balance)	600Ω + 2.16 μF at distant PBX	18	10/10	1.5
CO or FX Trunk (terminal balance)	900R + 2.16 μF at c o	18	10/10	2.5
PBX Station Line (terminal balance)	600Ω + 2.16 μF	24	18/18	1,4
SL-1 Station Line (terminal balance)	600Ω	24	18/18	1,4
PBX Station Line (terminal balance)	Station off-hook	12	8/8	1,4

Note 1: Reference impedance is 600/900Ω + 2.16 μF.

Note 2: Reference impedance is 900Ω + 2.16 μF.

Note 3: Switchable pads set for nominal loss of 1 dB.

Note 4: Switchable pads set for nominal loss of 3 dB.

Note 5: If facility loss is less than 2 dB or adequate impedance correction is not provided, nominal loss has to be increased to 3 dB by switching in the 2 dB pad.

Table 2-E
DISTORTION AND MODULATION PRODUCTS

DISTORTION TYPE	INPUT LEVEL (dB) BELOW OVERLOAD	INPUT FREQUENCY/s (Hz) (excluding submultiples of 8 kHz)	MAXIMUM LEVEL OF DISTORTION PRODUCT
Harmonic	3	700-1100	⩾40 dB below fundamental output signal
Intermodulation	13	300-3400 (see Note)	⩾35 dB below fundamental output signal
Sideband Suppression	3	700-1100	⩾40 dB below fundamental output signal
Quantization	0-33	700-1100	⩾33 dB
	33-43	700-1100	⩾27 dB
	43-48	700-1100	⩾22 dB

Note: Using two oscillators. each with an output impedance of 1200/1800Ω.

Table 2-F
LINEARITY

820 Hz SIGNAL INPUT LEVEL (dB) BELOW OVERLOAD	VARIATION IN INSERTION LOSS (dB)
0 to 43	±0.5
43 to 53	±1
53 to 58	±3

Table 2-G
ENVELOPE DELAY DISTORTION

BANDWIDTH (Hz)	ENVELOPE DELAY DISTORTION (μs) LINE-LINE	LINE-TRUNK/ TRUNK-LINE/ TRUNK-TRUNK
1000 to 2600	380	190
1150 to 2300	300	150
800 to 2700	750	375

Note: The limits above apply to 95% of all connections.

Table 2-H
CROSSTALK

CONNECTION	CROSSTALK ATTENUATION (dB)
Line-to-Line	>75
Line-to-Trunk	>75
Trunk-to-Trunk	>75

Note: Frequency range of test signal 0.2 to 3.4 kHz at -10 dBm.

Table 2-J
OVERLOAD LEVELS

TYPE OF CIRCUIT	NOMINAL OVERLOAD LEVEL (dBm) TRANSMIT	RECEIVE
Line	+7	+2
Trunk	+3	+6

Table 2-K
MESSAGE CIRCUIT NOISE

CONNECTION	NOISE LEVEL dBm0p	NOISE LEVEL dBrn 3 kHz FLAT
Line-to-Line	≤−65	≤29
Line-to-Trunk:		
(a) Trunk side	≤−65	≤29
(b) Line side	≤−65	≤29
Trunk-to-Trunk (2 dB pads out)	≤−65	≤29

Table 2-L
IMPULSE NOISE

With all circuits at the MDF correctly terminated. the impulse noise measured at line terminals should be as follows.

NOISE LEVEL (dB)	COUNTS
50	<5 counts/S min for 50% of the connections
50	<100 counts/5 min for all connections
59	<5 count.45 min for all connections

Table 2-M
LONGITUDINAL BALANCE

FREQUENCY (Hz)	MINIMUM BALANCE (dB)	AVERAGE BALANCE (dB)
200	58	63
500	58	63
1000	58	63
3000	53	58

Table 2-N
QUANTIZATION DISTORTION

INPUT LEVEL BELOW OVERLOAD	SIGNAL/DISTORTION RATIO (dB)
3 to 33	33
33 to 43	27
43 to 48	22

Note: Input signal is 820 Hz sinewave: output measured with psophometric weighting. (See Table 2-J for a definition of overload.)

3. DTI LOSS TABLES

3.01 Tables 3-A through 3-D provide the insertion loss specifications of the SL-1 Business Communications System when it is equipped with a QPC472 Digital Trunk Interface (DTI).

3.02 The insertion loss for connections between analog ports of the SL-1 and the DTI or beteween DTI ports is connection-specific in order to be compatible with end-to-end network connection loss requirements. SL-1' connection loss specifications are in agreement with U.S. and Canadian standards which are formulated to provide satisfactory transmission on connections between switches in a *private network and between a private network and the public network. (EIA Communications Interim Standard. CIS-4 (U.S.); Department of Communications Standard CS-03 (Canada).) This formulation is based on the use of a fixed loss plan for digital portions of these connections. As a result. certain connections through the SL-1 are asymmetrical: this asymmetry is resolved at the far end of the connection.

3.03 Tie trunk connections to a satellite PBX require different loss treatment than non-satellite tie trunks. The insertion loss for satellite tie trunk connections is given in Tables 3-C and 3-D. Loss values associated with tie trunks in Tables 3-A and 3-B should not be applied to satellite PBX tie trunk connections.

> Note: In this NTP. "satellite" denotes a PBX which homes on a main PBX and does not have a directory number for incoming calls: satellite tie trunks are trunks connecting such a PBX to the main PBX. There is no explicit or implied reference to facilities usuing satellite (i.e.. space vehicle) circuits.

3.04 In these tables. the notation "1000 Hz Insertion Loss" refers to a sinusoidal signal having a frequency between 1000 and 1020 Hz; the value of 1004 Hz has been standardized in the telephone industry in order to avoid frequency beating of an exact 1000 Hz signal in the presence of PCM carrier systems.

Table 3-A
1000 Hz INSERTION LOSS FOR CONNECTIONS BETWEEN AN ANALOG PORT AND A DIGITAL TRUNK INTERFACE (DTI) PORT

TYPE OF CONNECTION	ANALOG PORT	DIGITAL PORT	NOMINAL INSERTION LOSS (dB)	
			Analog port to DTI	DTI to Analog port
Station to Trunk	Local Station	Tie Trunk	3	9
	Local Station	CO/FX/WATS	3	3
	Local Station	Toll WATS (Note 1)	3	9
	OPS	Tie Trunk	0	6
	OPS	CO/FX/WATS	0	0
	OPS	Toll WATS (Note 1)	0	6
Trunk to Trunk	Tie Trunk	Tie Trunk	- 2	4
	Tie Trunk	CO/FX/WATS	3	3
	Tie Trunk	Toll WATS (Note 1)	- 2	4
	Tie Trunk-ESN	Tie Trunk	-2.5	3.5
	Tie Trunk-ESN	CO/FX/WATS	2.5	2.5
	Tie Trunk-ESN	Toll WATS (Note 1)	-2.5	3.5
	CO/FX/WATS	Tie Trunk	0	6
	CO/FX/WATS	CO/FX/WATS	0	0
	CO/FX/WATS	Toll WATS (Note 1)	0	6
	Toll WATS (Note 1)	Tie Trunk	- 3	3
	Toll WATS (Note 1)	CO/FX/WATS	3	3
	Toll WATS (Note 1)	Toll WATS (Note 1)	0	6

Note 1: Toll WATS is a trunk to a Toll (Class 4) office for WATS access.

Note 2: Insertion loss limits are nominal loss ± 0.7 dB.

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Table 3-8
1000 Hz INSERTION LOSS FOR CONNECTIONS BETWEEN TWO PORTS OF A DIGITAL TRUNK INTERFACE (DTI)

TYPE OF CONNECTION	DIGITAL PORT (A)	DIGITAL PORT (B)	NOMINAL INSERTION LOSS (dB) DTI port (A) to DTI port (B)	DTI port (B) to DTI port (A)
Trunk to Trunk	Tie Trunk	Tie Trunk	0	0
	Tie Trunk	CO/FX/WATS	6	0
	Tie Trunk	Toll WATS (Note 1)	0	0
	CO/FX/WATS	CO/FX/WATS	3	3
	CO/FX/WATS	Toll WATS (Note 1)	0	6
	Toll WATS (Note 1)	Toll WATS (Note 1)	0	0

Note 1: Toll WATS is a trunk to a Toll (Class 4) office for WATS access.

Note 2: Insertion loss limits are nominal loss ±0.2 dB.

Table 3-C
1000 Hz INSERTION LOSS FOR CONNECTIONS-BETWEEN AN ANALOG PORT AND A DIGITAL TRUNK INTERFACE (DTI) PORT FOR CONNECTIONS TO A SATELLITE PBX

TYPE OF CONNECTION	ANALOG PORT	DIGITAL PORT (Note 1)	NOMINAL INSERTION LOSS (dB) Analog port to DTI	DTI to Analog port
Station to Satellite Tie Trunk	Local Station	Comb. STT	3	9
	Local Station	Digital STT	3	3
	OPS	Comb. STT	0	6
	OPS	Digital STT	2	2
Non-satellite Trunk to Satellite Tie Trunk	Tie Trunk	Comb. STT	- 2	4
	Tie Trunk	Digital STT (Note 3)	3	3
	Tie Trunk-ESN	Comb. STT	-2.5	3.5
	Tie Trunk-ESN	Digital STT (Note 4)	2.5	2.5
	CO/FX/WATS	Comb. STT	- 3	3
	CO/FX/WATS	Digital STT	0	0
	Toll WATS (Note 2)	Comb. STT	- 3	3
	Toll WATS (Note 2)	Digital STT	3	3
Satellite Tie Trunk to DTI Trunk	STT	Comb. STT	1	7
	STT	Digital STT	1	1
	STT	Tie Trunk (non-satellite)	1	7
	STT	CO/FX/WATS	1	1
	STT	Toll WATS (Note 2)	1	7
	STT-ESN	Comb. STT	0.5	6.5
	STT-ESN	Digital STT	0.5	0.5
	STT-ESN	Tie Trunk hoc-satellite)	0.5	6.5

Table 3-C Continued
1000 Hz INSERTION LOSS FOR CONNECTIONS BETWEEN AN ANALOG PORT AND A DIGITAL TRUNK INTERFACE (DTI) PORT FOR CONNECTIONS TO A SATELLITE PBX

TYPE OF CONNECTION	ANALOG PORT	DIGITAL PORT (Note 1)	NOMINAL INSERTION LOSS (dB) Analog port to DTI	NOMINAL INSERTION LOSS (dB) DTI to Analog port
	STT-ESN	CO/FX/WATS	0.5	0.5
	STT-ESN	Toll WATS (Note 2)	0.5	6.5

Note 1: DTI port to Combination or Digital Satellite Tie Trunks (STT) unless otherwise noted.

Note 2: Toll WATS is a trunk to a Toll (Class 4) office for WATS access.

Note 3: Optionally. 1 dB loss each direction may be specified. provided the satellite PBX does not serve OPS lines.

Note 4: Optionally. 0.5 dB loss each direction may be specified, provided the satellite PBX does not serve OPS lines.

Note 5: Insertion loss limits are nominal loss ±0.7 dB.

Table 3-D
1000 Hz INSERTION LOSS FOR CONNECTIONS BETWEEN TWO PORTS OF A DIGITAL TRUNK INTERFACE (DTI) FOR CONNECTIONS TO A SATELLITE PBX

TYPE OF CONNECTION	DIGITAL PORT (A) (Note 1)	DIGITAL PORT (B) (Note 1)	NOMINAL INSERTION LOSS (dB) DTI port (A) to DTI port (B)	NOMINAL INSERTION LOSS (dB) DTI port (B) to DTI port (A)
Satellite Trunk to Trunk	Comb. STT	Comb. STT	0	0
	Comb. STT	Digital STT	6	0
	Comb. STT	Tie Trunk (non-satellite)	0	0
	Comb. STT	CO/FX/WATS	6	0
	Comb. STT	Toll WATS (Note 2)	0	0
	Digital STT	Digital STT	0	0
	Digital STT	Tie Trunk (non-satellite)	0	6
	Digital STT	CO/FX/WATS	0	0
	Digital STT	Toll WATS (Note 2)	0	6

Note 1: DTI port to Combination or Digital Satellite Tie Trunks (STT) unless otherwise noted.

Note 2: Toll WATS is a trunk to a Toll (Class 4) office for WATS access.

Note 3: Insertion loss limits are nominal loss ± 0.2 dB.

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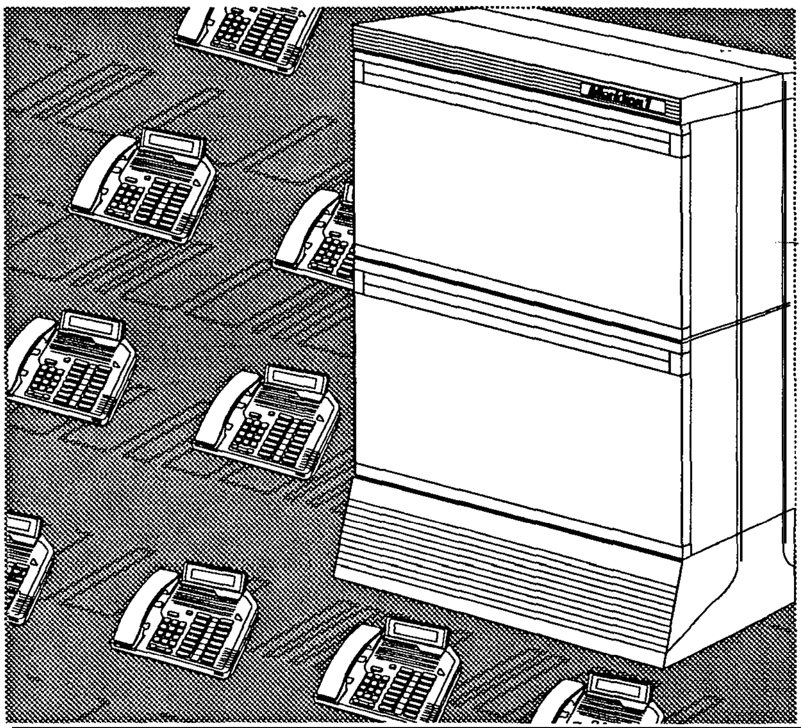
553-3001-161

SL-1

System options 21, 51, 61, 71

Analog line card description

Standard



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Meridian 1
Communication Systems

SL-1

System options 21, 51, 61, 71

Analog line card description

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About this document

This practice outlines the characteristics, application, and operation of the NT8D03AB Analog Line Card. The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit. New naming conventions are applied to this release. The following documents should be used as references to this document:

References

See. the SL-I planning & engineering guide for

— ***Master index*** (553-3001-000)

— ***System overview*** (553-3001-100)

— ***System engineering*** (553-3001-151)

— ***Sparesplanning*** (553-3001-153)

— ***Equipment identification and ordering*** (553-3001-M)

See the list of line and trunk circuit descriptions in the ***Master index*** (553-3001-000) for specific references to lines and trunks.

See the SL-1 installation and maintenance guide for

— ***Circuit pack installation and testing*** (553-3001-211)

— ***Fault clearing*** (553-3001-510)

— ***Hardware replacement*** (553-3001-520)

See the ***SL-1 XII software guide*** for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

— *XII software management* (553-3001-300)

— XII *features and services* (553-3001-305)

See the SL-I XII input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

See the following Northern Telecom Publications for references to specific telephone sets:

— *Meridian M2000 digital telephones: description, installation, operation and maintenance* (553-2201-110)

— *Meridian M2317 digital telephone with alphanumeric display: description , installation, operation, and maintenance* (553-2201-113

— *Meridian M3000 touchphone: description, installation, operation and maintenance* (553-2201-115)

— *Meridian modular telephones: description and specifications* (553-2201-116)

Contents

General information

This publication outlines the characteristics, application and operation of the Analog Line Card. The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit. The following Analog Line Card is available:

— NT8D03AB — Analog Line Card (µ-Law)

The Analog Line Card provides talk battery and signaling for regular 2-wire common battery 500-type (rotary dial), 2500-type (DIGITONE dial) telephones and key telephone equipment.

Note: DIGITONE is a trademark of Northern Telecom.

The NT8D03AB Analog Line Card mounts in an NT8D37AA Intelligent Peripheral Equipment Module (IPE). The circuit connects with the switching system and with the external apparatus via an 80-pin connector at the rear of the pack. The pack is 3 18 mm (12.5 in) in height and 254 mm (10 in) in depth.

The circuits are connected to the shelf backplane and fed to the I/O panel via I/O cables. Fron the I/O panel, the circuits are connected to the cross-connect terminal via 25-pair cables. Connection to the station apparatus is made at the cross-connecting terminal.

Application

The line circuit interfaces and is compatible with the equipment listed in Table 1.

Table 1
Line circuit application and compatibility

Equipment	Specifications
NE-500 type rotary dial sets (or equivalent)	
Dial Speed	8.0 to 22.5 pps
Percent Break	58 to 70%
Interdigital Time	240 ms
NE-2500 type Digitone sets (or equivalent)	
Frequency Accuracy	± 1.5 %
Pulse Duration	40 ms
Interdigital Time	40 ms
Speed	12.5 digits/s

Characteristics

Functional

The Analog Line Card contains an 8050 microprocessor that provides the following functions:

- card self-identification
- self-test
- control card operation
- status report to the controller
- diagnostics for maintenance purposes

The Analog Line Card also provides the following:

- 600Ω balanced terminating impedance
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines
- transmission and reception of SSD signalling messages over a DS30X signalling channel in A10 format
- detection of on-hook/off-hook status
- connection of 20 Hz ringing signal and automatic disconnection when the station goes offhook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and PCM signals for diagnostic purposes
- indication of board status with faceplate-mounted LED
- correct initialization of all features at power-up
- direct reporting of digit dialed (500 sets) by collecting dial pulses

Technical summary

Analog line interface

Input impedance

The impedance at tip and ring is 600 Ohm with a return loss of
20 dB for 200-500 Hz
26 dB for 500-3400 Hz

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 KHz is 6dB ± 1dB. This is arranged as 3.5dB loss for analog to PCM and 2.5dB loss for PCM to analog.

Frequency response

The loss values in the table below are measured relative to the loss at 1 KHz:

Table 2
Frequency response

Frequency	Minimum	Maximum
60 Hz	20.0 dB	
200 Hz	0.0 dB	5.0 dB
300 Hz	-0.5 dB	l.OdB
3000 Hz	-0.5 dB	l.OdB
3200 Hz	-0.5 dB	1.5 dB
3400 Hz	0.0 dB	3.0 dB

Message channel noise

The message channel noise C-weighted (dBrnC) on 95% of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

A technical summary of the Analog line circuit pack is'given in Table 3.

Table 3
Technical summary of Analog Line Card

Impedance:	600 Ω
Loop limit (excluding set)	1000 Ω at nominal -48 V (excluding set)
Leakage resistance	30,000 Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86Vac
Signaling	Loop start
Supervision	**Normal** battery conditions are continuously applied (-48 V on ring; ground on tip)
Power input from shelf backplane	-48, +15, -15, +8.5 V and ringing voltage; also -150 V on Message Waiting Line card.
Insertion loss	6dB ± 1dB at 1020 Hz 3.5dB loss for analog to F'CM, 2.5dB loss for PCM to analog
Effective gain	1.5dB at 1020 Hz

Power requirements

NT8D03AB

The NT8D03AB Analog Line Card has the following power requirements:

Voltage (+/-)	Tolerance	Idle Current	Active Current	Max
+ 15.0 V dc	0.50 V dc	48 ma	O ma	48 ma
+ 8.5 Vdc	1.00 V dc	150 ma	8 ma	280 ma
- 48.0 V dc	2.40 V dc	48 ma	40 ma	688 ma
- 48.0 V dc	2.40 V dc	O ma	(1) 10 ma	320 ma
86.0 V ac	5.00 V ac	O ma	(2) 10 ma	160 ma
-150.0 V dc	5.00 V dc	0 ma	2 ma	32 ma

Note: (1) Each active ringing relay requires 10 ma of battery voltage.

(2) Reflects the current for ringing a single station set. There may be as many as five ringers on each line.

Foreign and surge voltage protections

When telephone lines connected to the line circuit are exposed to foreign voltages by direct contact or induction (for example, power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip and ring for foreign voltages that exceed 600 V peak.

Overload level

Signal levels exceeding + 7 dBm applied to the tip and ring cause distortion in speech transmission.

SL-1 System

Options 21, 51, 61, 71

Analog line card description

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Standard
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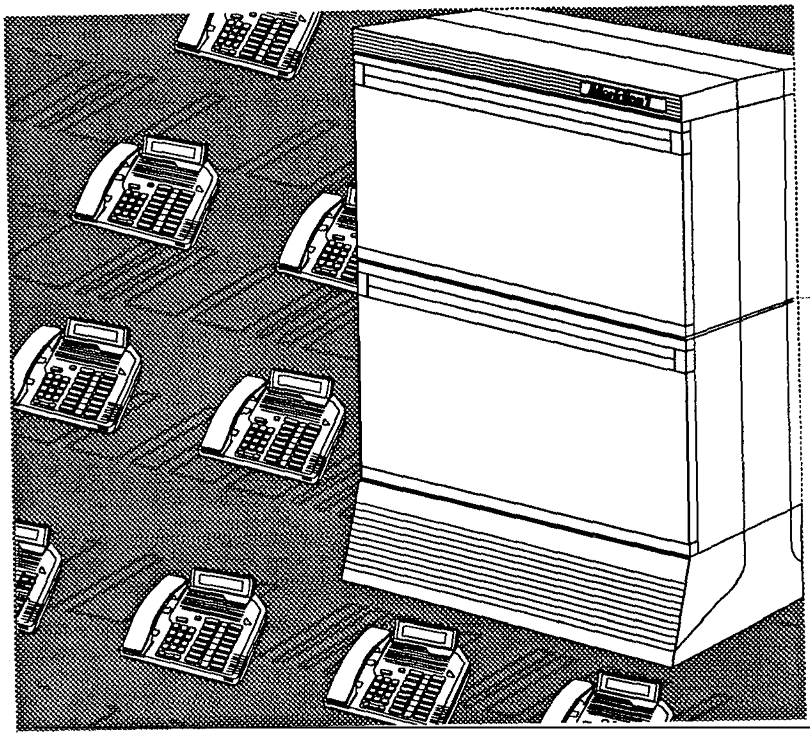
SL-1

System options 21, 51, 61, 71

Digital line card description

Standard



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Meridian1

Communication Systems

SL-1

System options 21, 51, 61, 71

Digital line card description

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First issue of this document.

About this document

This practice outlines the characteristics, application, and operation of the NT8D02AA Digital Line Card (Dgtl LC). The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit. New naming conventions are applied to this release. The following documents should be used as reference material:

References

See the SL-1 Planning & Engineering Guide for

- ***Muster Index*** (553-3001-000)
- ***System Overview*** (553-3001-100)
- ***System Engineering*** (553-3001-151)
- ***Spares Planning*** (553-3001-153)
- ***Equipment Identification*** and ***Ordering*** (553-3001-154)

See the list of Line and Trunk Circuit Descriptions in the ***Muster Index*** (553-3001-000) for specific references to lines and trunks.

See the SL-1 Installation and Maintenance Guide for

- ***Circuit Pack Installation and Testing*** (553-3001-211)
- Fault *Clearing* (553-3001-510)
- ***Hardware Replacement*** (553-3001-520)

See the ***SL-1 XI 1 Software*** Guide for an overview of software architecture, procedures for software installation and management, and a detailed description of all Xl 1 features and services. This information is contained in two documents:

- *XII Software Management* (553-3001-300)
- *X11 Features and Services* (553-3001-305)

See the SL-I XII Input/Output Guide (553-300140) for a description of all administration programs, maintenance programs, and system messages.

See the following Northern Telecom Publications for references to specific telephone sets:

- *Meridian M2000 digital telephones: description, installation, operation and maintenance* (553-2201-110)
- *Meridian M2317 digital telephone with alphanumeric display: description , installation, operation, and maintenance* (553-2201-113
- *Meridian M3000 touchphone: description, installation, operation and maintenance* (553-2201-115)
- *Meridian modular telephones: description and specifications* (553-2201-l 16)

Contents

General information

The NT8D02AA Digital Line Card (Dgtl LC) is based on the design of the QPC578 Integrated Services Digital Line Card. See 553-2201-193 for a complete description of the QPC578. The Dgtl LC is a voice and data communication link between the Meridian SL-1 switch and modular digital telephones. When a digital telephone is equipped with the data option, an asynchronous ASCII terminal or PC can be connected to SL-1 System through the digital telephone.

The Dgtl LC supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring.

This publication describes the Dgtl LC. New naming conventions are applied to this document.

For more information on modular digital telephones, see 553-2201-110 and 553-2201-l 11 for the M2000 series telephones, 553-2201-115 for the M3000 telephone, and 553-2201- 113 for the M23 17 telephone.

Requirements

To use the Dgtl LC, the following SL- 1 requirements must be met:

- Intelligent Peripheral Equipment (IPE) Modules must be used
- Generic Xl 1, Release 15 software must be running
- Superloops must be defined in the software

Description

The NT8D02AA Digital Line Card (Dgtl LC) is equipped with 16 identical line circuits housed within an NT8D37AA Intelligent Peripheral Equipment Module (IPE). Each line circuit provides a multiplexed voice, data, and signaling path to and from digital apparatus over a 2-wire full duplex 5 12 KHz Time Compression Multiplexed (TCM) digital link.

Meridian SL-1 data block

Each digital telephone and each associated data terminal is assigned a separate Terminal Number (TN) in the SL-1 System data base.

Physical

Dgtl LC circuitry is contained on a 320 mm (12.5 in.) by 254 mm (10 in.) double-sided printed circuit board The pack connects to the backplane via a 120-pin edge connector.

The faceplate of the Dgtl LC (7/8 in. wide) snaps in place on the front of the pack and is equipped with a red LED which lights only when the pack is disabled. Upon power-up, the Dgtl LC resets and the red LED will turn off after the Dgtl LC is enabled. The card provides self-identification and fault detection.

For information on the Mean Time Between Failure rate for the Dgtl LC, *see Spares Planning* (553-3001-153).

Functional

The Dgtl LC contains an 8050 microprocessor that provides the following functions:

- card self-identification
- self-test
- control card operation
- status report to the controller
- diagnostics for maintenance purposes

Configuration

Up to 16 Dgtl LC circuit packs can be mounted in one PE shelf if the remaining slots are not used. In addition, up to 16 Dgtl LC packs can be supported by a single NT8D06AA Peripheral Equipment Power Supply (PE Pwr Sup). The PE Pwr Sup is available for both ac and dc power.

Power supply to digital telephones

The Dgtl LC needs ±15V dc over each loop at a maximum current of 80 mA. The line feed interface can supply power to one loop of varying length up to 1067 m (3500 ft) using 24 AWG gauge wire with a maximum allowable ac signal loss of 15.5 dB at 256 KHz, and a maximum dc loop resistance of 210 ohms.; 26 AWG gauge wire is limited to 745 m (2450 ft).

For a detailed description of the exact power requirements of each set type, refer ***to Meridian modular telephones*** (553-2201-l 16)

Characteristics

Table 1
Digital LIne Card circuit characteristics

Characteristics	Description
Circuits per pack	16 voice, 16 data
Options	Nil
Impedance	1008
Loop limits	
	100 ft (30 m) to 3000 ft (900 m) with 24 AWG PVC cable (±15 VDC at 80 mA)]
	0 to 3500 ft (1067 m) with 24 AWG PVC cable (±15 VDC at 80 mA)]

Table 1 continued
Digital Line Card circuit characteristics

Characteristics	Description
Line rate	512 kbps ± 100 ppm
Power supply	+ 5vdc ±15 V dc +10 V dc
Transmitter output voltage	
-successive "1" bits	+1.5 ± 0.15 V and -1.5 ± 0.15 V
—"0" bits	0 ± 50 mV

Note: The Dgtl LC requires +15V, - 15V, and +5V from the backplane.

SL-1

System options **21, 51, 61, 71**

Digital line card description

Information subject to change without notice.
Release 1 .0
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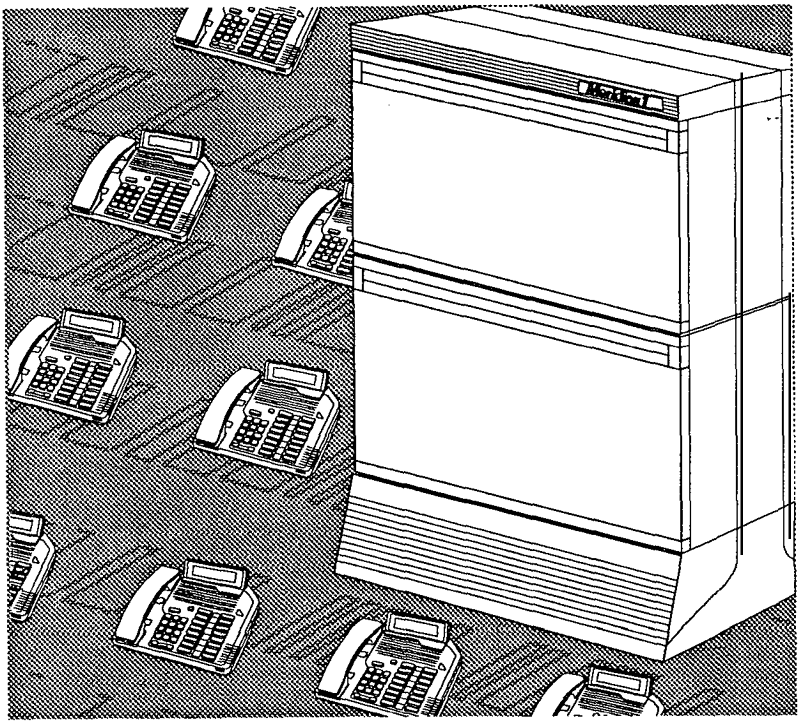
553-3001-163

SL-1

System options 21, 51, 61, 71

Analog message waiting line card description

Standard



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Meridian 1
Communication Systems

SL-1

System options 21, 51, 61, 71

Analog message waiting line card description

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Document status: Standard
Date: January 29, 1990

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January 29, 1990

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About this document

This practice outlines the characteristics, application, and operation of the NT8D09AB Analog Message Waiting Line Card. The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit. New naming conventions are applied to this release. The following documents should be used as a reference:

References

See the SL-I planning & engineering guide for

- ***Master index*** (553-3001-000)
- ***System overview*** (553-3001-100)
- ***System engineering*** (553-3001-151)
- ***Sparesplanning*** (553-3001-153)
- ***Equipment identification and ordering*** (553-3001-154)

See the list of line and trunk circuit descriptions in the ***Master index*** (553-3001-000) for specific references to lines and trunks.

See the SL-1 installation and maintenance guide for

- ***Circuit pack installation and testing*** (553-3001-211)
- ***Fault clearing*** (553-3001-510)
- ***Hardware replacement*** (553-3001-520)

See the ***SL-I X11 software guide*** for an overview of software architecture, procedures for software installation and management, and a detailed description of all X 11 features and services. This information is contained in two documents:

— *X11 software management* (553-3001-300)

— *X11 features and services* (553-3001-305)

See the SL-1 XII input/output guide (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

See the following Northern Telecom Publications for references to specific telephone sets:

— *Meridian M2000 digital telephones: description, installation, operation and maintenance* (553-2201-110)

— *Meridian M2317 digital telephone with alphanumeric display: description , installation, operation, and maintenance* (553-2201-113

— *Meridian M3000 touchphone: description, installation, operation and maintenance* (553-2201-l 15)

— *Meridian modular telephones: description and specifications* (553-2201-l 16)

Contents

General information

This publication outlines the characteristics, application, and operation of the Analog Message Waiting Line Card. The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit. The following Analog Message Waiting Line Card is available:

— NT8D09AB — Analog Message Waiting Line Card @-Law)

The Analog Message Waiting Line Card provides talk battery and signaling for regular 2-wire common battery 500-type (rotary dial), 2500-type (DIGITONE dial) telephones and key telephone equipment.

Note: DIGITONE is a trademark of Northern Telecom.

The NT8D09AB Analog Message Waiting Line Card mounts in any of the 16 slots in an NT8D37AA Intelligent Peripheral Equipment Module (IPE). The 16 circuits connect with the switching system and with the external apparatus via a 160-pin connector at the rear of the pack. The pack is 320 mm (12.5 in) in height and 254 mm (10 in) in depth.

The circuits are connected to the shelf backplane and fed to the I/O panel via I/O cables. From the I/O panel, the circuits are connected to the cross-connect terminal via 25-pair cables. Connection to the station apparatus is made at the cross-connecting terminal

Application

The line card interfaces and is compatible with the equipment listed in Table 1.

Table 1
Line card application and compatibility

Equipment	Specifications
NE-500 type rotary dial sets (or equivalent)	
Dial Speed	8.0 to 12.5 pps
Percent Break	58 to 70%
Interdigital Time	240 ms
NE-2500 type Digitone sets (or equivalent)	
Frequency Accuracy	± 1.5%
Pulse Duration	40 ms
Interdigital Time	40 ms
Speed	12.5 digits/s

Characteristics

Functional

The Analog Message Waiting Line Card contains a microprocessor that provides the following functions:

— card self-identification

— self-test

— control card operation

— status report to the controller

— diagnostics for maintenance purposes

The Analog Message Waiting Line Card also provides the following: --

— 600Ω balanced terminating impedance

— analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines

— transmission and reception of SSD signalling messages over a DS30X signalling channel in A10 format

— detection of on-hook/off-hook status and switchhook flash

— connection of 20 Hz ringing signal and automatic disconnection when the station goes offhook

— synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage

— loopback of SSD messages and PCM signals for diagnostic purposes

— indication of board status with faceplate-mounted LED

- correct initialization of all features at power-up
- connection of -150 Vdc at 1 Hz to activate message waiting lamps
- direct reporting of digit dialed (500 sets) by collecting dial pulses
- detection of lamp status
- disable/enable-selected circuits for maintenance

Technical summary

Analog line interface

Input impedance

The impedance at tip and ring is 600 Ohm with a return loss of
20 dB for 200-500 Hz
26 dB for 500-3400 Hz

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 KHz is 6dB ± 1dB. This is arranged as 3.5dB loss for analog to PCM and 2.5dB loss for PCM to analog.

Frequency response

The loss values in the table below are measured relative to the loss at 1 KHz:

Table 2
Frequency response

Frequency	Minimum	Maximum
60 Hz	20.0 dB	
200 Hz	0.0 dB	5.0 dB
300 Hz	-0.5 dB	1.0 dB
3000 Hz	-0.5 dB	1.0 dB
3200 Hz	-0.5 dB	1.5 dB
3400 Hz	0.0 dB	3.0 dB

Message channel noise-

The message channel noise C-weighted (dBrnC) on 95% of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

A technical summary of the line card is given in Table 3.

Table 3
Technical summary of Analog Message Waiting Line Card

Impedance:	600 Ω
Loop limit (excluding set)	1000 Ω at nominal -48 V
Leakage resistance	30,000 Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86Vac
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (-48 V on ring; ground on tip)
Power input from shelf backplane	-48, +15, -15, +8.5 V and ringing voltage; also - 150 V on Message Waiting Line card.
Insertion loss	6dB ±1dB at 1020 Hz 3.5dB loss for analog to PCM, 2.5dB loss for PCM to analog
Effective gain	1.5dB at 1020 Hz

Power requirements

NT8D09AB

The NT8D09AB Analog Message Waiting Line Card has the following power requirements:

Table 4
Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+ 12.0 V dc	0.36 V dc	48 ma	O ma	48 ma
+ 8.0 Vdc	0.40 V dc	150 ma	8 ma	280 ma
- 48.0 Vdc	2.00 V dc	48 ma	40 ma	688 ma
- 48.0 Vdc	5.00 V dc	0 ma	(1) 10 ma	320 ma
88.0 V ac	5.00 V ac	0 ma	(2) 10 ma	160 ma
-150.0 V dc	3.00 V dc	0 ma	2 ma	32 ma

Note: (1) Each active ringing relay requires 10 ma of battery voltage.

(2) Reflects the current for ringing a single station set. There may be as many as five ringers on each line.

Foreign and surge voltage protections

When telephone lines connected to the line circuit are exposed to foreign voltages by direct contact or induction (for example, power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip and ring for foreign voltages that exceed 600 V peak.

Overload level

Signal levels exceeding + 7 dBm applied to the tip and ring cause distortion in speech transmission.

SL-1

System options 21, 51, 61,71

Analog message waiting line card
description

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PRACTICE 553-2201-184
Issued: 84 01 20
Standard

INTEGRATED SERVICES NETWORK

MERIDIAN SL-1.

SL-1 LINE AND CONSOLE LINE PACKS DESCRIPTION AND OPERATION

CONTENTS PAGE

* Meridian and SL-1 are trademarks of Northern Telecom Limited

Printed in U.S.A.

1. GENERAL

1.01 This practice outlines the functions, interconnections, characteristics and operation of the SL-1 Business Communications System, SL-1 Line and Console Line circuit packs. The information is intended to be used as a guide when designing or engineering the connection of apparatus to the line circuit.

1.02 The information in this practice applies to the following packs:

- QPC451 SL-1 Line (μ-Law)
- QPC520 SL-1 Line (A-Law)
- QPC518 Console Line (μ-Law) (superceded by the QPC451)
- QPC519 Console Line (A-Law).

1.03 The four packs use identical circuit boards but are configured for their respective operation. The SL-1 line packs can each interface to up to eight SL-1 sets. The console line packs can interface to two attendant consoles. The QPC451 SL-1 line pack can be used for four attendant-consoles without console power or two attendant consoles with console power.

2. DESCRIPTION

FUNCTIONS

2.01 The SL-1 and console line circuit packs each contain eight line circuits (see Fig. 2-1). The SL-1 line pack can use all eight circuits, each circuit interfacing to an SL-1 set. The console line pack uses pairs of line circuits to interface to attendant consoles: one pair may be used from the upper four circuits and one pair from the lower four to interface to two consoles.

> **Note:** Line circuits on the SL-1 line pack are automatically powered up during signaling and transmission. The connected circuit pairs on the console line pack are continuously powered on.

2.02 For SL-1 set connections. one pair of wires is used for ← transmission and a second pair for signaling (see Fig. 2-2). For attendant console connections, two pairs of wires are used for transmission connections and two pairs for signaling connections. These connecLions:

(a) terminate the loop tip and ring conductors with a balanced 600-ohm termination:

(b) provide ±15 V power, phantomed over the transmission and signaling pairs, to the set or console terminals:

(c) provide a measure of isolation of foreign potentials on the loop from portions of the transmission and signaling circuitry;

(d) convert from the 2-wire transmission path of the loop to a 4-wire transmission path:

(e) provide analog-to-digital and digital-to-analog conversion of transmission signals.

2.03 The circuit pack includes two common multiplexing circuits to:

(a) interface the individual line circuits with the peripheral bus signaling channel:

(b) retime digital signals received from the peripheral bus;

(c) decode address information received from the peripheral bus and enable individual line circuits during selected time slots.

2.04 The information and signaling relevant to the SL-1 set or console passes through the line circuit pack and is multiplexed with information from other circuit packs. A multiplex loop connects the input and output of up to two Peripheral Equipment (PE) shelves to the Common Equipment (CE) where switching takes place (see Fig. 2-2 and 2-3).

PHYSICAL DESCRIPTION

2.05 The line circuits and common circuitry of the pack are mounted on a 12.5 in (320-mm) by 10 in (254-mm) printed circuit board. The front of the pack is equipped with two pack extractors and a Light Emitting Diode (LED). The rear of the pack is equipped with a connector capable of accepting 80 pins. Ten of these circuit packs may be mounted in one PE shelf but not to exceed 50% of the packs in a cabinet.

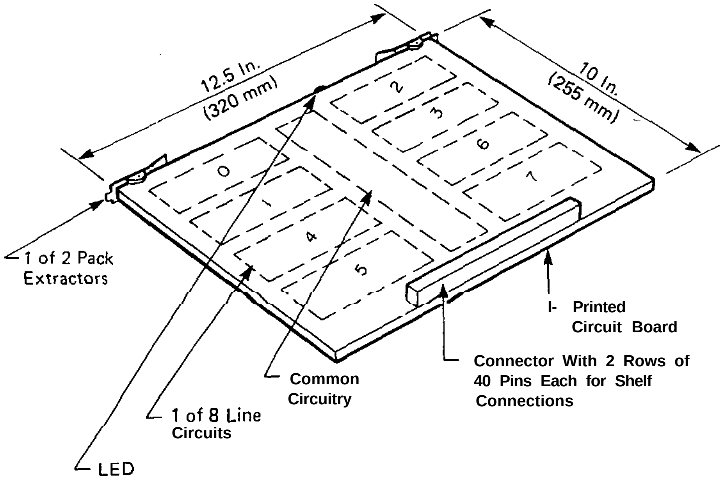


Fig. 2-l
Identification of the Circuits on the Board

INTERCONNECTION WITH SHELF

2.06 The IO-pin connector on the rear of the circuit pack connects to an 80-line bus system at the rear of the PE shelf. The bus lines feed into eight multi-pin connectors. Seven of these connectors link the line circuits to the corresponding terminal equipment and one feeds power to the PE shelf from the power converter shelf.

2.07 Thirty-two of the 80 pins per circuit pack are connected to terminal equipment, 2 pins provide ground, 13 pins interface with the CE via the peripheral buffer and 15 pins provide voltages to the circuit pack.

2.08 For detailed information on terminal set line connections to the four PE shelf connectors, refer to 553-2YY1-210.

POWER SUPPLY TO TERMINALS

2.09 The SL-1 set battery supply is -30 V dc phantomed over the audio and signaling leads to each terminal set.

2.10 As a general installation guideline. sufficient power is available for the SL-1 set at a normal operating range of 189 ohms (see Loop Limits in Table 3-A).

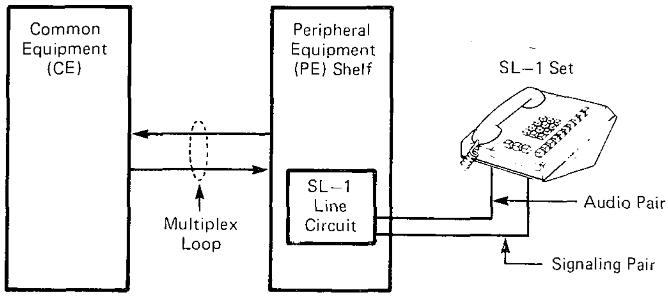


Fig. 2-2
Line Circuit Connection to SL-1 Set

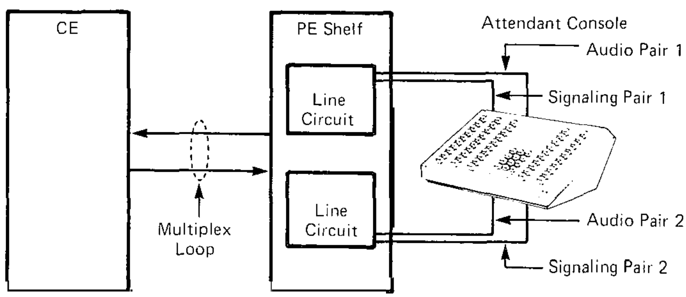


Fig. 2-3
Line Circuit Connection to Attendant Console

3. CIRCUIT CHARACTERISTICS

3.01 The circuit characteristics of the line pack are listed in Table 3-A.

Table 3-A
CIRCUIT CHARACTERISTICS OF THE LINE PACK

CHARACTERISTICS	AS RELATED TO THE CIRCUIT PACK
CIRCUITS PER PACK	Eight individual circuits
OPTIONS	Nil
IMPEDANCE	
Voice Pair	600 ohms
Signaling Pair	600 ohms
NOMINAL INSERTION LOSS	5 dB line-to-line
LOOP LIMITS	WIRE GAUGE / DISTANCE
	22: 6000 feet (1830 m)
	24: 3700 feet (1150 m)
	26: 2300 feet (675 m)
	Note: Under certain conditions the loop limits may be extended to 8000 feet (2450 m). See 553-2YY1-210.
SIGNALING PAIR	
Mode	Diphase
Rate	2.37K bit/s
Level	0.75 ±0.05 V peak-to-peak across the line.
AUDIO PAIR	
Mode	Analog (audio)

Table 3-A Continued
CIRCUIT CHARACTERISTICS OF THE LINE PACK

CHARACTERISTICS	AS RELATED TO THE CIRCUIT PACK
PHANTOMED POWER	30 ±1 V divided as:
Audio Pair Level	+15 ±0.05 v
Signaling Pair Level	-15 ±0.05 v
POWER INPUT FROM SHELF BACKPLANE	+6, -6, +2.5 V, 30 V dc balanced

4. OPERATION WITH SL-1 SET

IDLE CIRCUIT STATES

4.01 SL-1 Set On-Hook. Multiplex control generates and sends scan message to SL-1 set (2.5 ms message every 10 ms). Message is sent via the signaling pair and hybrid transformer (Fig. 4-l).

(1) Message detected by Scan and Signal Distributor (SSD). (See Fig. 4-2 and 4-3.)

(2) No message is being sent to line circuit on signaling pair.

(3) In time slot 0, CE scans each line circuit on loop in sequence, detecting any change in signaling on the data input bus.

(4) Line circuit 0 is enabled in time slot 0. Signaling on data output bus indicates that CE is ready to receive data.

(5) No message on data input bus to CE indicates line circuit 0 is idle.

CALL ORIGINATED FROM AN SL-1 SET

4.02 Originating the Call. SL-1 is off-hook (key operated). Off-hook is detected by SSD in SL-1 set.

(1) SSD sends off-hook signaling to line circuit on signaling pair at 2.37K bit/s when scanned by message from multiplex. control.

(2) Off-hook message from line circuit 0 is multiplexed with messages from other line circuits and sent at a rate of 64K bit/s to the CE.

(3) CE line scan detects change in signaling for line circuit 0.

(4) CE line scan stops.

(5) For the next 31 times, time slot 0 signaling message is sent-to CE on data input bus from line circuit 0, then line scan continues.

(6) CE detects signaling from line circuit 0 and determines circuit number (TN number).

(7) CE assigns message time slot to line circuit from time slots 2 through 31.

(8) Signaling from CE is applied to the SL-1 set or console on signaling pair. Rate is changed from 64K bit/s to 2.37K bit/s by multiplex control.

(9) Signaling is detected by SSD.

(10) SL-1 set directory number lamp is lit.

(11) PCM codec is enabled during message time slot assigned by CE.

(12) Dial tone on the data output bus is applied to SL-1 set via multiplex control, PCM codec, digital-to-analog filter, hybrid transformer and audio pair (during message time slot).

(13) Dialed information from SL-1 set on signaling pair is applied to the data input bus during time slot 0 (signaling).

(14) CE detects dialing and removes dial tone at start of dialing.

(15) CE encodes dialed information.

(16) Ringback tone on the dam output bus is applied to SL-1 set over audio pair during message time slot assigned by CE (busy tone received if called number is busy).

4.03 Talking Connection. Called number answers.

(1) Ringback tone is removed by CE.

(2) Digital voice on dam output bus is applied to SL-1 set via multiplex control, PCM codec, digital-to-analog filter, hybrid transformer and audio pair during message time slot.

(3) Analog voice on audio pair from SL-1 set is applied to dam input bus via hybrid transformer, analog-to-digital filter, PCM codec, multiplex control, and buffer (during time slot).

4.04 Terminating the Call. Assume SL-1 set goes on-hook first.

(1) On-hook message is transmitted from set to line circuit.

(2) Signaling on data output bus changes: SL-1 set lamp extinguishes.

(3) ADD inputs removed (no signaling for line circuit 0).

(4) Line circuit enable inputs are removed (message time slot is no longer assigned to line circuit).

(5) Circuitry in IDLE condition, ready for next call.

CALL TO SL-1 SET

4.05 Signaling to the Terminal. In time slot 0, CE scans each line on the loop-in sequence.

(1) CE has call for line circuit 0.

(2) CE determines line circuit 0 is idle (no signaling from circuit on data input bus during time slot 0).

(3) CE assigns message time slot for audible signaling (from time slots 1 through 31).

(4) Line circuit is enabled during time slot 0.

(5) Visual signaling data on data output bus during time slot 0 is applied to multiplex control. Visual signaling data is applied to SL-1 set over signaling pair.

(6) Signaling is detected by SSD (Line lamp of SL-1 set flashes).

(7) PCM codec is enabled during message time slot.

(8) Audible signaling applied to SL-1 set via digital-to-analog filter, hybrid transformer and audio pair.

(9) SL-1 set signaled audibly (tone ringing).

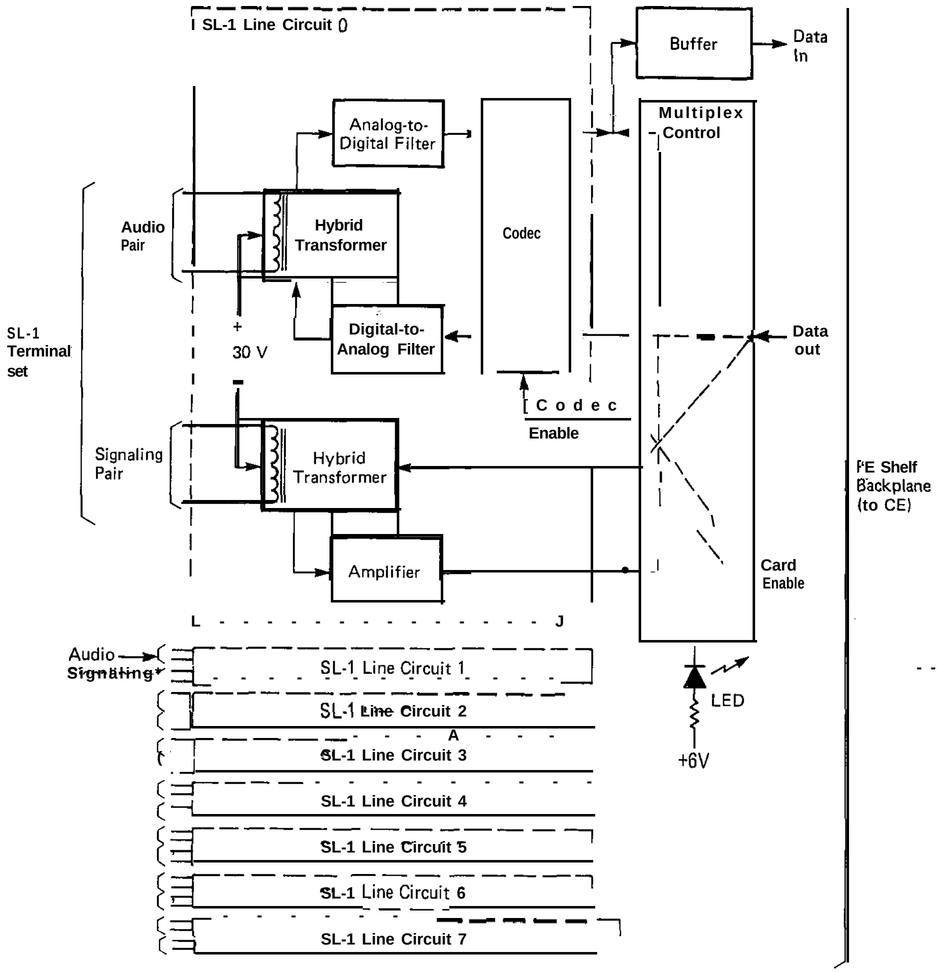


Fig. 4-l
Simplified Functional Block Diagram of Line Circuit Pack

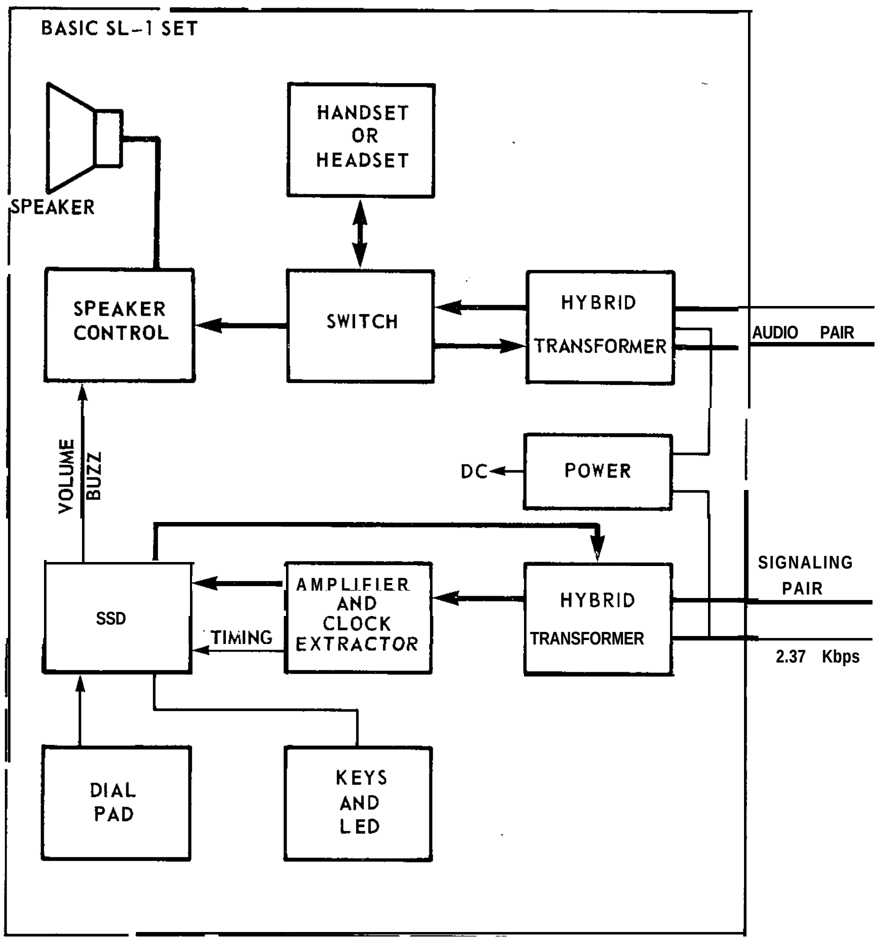


Fig. 4-2
SL-1 Line Circuit Connected to Basic SL-1 Set

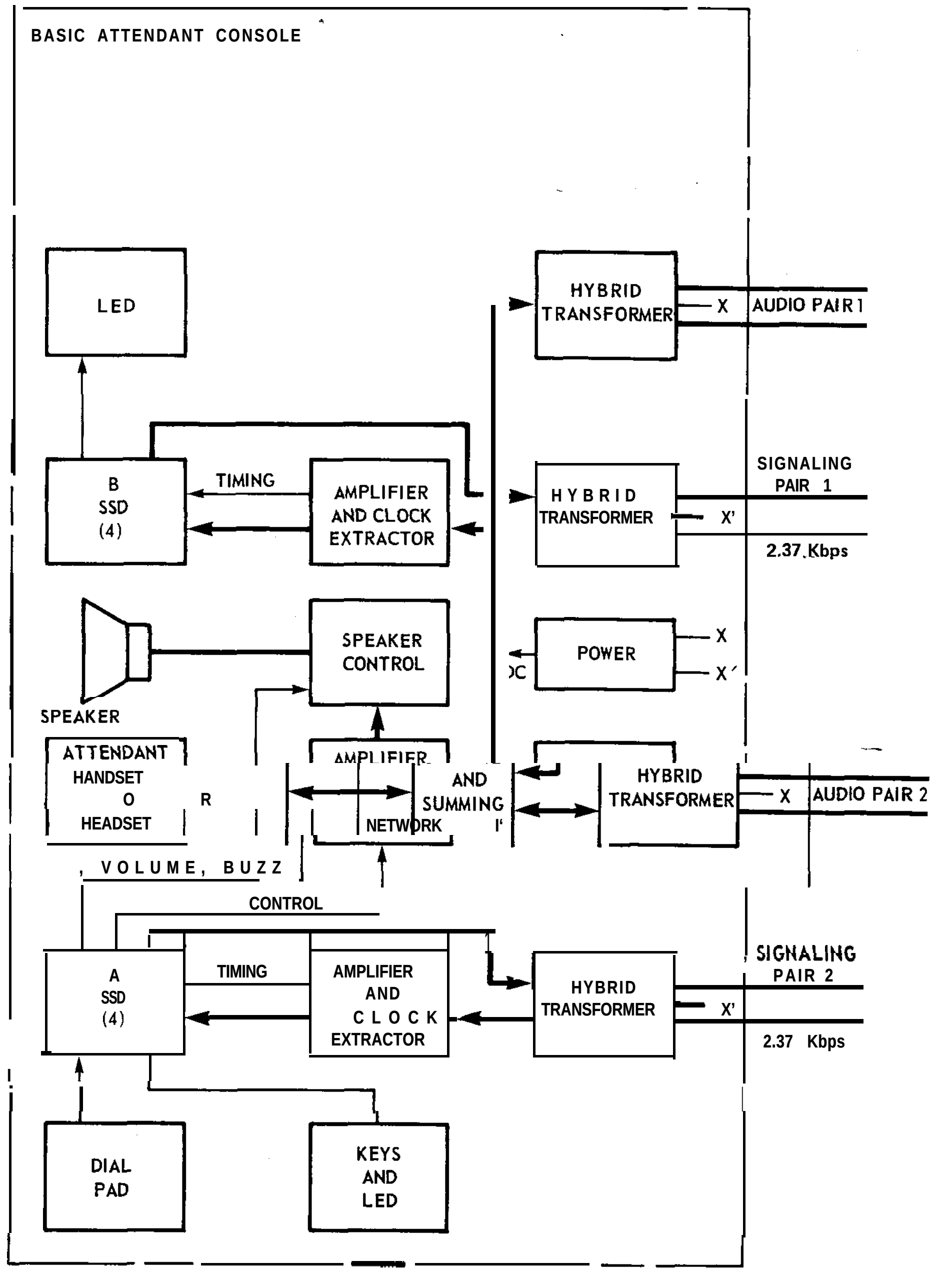


Fig. 4-3
Console Line Circuit Connected to Basic Attendant Console

4.06 Terminal Answers. SSD in SL-1 set sends off-hook signaling to line circuit on signaling pair.

(1) Off-hook signaling data on data input bus during time slot 0 (via multiplex control and buffer).

(2) CE detects signaling.

(3) CE changes visual signaling on data output bus during time slot 0. Visual signaling is applied to SL-1 set on signaling pair. Line lamp of SL-1 set changes from flashing to steady light,

(4) CE removes audible signaling from data output bus during message time slot (message time slot now assigned for voice communications).

(5) Audible signaling at SL-1 set stops.

4.07 Talking Connection. PCM codec is enabled during message time slot.

(1) Digital voice on data output bus is applied to SL-1 set via multiplex control, PCM codec, digital-to-analog filter, hybrid transformer, and audio pair.

(2) Analog voice from SL-1 set is applied to data input bus via audio pair, hybrid transformer, analog-to-digital filter, PCM codec, multiplex control, and buffer.

4.08 Terminating the Call. Assume SL-1 is put on-hook first.

(1) SSD transmits on-hook message to line circuit.

(2) On-hook message transmitted to CE through data input bus during time slot 0 at a rate of 64K bit/s.

(3) CE detects a change in signaling.

(4) Signaling on data output bus changes; SL-1 set line lamp extinguishes.

(5) ADD inputs are removed (no signaling for line circuit 0).

(6) Enable inputs are removed (message time slot no longer is assigned to line circuit 0).

(7) Circuitry in IDLE condition: ready for next call.

CLASS-OF-SERVICE AND FEATURES

4.09 All calls originating from and terminating on stations connected to line and trunk circuits may be controlled with or without attendant assistance. Call restrictions to the exchange network and special services, are assigned through unique station/line circuit data blocks contained in the system memory. Similarly, feature assignments are arranged through the same data blocks. Refer to 553-2YY1-105 for a complete list and description of features and services. Refer to 553-2YY1-310 for a description of how features and services are created in the system memory.

5. DESIGN CONSIDERATIONS

FOREIGN AND SURGE VOLTAGE PROTECTION

5.01 When telephone lines connected to the line circuit are exposed to foreign voltages by direct contact or induction (e.g., power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip to ring for foreign voltages that exceed 600 V peak.

OVERLOAD LEVEL

5.02 Signal levels exceeding +7 dBm applied to the tip and ring will cause distortion in the system.

northern telecom

INTEGRATED SERVICES NETWORK

MERIDIAN SL-1*

500/2500 LINE PACKS DESCRIPTION AND OPERATION

CONTENTS PAGE

Reason for Reissue: This practice is reissued to include information related to the QPC789 16-Port Message Waiting 500/2500 Line circuit pack. Changes are indicated by margin arrows.

* SL-1 and Meridian are trademarks of Northern Telecom

1. GENERAL

1.01 This practice outlines the characteristics, application and operation of the 500/2500 line circuit packs. The information is intended to be used as a guide when connecting customer-provided apparatus to the line circuit.

1.02 The following 500/2500 line packs are availadle:

- QPC192 - Off-Premise Extension (OPX) Line pack (μ-Law)
- QPC292 - Off-Premise Extension (OPX) Line pack (A-Law)
- QPC452 - Basic 500/2500 Line pack for μ-Law applications
- QPC494 - Message Waiting Line pack (μ-Law)
- QPC521 - Basic 500/2500 Line pack for A-Law applications
- QPC532 - Ground Button Recall Line pack (A-Law and μ-Law)
- QPC558 - Message Waiting Line pack (A-Law)
- QPC594 - 16-Port Basic 500/2500 Line pack (μ-Law)
- QPC681 - Parallel Message Waiting Line pack (μ-Law)
- QPC682 - Parallel Message Waiting Line pack (A-Law).
- QPC729 - 16-Port Basic 500/2500 Line pack (A-Law)
- QPC789 - 16-Port Message Waiting 500/2500 Line pack (μ-Law) ←

2. DESCRIPTION

2.01 All versions of the 500/2500 line packs provide talk battery and signaling for regular 2-wire common battery 500-type (rotary dial), 2500-type (DIGITONE* dial) telephones and key telephone equipment. The various special versions serve additional purposes as described in Part 4.

2.02 The line circuit packs mount in a Peripheral Equipment (PE) shelf. The circuits connect with the switching system and with the external apparatus via an 80-pin connector at the rear of the pack. The pack is 318 mm (12.5 in) in height and 254 mm (10 in) in depth.

2.03 The 80-pin connector plugs into an IO-line bus system on the back of the PE shelf. These 80 bus lines feed into seven multi-pin connectors. Seven connectors link the line circuits to the cross-connect terminal; two faceplate connectors on the Peripheral Buffer link the PE shelves to each other and to the Common Equipment (CE); and one connector feeds power to the PE from the converter shelf.

2.04 Connection to the station apparatus is made at the cross-connecting terminal, as shown in the following block diagram of the line circuit connected to a 500/2500 telephone:

* DIGITONE is a trademark of Northern Telecom

3. APPLICATION

3.01 The line circuit interfaces and is compatible with the equipment listed in Table 3-A.

Table 3-A
LINE CIRCUIT APPLICATION AND COMPATIBILITY

EQUIPMENT	SPECIFICATIONS
NE-500 TYPE ROTARY DIAL SETS (or equivalent)	
Dial Speed	8.0 to 12.0 pps
Percent Break	58 to 69%
Interdigital Time	240 ms
NE-2500 TYPE DIGITONE SETS (or equivalent)	
Frequency Accuracy	±1.5 %
Pulse Duration	40 ms
Interdigital Time	40 ms
Speed	12.5 digits/s
KEY TELEPHONE EQUIPMENT	NE-1A1, NE-1A2, or equivalent
RECORDED ANNOUNCEMENT	*CODE-A-PHONE 200 VCA RDY (unattended telephone answering set)
DIAL LONG LINE CIRCUIT	J99234T-2/SD96555-01
LOOP EXTENDERS	Various
24V4 REPEATERS	598615 AJ-1/SD97747-01 598615 BJ-1/SD97747-01

* CODE-A-PHONE is a trademark of Ford Industries Inc

4. CHARACTERISTICS

FUNCTIONAL

Common Features

4.01 The following features are provided:

- 600Ω balanced terminating impedance
- -48 V through a battery feed resistance and ground
- supervise the loop current to determine on-hook/off-hook status
- ringing current to the loop
- isolation of foreign potentials on the loop from the transmission and signaling circuit
- conversion from a 2- to a 4-wire transmission path
- analog-to-digital and digital-to-analog conversion of transmission signals
- common multiplexing' circuit to interface with the peripheral bus signaling channel
- retime the digital signals received from the peripheral bus
- decode address information received from the peripheral bus to enable individual line circuits during selected time slots
- control the disconnection timing of ringing current to the loops to avoid switching during current peaks.

Unique Features

4.02 The various special versions of the 500/2500 line pack have additional features as follows:

4.03 QPC192 and QPC292 OPX Line packs:

- serve lines up to a maximum loop resistance of 1400 Ω
- serve Dataphone sets
- have line-to-line insertion loss of 1 dB.

4.04 QPC494 and QPC558 Message Waiting Line packs:

- provides connection of -150 V in a steady or 1 Hz flash rate to activate the Message Waiting lamp on the telephone
- provides for one Message Waiting lamp per line
- maintain all Message Waiting lamps off and do not allow phones to ring during power-up sequence.

- generate diagnostics 'an "ERROR 500" message when the Message Waiting lamp is defective or the telephone is unplugged provided -150 V is present. If -150 V is missing (blown fuse) no message is generated under any condition.

4.05 QPC681 and QPC682 Parallel Message Waiting Line packs:

- provides the same features as the QPC494 and QPC558 Message Waiting Line packs
- provides a -48 V connection to a lamp bank.

4.06 QPC532 Ground Button Recall Line pack:

- provides detection of ground on tip or ring with 40 ms validation time
- strap-selectable A-Law or μ-Law coding
- strap-selectable 0, 1, 2 or 4 dB pad in each transmission path
- impedance-matching to 3-component complex impedances
- trans hybrid balance against 3-component complex impedances.

4.07 QPC594 and QPC729 16-Port Basic 50012500 Line Packs:

- sixteen individual line circuits per pack.

4.08 QPC789 16-Port Message Waiting 50012500 Line Pack:

- sixteen message waiting individual line circuits per pack.

TECHNICAL SUMMARY

4.09 A technical summary of the line circuit pack is given in Table 4-A.

Table 4-A
TECHNICAL SUMMARY OF LINE CIRCUIT PACK

Impedance:	
QPC452/521, QPC494/558	600 Ω
QPC594/729/789, QPC681/682	600 Ω
QPC192/292	900 Ω
QPC532	600 Ω, matches 3-component complex impedances
Loop Limit (excluding set):	
QPC192/292	1400 Ω at nominal -48 V
All others	1000 Ω at nominal -48 V
Leakage Resistance	
QPC532	20,000 Ω
All others	30,000 Ω
Ring Trip	During silent or ringing intervals
Ringing Voltage	Determined by the type of ringing generator provided in the system
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (—48 V on ring: ground on tip) - -
Power input from shelf backplane	-52, -48, i-6, -6, i-2.5 V and ringing voltage: also -150 V on Message Waiting Line cards.
Insertion loss	5, ±1 dB, at 1020 Hz
Effective Gain (QPC192/292)	1.5 dB at 1020 Hz

LIMITATIONS

4.10 The maximum number of **Ringers** that can be connected to each DN loop is shown below:

LOOP RESISTANCE	MAXIMUM NUMBER OF RINGERS QPC452/QPC494 QPC521/QPC558	QPC594/QPC789 QPC729
1000	2	2
850	3	3
600	4	4
350	5	4

Note: Loop resistance excludes impedance of telephone sets.

4.11 Supervision limitations are given in Table 4-B.

4.12 To maintain transmission quality, the following shows the maximum number of **Voice Calls** (number of telephone sets off-hook on the same DN) recommended:

RESISTANCE (OHMS)	QPC452/QPC494 QPC521/QPC558		QPC594/QPC789 QPC729	
	17ma	20ma	17ma	20ma
	2		2	
up to 40	2	2	2	1
41 to 100		1		1
101 to 250	2	1	1	1
251 to 1000	1	1	1	1

Note 1: Loop resistance excludes impedance of telephone sets.

Note 2: 17ma/20ma is the current that a typical telephone set requires in an off-hook condition.

POWER REQUIREMENTS

4.13 The QPC452, QPC521, QPC681 and QPC682 packs have the following typical power requirements:

VOLTAGE	IDLE CURRENT (mA)	ACTIVE CURRENT (mA)
+2.5 V, ±0.5%	<0.1	<0.1
+6 V, ±1%	50	140
−6 V, ±1%	50	140
-48 V, ±3%	1	320
+52 V, ±4%	1	85

4.14 **The QPC494 and QPC558 packs** have the following typical power requirements:

VOLTAGE	IDLE CURRENT (mA)	ACTIVE CURRENT (mA)
-150 V, ±5%	0	30
+2.5 V, ±0.5%	<0.1	co.1
+6 V, ±1%	50	140
-6 V, ±1%	50	140
—48 V, ±3%	1	320
+52 V, ±4%	1	85

4.15 **The QPC532 pack** has the following typical power requirements:

VOLTAGE	IDLE CURRENT (mA)	ACTIVE CURRENT (mA)
+2.5 V, ±0.5%	<0.1	<0.1
+6 V, ±1%	50	150
—6 V, ±1%	50	150
-48 V, ±3%	1	320
+52 V, ±4%	1	85

4.15 **The QPC594. QPC729 and QPC789** have the following typical power requirements:

VOLTAGE	IDLE CURRENT (mA)	ACTIVE CURRENT (mA)
+6 V, ±1%	120	300
- 6 V, ±1%	120	300
-48 V, ±3%	2	550
+52 V, ±4%	2	10
-150 V, ±5%(QPC789 only)	0	20

4.17 **The QPC594, QPC729 and QPC789** Quad Density Line Cards use the following configurations on a per shelf basis when used with the QPC464 buffers (note 1):

Max # of QPC594/QPC729 QPC789 per shelf	Max # of Double Density Packs per shelf	# of Empty Slots
3	7	0
4	5	1
5	3	2 (note 2)
6	1	3

Note 1: One QPC80 is required for every 5 PE shelves.

Note 2: The Meridian SL-1 S QPC501 optional backplane is equipped with only 8 slots.

4.18 When the QPC594, QPC729 or QPC789 Quad Density line card is used with the QPC659 (note) Dual Loop buffer, there are no restrictions to the number of packs in a Dual Loop shelf.

Note: In cabinets equipped with QSD65 Dual Loop shelves, one QPC80 is required for every 14 PE shelves.

4 4.19 There are no **Thermal Restrictions** for the QPC594, QPC729 and QPC789 Quad Density line cards even though no cooling unit is available.

ENVIRONMENTAL

4.20 The 500/2500 Line packs have the following environmental specifications:

(a) Operating Temperature Range: 0 to 50° C, ambient.

(b) Operating Humidity Range: 5 to 95 %.

(c) Storage Temperature: -40 to i-70“ C.

Table 4-B
SUPERVISION LIMITATIONS

SUPERVISION	LIMITATION
Answer	Does not reverse the battery when the terminating end answers.
Disconnect	Does not momentarily open-circuit the Tip and Ring leads or disconnect.

FOREIGN AND SURGE VOLTAGE PROTECTION

4.21 When telephone lines connected to the line circuit are exposed to foreign voltages by direct contact or induction (e.g., power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip and ring for foreign voltages that exceed 600 V peak.

OVERLOAD LEVEL

4.22 Signal levels exceeding i-7 dBm applied to the tip and ring cause distortion in speech transmission.

5. OPERATION

5.01 This part contains signaling and supervision operations which apply to the line circuit during various states of operation. Refer to Fig. 5-l for a block diagram of a typical 500/2500 line circuit, Fig. 5-2 for a block diagram of the QPC192 and QPC292 packs, and Fig. 5-3 for a block diagram of the QPC594, QPC729 and QPC789.

IDLE CIRCUIT STATE

5.02 The 50012500 Telephone is On-Hook:

- No current is drawn from the -48 V supply.
- Off-hook detector continuously monitors the state of the 500/2500 line.
- In time slot 0, the CE scans each line circuit on the loop in sequence, detecting any change in signaling on the data input bus.
- In time slot 0, the circuit is enabled. Signaling on the data output bus indicates that the CE is ready to receive data. If no message is returned from the line circuit to CE, then line circuit is idle.

CALL ORIGINATED FROM A 50012500 TELEPHONE

5.03 Originating the Call.

(1) Telephone goes off-hook.

(2) Current is drawn from the -48 V supply.

(3) Off-hook state is detected by off-hook detector.

(4) Multiplex control sends off-hook signaling to CE on data input-bus during time slot 0 (via the buffer).

(5) CE detects signaling from line circuit and determines circuit number (terminal number).

(6) CE assigns message time slot to line circuit (from time slots 2 to 31)

(7) The line circuit and PCM codec are enabled during the message time slot assigned to the line circuit.

(8) CE applies dial tone (during message time slot) to telephone via data output bus, multiplex control, digital-to-analog filter and hybrid transformer.

(9) Dialed information from telephone is applied to data input bus during time slot 0 (signaling).

(10) CE detects dialing and removes dial tone at start of dialing.

(11) CE decodes dialed information.

(12) Ringback tone on the data output bus is applied to telephone during message time slot assigned by CE (busy tone received if called number is busy).

5.04 Talking Connection.

(1) Called party answers.

(2) Ringback tone removed by CE.

(3) During message time slot,. digital voice on data output bus is applied to telephone via multiplex control, PCM codec, digital-to-analog filter and hybrid transformer.

(4) During the message time slot, analog voice from telephone is applied to the data input bus via hybrid transformer, analog-to-digital filter, PCM codec, multiplex control and buffer.

5.05 Terminating Call.

(1) Telephone goes on-hook.

(2) On-hook condition is detected by off-hook detector.

(3) Message sent to CE.

(4) CE detects removal of signaling.

(5) The circuit enable inputs are removed and the message time slot is no longer assigned to the line circuit.

(6) Circuitry in 'idle' condition, ready for next call.

CALL TO TELEPHONE

5.06 Signaling the Called Telephone.

(1) CE is continuously monitoring the status of line circuit (time slot 0 signaling).

(2) CE has call for line circuit 0.

(3) CE determines that line circuit 0 is idle (no signaling from circuit on the data input bus during time slot 0).

(4) Signaling on the data output bus during time slot 0 is applied to multiplex control.

(5) Ring Control (RC) signal from the multiplex control energizes circuit at the rate determined by software.

(6) The 20 Hz ringing is applied to the 500/2500 telephone via K1 make-contacts and hybrid transformer.

5.07 Called Telephone Answers.

(1) Telephone goes off-hook, closing loop.

(2) Off-hook condition is detected by the off-hook detector during the silent or ringing interval.

(3) Ring control signal is removed.. Relay K1 is deenergized.

(4) Ringing voltage is removed from called telephone.

(5) Multiplex control sends off-hook signaling data to CE on the data input bus during time slot 0.

(6) CE detects signaling.

(7) CE removes ringing signaling on the data output bus during time slot 0.

5.08 Talking Connection.

(1) Circuit and codec enable inputs are received during message time slot assigned by CE.

(2) During message time slot, digital voice on the data output bus is applied to the telephone via multiplex control, PCM codec, digital-to-analog filter and hybrid transformer.

(3) During message time slot, analog voice from telephone is applied to the data input bus via hybrid transformer, analog-to-digital filter, PCM codec, multiplex control and buffer.

5.09 Terminating the Call.

(1) Called telephone goes on-hook.

(2) On-hook condition detected by off-hook detector.

(3) No signaling on the data input bus during time slot 0.

(4) CE detects removal of signaling.

(5) Signaling for line circuit is removed from data output bus.

(6) Circuit enable inputs removed (message time slot is no longer assigned to line circuit 0).

(7) Circuitry in 'idle' condition, ready for next call.

MESSAGE WAITING LAMP OPERATION

5.10 Message Waiting Lamp Activation.

(1) Telephone idle.

(2) CE receives a signal from the message center and sends it to the message waiting line circuit.

(3) The message waiting lamp control on the message waiting line circuit places -150 V across tip and ring to light the lamp at the telephone and -48 V accross -48 V and GND pair to the lamp bank.

(4) Telephone goes off -hook.

(5) The off-hook condition is detected by the line circuit and the lamp control removes the -150 V from the tip and ring of the telephone. The message waiting lamp is deactivated.

(6) Telephone goes on-hook.

(7) The on-hook condition is detected by the line circuit,, the lamp control places -150 V on the tip and ring of the telephone and restores the message waiting lamp to the lit state.

5.11 Message Waiting Lamp Cancellation from Telephone.

(1) Telephone originates a call to the message center.

(2) The off-hook condition is detected by the message waiting line circuit and the lamps at the telephone and at the lamp bank are deactivated.

(3) The message center answers.

(4) The CE signals the line circuit and the message lamp control cancels the message waiting condition.

(5) Telephone goes on-hook.

(6) Message waiting lamp remains unlit.

5.12 Message Waiting Lamp Cancellation from Message Center.

(1) The CE receives a signal from the message center to cancel the message waiting condition.

(2) The message waiting line circuit receives the signal from the CE and the message waiting lamp control removes the -150 V from the tip and ring of the telephone and the -48 V from the lamp bank.

(3) The lamp is deactivated and the message waiting condition is cancelled.

GROUNDBUTTON OPERATION

5.13 Ground Button Depressed While on an Established Call:

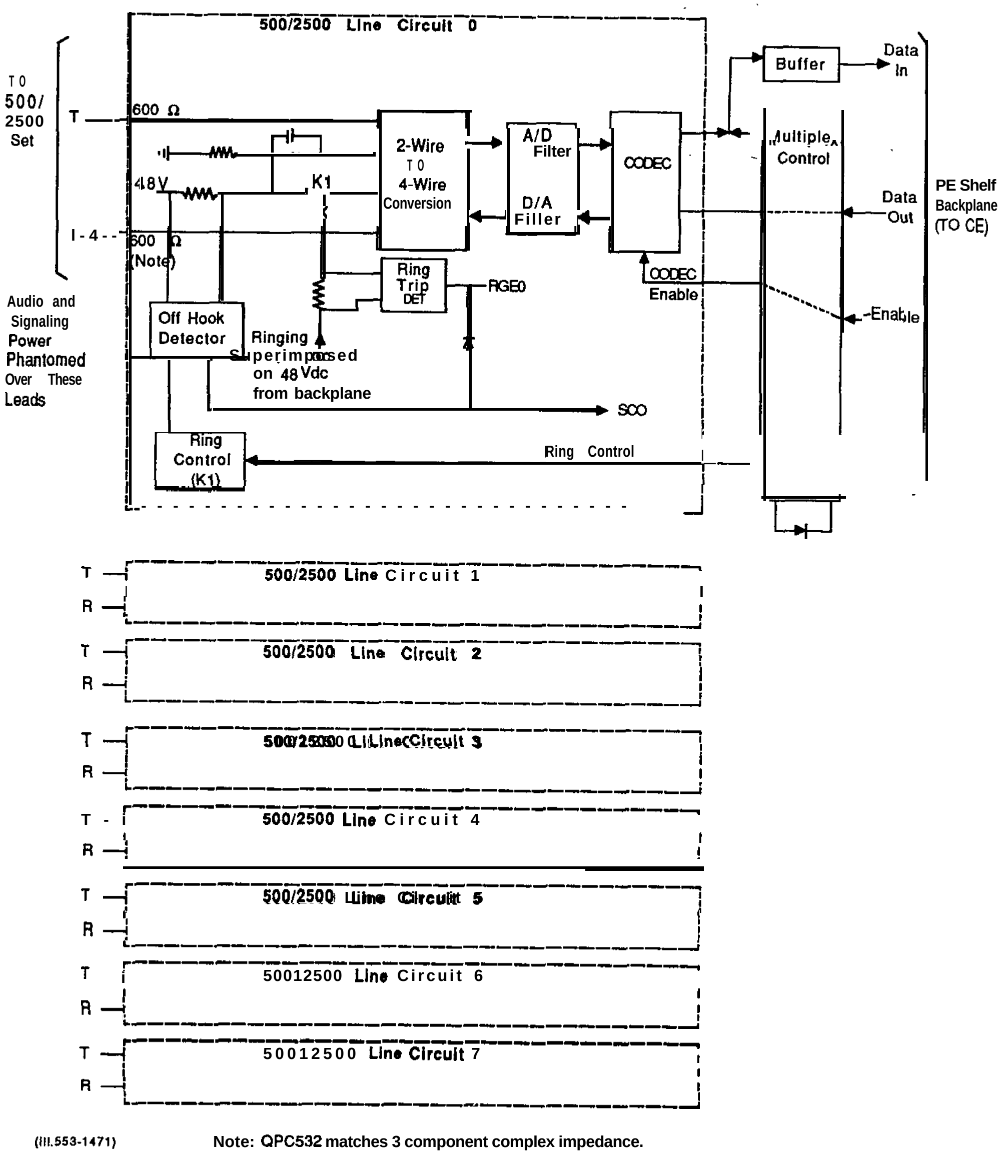
(1) Ground button detector on the QPC532 sends a ‘ground detected signal to the scan and signal distributor.

(2) The SSD encodes a signal and sends it to the central processing unit (CPU).

(3) The CPU provides a special tone to the party that depressed the ground button and places the other party on hold.

CLASS OF SERVICE AND FEATURES

5.14 All calls originating from and, terminating on stations connected to line and trunk circuits may be controlled with or without attendant assistance. Call restrictions to the exchange network and special services are assigned through unique station/line circuit data blocks contained in the system memory. Similarly, feature assignments are arranged through the same data blocks. Refer to 552-2YY1-105 for a complete list and description of features and services. Refer to 552-2YY1-310 for a description of how features and services are created in the system memory.



Note: QPC532 matches 3 component complex impedance.

Fig. 5-l
→ Block Diagram of a double density 50012500 Line Pack

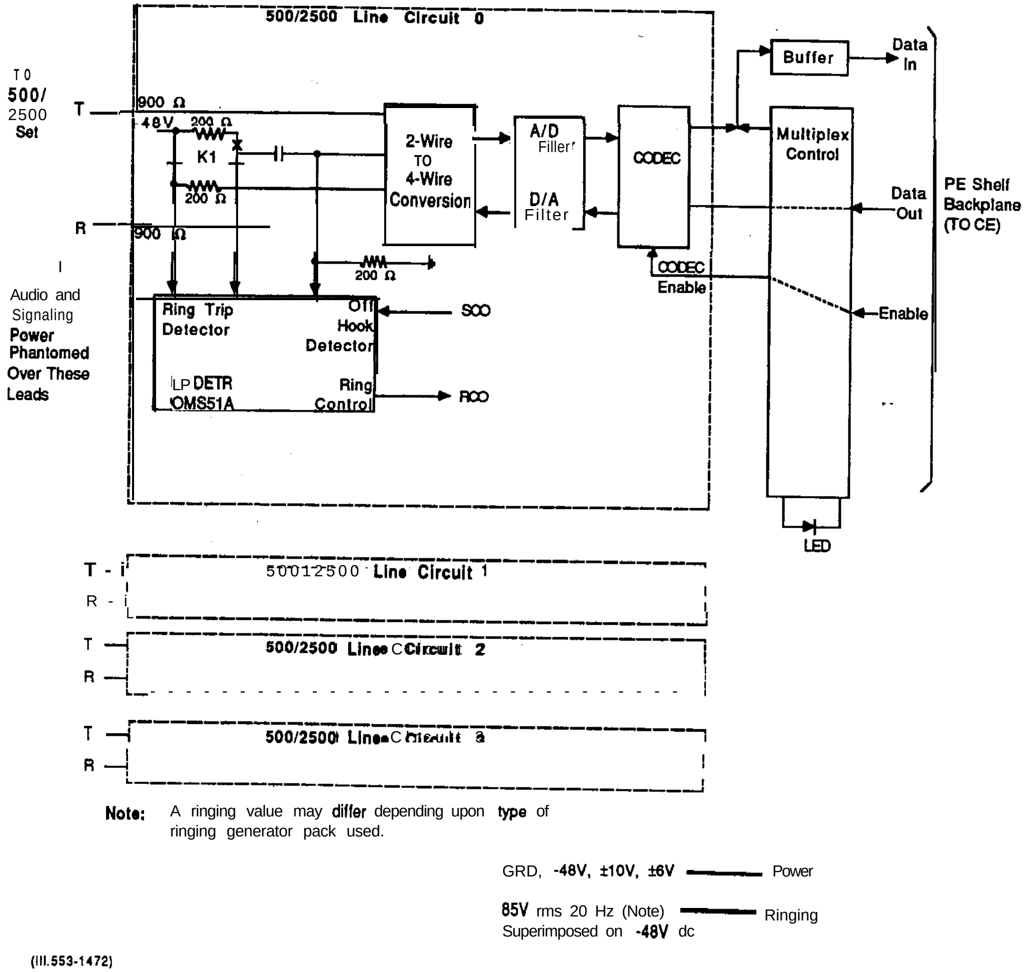
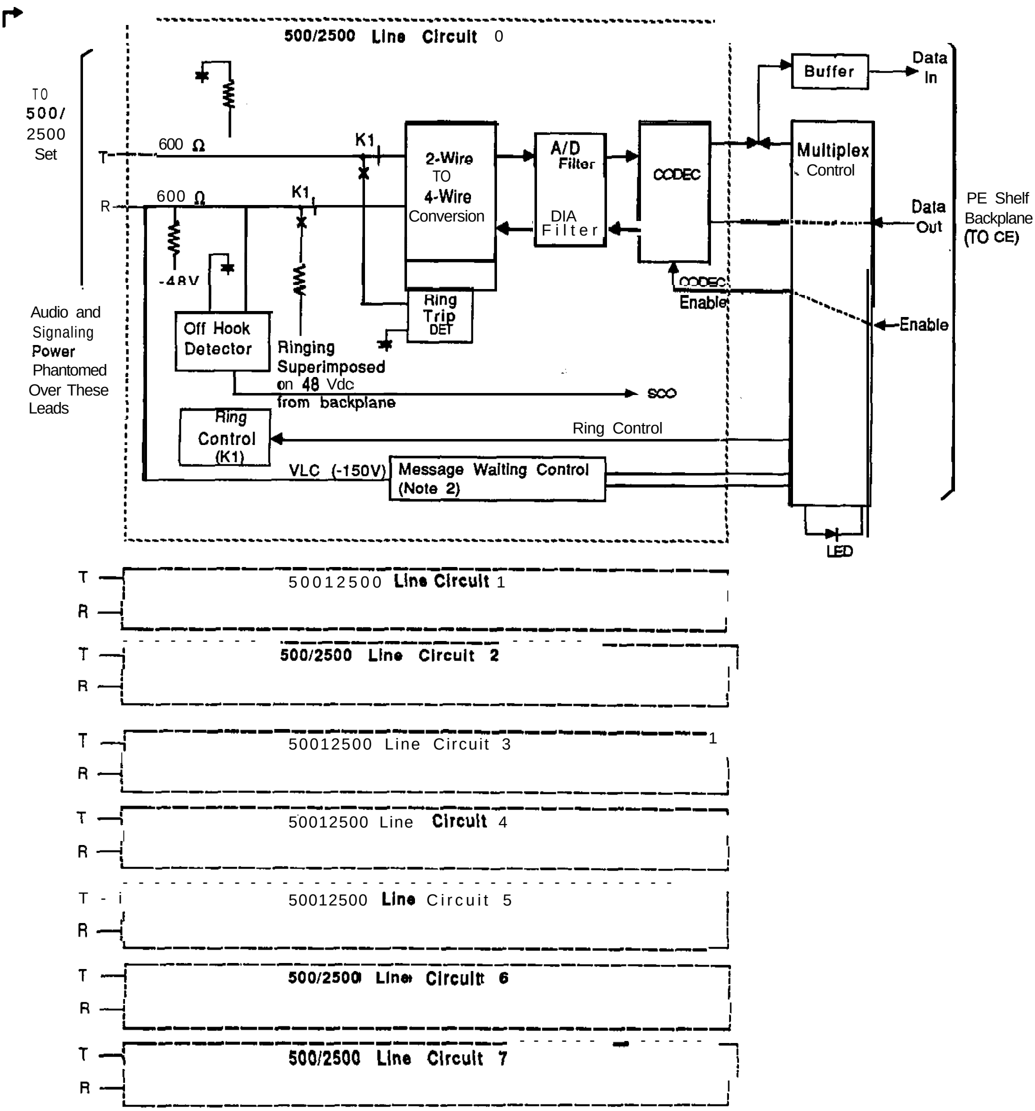


Fig. 5-2
Block Diagram of QPC192/292 Line Pack



Note 1: There is an additional 8 line circuits (line circuits 6-15) on the QPC594/QPC729/QPC789 16-port line cards.

Note 2: This circuitry is only supplied on the QPC789 circuit Packs.

(III.553-1470)

Fig. 5-3
Block Diagram of QPC594/729/789 Line Pack

INTEGRATED SERVICES NETWORK

MERIDIAN SL-1*

QPC578 INTEGRATED SERVICES DIGITAL LINE CARD

DESCRIPTION

CONTENTS **PAGE**

Reason for Reissue: This practice is reissued to add further reference information on digital telephones. Changes are indicated by arrows in the margin.

*Meridian and SL-1 are trademarks of Northern Telecom

1. QPC578 INTEGRATED SERVICES DIGITAL LINE CARD

1.01 The QPC578 Integrated Services Digital Line Card (ISDLC) is a voice and data communication link between a Meridian SL-1 and the Meridian M2000/M3000 series of digital telephones. When a digital telephone is equipped with the data option, an asynchronous ASCII terminal or PC can be connected to Meridian SL-1 through the digital telephone. The ISDLC circuit pack supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring. This practice describes the ISDLC. For more information on Meridian digital telephones, see 553-2201-110 and 553-2201-111 for the M2000 series telephones, the 553-2201-115 for the M3000 telephone,+ and the 553-2201-113 for the M2317 telephone.

1.02 Requirements. To use the ISDLC, the following Meridian SL-1 requirements must be met:

- Double Density Peripheral Shelves must be equipped (one shelf per loop)
- Generic X11, Release 7 (or later) or Generic X08, Release 10 (or later) software must be running.
- Quadruple Density loops must be defined in hardware (SW5 set to ON on the associated Peripheral Buffer) and software (OVL 17)
- At remote locations using Remote Peripheral Equipment (RPE), ISDLC packs must be QPC578B, series C or higher.

Description

1.03 The QPC578 ISDLC is equipped with eight identical line circuits. Each line circuit provides a multiplexed voice, data and signaling path to and from digital apparatus over a 2-wire full duplex 512 KHz Time Compression Multiplexed (TCM) digital link.

1.04 Time Compression Multiplexing. Once every 125 μsecond, the ISDLC transmits a 23 bit message to a digital telephone. At the end of the 23 bit message a 2.7 bit guard band delay is inserted. Then the digital telephone begins transmitting a similarly formatted 23 bit message to the ISDLC. Each 23 bit message consists of:

- start (1 bit)
- voice signaling (1 bit)
- voice valid (1 bit)
- PCM voice (8 bits)
- data signaling (1 bit)
- data valid (1 bit)
- data (8 bits)
- parity (1 bit)
- stop (1 bit)

1.05 Meridian SL-i Data Block. Each digital telephone and each associated data terminal is assigned a separate Terminal Number (TN) in the Meridian SL-1 data base.

1.06 Physical. ISDLC circuitry is contained on a 320 mm (12.5 in) by 254 mm (10 in) printed circuit board. The faceplate of the pack is equipped with a red LED which lights if the pack is disabled. The rear of the pack is equipped with an IO-pin connector which provides access to:

- digital telephones (and associated ASCII terminals or PCs if equipped)
- Peripheral Bus
- power supply

1.07 Configuration. Up to six ISDLC circuit packs can be mounted in one PE shelf if the remaining slots are used: up to eight ISDLC circuit packs can be equipped if the remaining slots are left unused. In addition, up to 18 ISDLC packs can be supported by a single QPC82 Power Converter. This assumes that no other packs exist that require power from that converter. If ISDLC circuit packs co-exist with other peripheral packs associated with the same power converter, the total number of ISDLC circuit packs is calculated as follows:

$D = 3/4\,(24 - X)$

where

D, an integer, is the maximum number of ISDLC packs allowed

X is the number of other circuit packs (e.g., QPC451) associated with the same power converter.

> **Note:** When ISDLC circuit packs serve M3000 Touchphones, this restriction does not appiy because Touchphones are locally powered.

1.06 Power Supply to Digital Telephones. The ISDLC provides +30 VDC over each loop at a maximum current of 60 mA. The iine feed interface can supply power to loops of up to 1067 m (3500 ft) length using 22 or 24 AWG gauge wire. 26 AWG guage vire is limited to 745 m (2450 ft). Typical cabling and cross-connections are shown in Fig. 1-1.

Functions

1.09 The ISDLC handles messages sent to and from Meridian SL-1 and digital telephones. Because the message formats and clocking used by Meridian SL-1 and the digital telephones are different, the ISDLC must be able to correctly format and synchronize all messages going to and from these devices. The ISDLC performs the following major tasks:

(a) Provides 8 bidirectional BPRZ-AM1 coded TCM lines at 512 kbps to interface up to 8 digital telephones and their associated Data Options.

(b) Multiplexes and demultiplexes 8 integrated voice and data lines and a 2.56 Mbps DS-30X data stream (used internally by ISDLC)

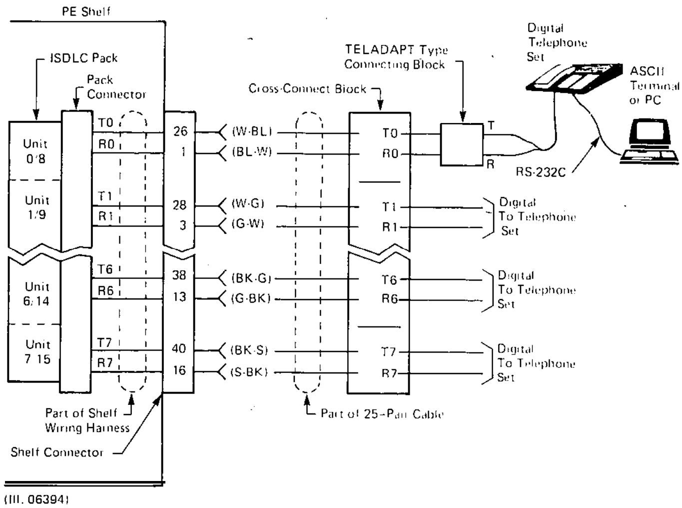


Fig. 1-1
Typical ISDLC Cabling and Cross-Connections

(c) Converts the Meridian SL-1 bit interleaved data format to DS-30X format and vice versa.

(d) Converts Meridian SL-1 SSD (signaling) messages to TCM format and vice versa.

(e) Synchronizes the digital telephones and their data options to the Meridian SL-1.

(f) Provides buffering of messages to compensate for different signaling rates

1.10 The ISDLC consists of the functional blocks shown in Fig. 1-2. Each block incorporates the following main functions:

(a) **TCM Loop interface.**

- Couples 8 identical TCM loops from the Digital Line Interface (DLIC) functional block of the ISDLC to the Digital Set Interface (DSIC) functional block located in each digitial telephone in both the transmit and receive directions.
- Provides i-30 V battery feed to each digital telephone through a voltage regulator, configured as a 60 mA constant current source.

(b) **Digital Line Interface (DLIC).** The DLIC provides the communication link between 8 digital telephones (including their associated Data Options) and the Meridian SL-1 peripheral bus. The DLIC performs the following functions:

- Multiplexes-8 integrated voice and data TCM lines into a 2.56 Mbps DS-30X formatted data stream (used internally in the pack) when the transmission is from the digital telephone or associated terminal to the Meridian SL-1.

- De-multiplexes the 2.56 Mbps DS-30X formatted data stream into 8 integrated voice and data TCM line-s when the transmission is from the Meridian SL-1 to the digital telephone or associated terminal.

- Provides a station line transmitter for 8 channels, each of which transmits BPRZ-AM1 coded data over the TCM loop at 512 kbps.

- provides 8 station line receivers, each of which receives BPRZ-AMI data from a TCM loop independantly at 512 bps.

(c) **Set Gate Array.** The Set Gate Array handles signalling conversion for up to 8 integrated voice and data lines.

- Receives signaling bits (8 voice and 8 data) from digital telephones and transfers the data in bytes via the FIFO to the Receive μP.

- Accepts DS-30X signaling messages from the Transmit μP and inserts the packets bit by bit to the appropriate signaling channel.

(d) **Transmit μProcessor.** The Transmit μProcessor receives outgoing Meridian SL-1 SSD messages (i.e., signaling) from the Peripheral Gate Array and:

- Converts outgoing SSD messages to DS-30X format.

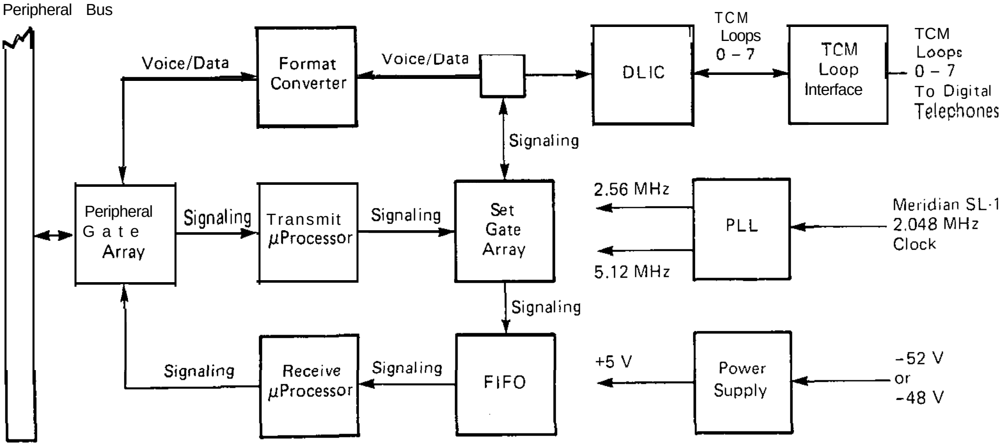


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Fig. I-2
ISDLC Block Diagram

- If required, packetizes several SSD messages into one DS-30X message.

(e) **Receive μProcessor.** The Receive μProcessor receives incoming signaling messages from digital telephones, via the Set Gate Array and:

- Converts incoming DS-30X signaling messages to SSD message format.
- Will repacketize a long message into several SSD sized (2-bytes) messages when required.

(f) **Format Converter.**

- Converts the Meridian SL-1 voice and data bii-interleaved format to DS-30X byte-interleaved format.
- Converts the incoming DS-30X byte-interleaved format to Meridian SL-1 bit-interleaved format.

(g) **Peripheral Gate Array.**

- Provides a bi-directional interface for voice and data-between the Meridian SL-1 Peripheral Bus and the Format Converter.
- Provides serial to parallel conversion of signaling data received from the Meridian SL-1 Peripheral Bus and transfers the data to the Transmit μP.
- Provides parallel to serial conversion of signaling data received from the Receive μP and transfers the data to the Meridian SL-1 Peripheral Bus.

(h) **Phase Locked Loop.**

- Ensures phase and frequency stability and correlation between incoming signals from the digital telephones and signals on the ISDLC.
- Three clocks, 2.56 MHz, 4.096 MHz and 5.12 MHz, are derived from the PLL and synchronized to the 2.048 MHz Meridian SL-1 clock.

(i) **Power Supply.**

- An onboard DC-to-DC converter takes either -52 VDC or -48 VDC input and generates the i-5 VDC required by the ISDLC logic circuits.
- up to 2 A with 5% regulation

Table 1-A
ISDLC CIRCUIT CHARACTERISTICS

CHARACTERISTICS	DESCRIPTION
circuits per pack	8 voice/data
options	nil
impedance	100 Ω
loop limits	
-QPC578A and B	100 (30 m) to 3000 feet (900 m) with 24 AWG PVC cable (i-30 VDC at 60 mA)
-QPC578C	0 to 3500 feet (1067 m) with 24 AWG PVC cable (i-30 VDC at 60 mA)
line rate	512 kbps ± 100 ppm
line coding	bipolar return-to-zero alternate mark inversion (BPRZ-AMI)
power supply	-52 VDC unregulated
	or
	-48 VDC regulated
	and ±6 VDC, ± 15 VDC. i-10 VDC
transmitter output voltage	
-successive '1' bits	i-l.5 ± 0.15V and -1.5 ± 0.15V
-'0' bits	0 ± 50mV