Meridian 1

Succession 1000M

Succession 3.0 Software

Small System

Planning and Engineering

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Revision history

October 2003

Standard 1.00. This document is a new NTP for Succession 3.0. It was created to support a restructuring of the Documentation Library, which resulted in the merging of multiple legacy NTPs. This new document consolidates information previously contained in the following legacy documents, now retired:

- *Option 11C and 11C Mini Technical Reference Guide* (553-3011-100) (Content from *Option 11C and 11C Mini Technical Reference Guide* (553-3011-100) also appears in *Small System: Overview* (553-3011-010), *Transmission Parameters* (553-3001-182), and *Circuit Card: Description and Installation* (553-3001-211).
- *Option 11 Planning and Installation Guide* (553-3021-210) (Content from *Option 11 Planning and Installation Guide* (553-3021-210) also appears in *Small System: Overview* (553-3011-010), and *Small System: Installation and Configuration* (553-3011-210).
- *Option 11C Mini Planning and Installation Guide* (553-3021-209) Content from *Option 11C Mini Planning and Installation Guide* (553-3021-209) also appears in *Small System: Overview* (553-3011-010), and *Small System: Installation and Configuration* (553-3011-210).

Contents

About this document

This document is a global document. Contact your system supplier or your Nortel Networks representative to verify that the hardware and software described are supported in your area.

Subject

This Nortel Networks Technical Publication (NTP) is a reference tool for activities surrounding the planning and engineering of a Small System.

Note on legacy products and releases

This NTP contains information about systems, components, and features that are compatible with Succession 3.0 Software. For more information on legacy products and releases, click the **Technical Documentation** link under **Support** on the Nortel Networks home page:

Applicable systems

This document applies to the following systems:

- Meridian 1 Option 11C Chassis
- Meridian 1 Option 11C Cabinet
- Succession 1000M Chassis
- Succession 1000M Cabinet

System migration

When particular Meridian 1 systems are upgraded to run Succession 3.0 Software and configured to include a Succession Signaling Server, they become Succession 1000M systems. Table 1 lists each Meridian 1 Small System that supports an upgrade path to a Succession 1000M Small System.

Table 1
Meridian 1 systems to Succession 1000M systems

This Meridian 1 system...	Maps to this Succession 1000M system
Meridian 1 Option 11C Chassis	Succession 1000M Chassis
Meridian 1 Option 11C Cabinet	Succession 1000M Cabinet

Note the following:

- When an Option 11C Mini system is upgraded to run Succession 3.0 Software, that system becomes a Meridian 1 Option 11C Chassis.
- When an Option 11C system is upgraded to run Succession 3.0 Software, that system becomes a Meridian 1 Option 11C Cabinet.

For more information, see *Small System: Upgrade Procedures* (553-3011-258).

Intended audience

This document is intended for individuals responsible for planning and engineering for Small Systems.

Conventions

Terminology

In this document, the following systems are referred to generically as “system”:

- Meridian 1
- Succession 1000M

The following systems are referred to generically as “Small System”:

- Meridian 1 Option 11C Chassis
- Meridian 1 Option 11C Cabinet
- Succession 1000M Chassis
- Succession 1000M Cabinet

The following systems are referred to generically as “Succession 1000M Chassis and Meridian 1 Option 11C Chassis”:

- Meridian 1 Option 11C Chassis
- Succession 1000M Chassis

The following systems are referred to generically as “Succession 1000M Cabinet and Meridian 1 Option 11C Cabinet”:

- Meridian 1 Option 11C Cabinet
- Succession 1000M Cabinet

UK-specific terminology

This document contains North American terms that are not common in the UK. Table 2 lists these terms and their UK equivalents.

Table 2
North American to UK terms (Part 1 of 2)

North American term	UK term or meaning
analog (500/2500-type) set	Analog rotary dial/MF4 telephone
Central Office (CO)	Local Public Exchange
cross-connect wire	jumper wire
Direct Inward Dialing (DID)	Direct Dialing In (DDI)
E1	2.0 Mbit, 32 channel digital carrier (Megastream)
grounding	earthing

Table 2
North American to UK terms (Part 2 of 2)

North American term	UK term or meaning
set	telephone
station	extension telephone
TIE trunks	private circuits
toll trunks	exchange lines
T1	1.5 Mbit, 24 channel digital carrier (North American equivalent to Megastream)
WATS, FEX (FX1 and FX2), CSA	Alternative public vendor network services (used only in North America)

Related information

This section lists information sources that relate to this document.

NTPs

The following NTPs are referenced in this document:

- *Spares Planning* (553-3001-153)
- *Transmission Parameters* (553-3001-182)
- *Circuit Card: Description and Installation* (553-3001-211)
- *Features and Services* (553-3001-306)
- *Software Input/Output: Administration* (553-3001-311)
- *Software Input/Output: Maintenance* (553-3001-511)
- *Telephones and Consoles: Description* (553-3001-367)
- *Small System: Installation and Configuration* (553-3011-210)
- *Small System: Upgrade Procedures* (553-3011-258)
- *Small System: Maintenance* (553-3011-500)

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System and site requirements

Contents

This section contains information on the following topics:

Before you install a Small System, make sure that the site meets all environmental, grounding, power, and cross-connect terminal requirements.

Environmental requirements

The environment of a Small System operates must meet the following operating conditions:

- The room must be clean and well ventilated. Each chassis can dissipate up to 370 Watts of power; each cabinet can dissipate up to 500 Watts of power in the form of heat (1700 BTU [1800 kJ] per hour). There must be enough ventilation in the equipment room to maintain the temperature at an acceptable level.
- For installed chassis, maintain the temperature between 0° and 45° C (32° and 113° F). For cabinets, the temperature is maintained between:
  - 0° and 45° C (32° and 113° F) when the cabinets are mounted side-by-side.
  - 0° and 35° C (32° and 95° F) when the cabinets are mounted one above the other.
- Maintain the humidity between 5% and 95% non-condensing.
- Select a location for installing the equipment that is not subject to constant vibration.
- Locate the equipment at least 12 ft (3660 mm) away from sources of electrostatic, electromagnetic, or radio frequency interference. These sources can include:
  - power tools
  - appliances (such as vacuum cleaners)
  - office business machines (such as copying machines)
  - all electric motors
  - electrical transformers

Earthquake bracing requirements for cabinets or chassis installed on a wall in a vertical position

IMPORTANT!

The following earthquake bracing guidelines meet the requirements for the state of California specifications in the United States. Other areas or countries can have different requirements.

Note: The earthquake bracing method for the Small System does not guarantee that the system will continue to operate during or after an earthquake.

WARNING

For earthquake bracing, you must install the Small System on a wall in a vertical position.

To earthquake brace your system, use a piece of 3/4 in. (20 mm) plywood as a backboard. Fasten the plywood to the wall with a minimum of six fasteners. Refer to Table 3 for a description of the appropriate fasteners. Fasten the chassis to the backboard.

Table 3
Minimum fastener requirements

Type of wall	Fasteners	
Wooden studs	#10 wood screws	Minimum 1 in. embedment in wood studs
Metal studs	# 14 sheet metal screws	Minimum 1 in. embedment in metal studs
Concrete (2000 PSI)	1/4 in. HILTI KB-II	Minimum 1 1/8 in. embedment
Masonry	1/4 in. Ramset Redhead Dynabolt sleeve anchor	

Table 4 identifies the maximum acceptable wall height for different types of stud wall construction in areas prone to earthquakes.

Table 4
Minimum wall requirements — stud construction

Wall Studs	Spacing off center	Maximum Height of Wall
2 in. x 4 in. wooden studs	16 in. or 24 in.	10 ft
2 in. x 6 in. wooden studs	16 in. or 24 in.	16 ft
3 5/8 in. 20 gauge metal studs	16 in. or 24 in.	12 ft
3 5/8 in. 18 gauge metal studs	16 in. or 24 in.	16 ft

Fasten the mounting bracket for each chassis and cabinet to the piece of plywood with the five, 1 in. #14 screws supplied with the bracket.

Refer to the chapter on earthquake bracing in *Small System: Installation and Configuration* (553-3011-210) for a detailed procedure on earthquake bracing.

Grounding requirements

WARNING

Failure to follow grounding recommendations can result in a system installation that is:

• unsafe for personnel working on, or using the equipment

• not protected correctly from lightning or power transients

• subject to service interruptions

Before you install a Small System and before you apply ac power, measure the impedance of the building ground reference. An ECOS 1023

POW-R-MATE, or similar meter, is acceptable for this purpose. If the ground path connected to the Small System has an impedance of 5 ohms or more, make better grounding arrangements. Make any improvements to the grounding system before you install the Small System.

DANGER OF ELECTRIC SHOCK

Never connect the Single Point Ground (SPG) conductor from the Small System to structural steel members or electrical conduit. Never tie this conductor to a ground source or grounded electrode that is not hard-wired to the building reference conductor.

The following are additional grounding requirements:

- Grounding requirements for the Small System are as follows:
  - The impedance of the link between the ground post of the system cabinets or chassis and the SPG to which it is connected must be less than 0.25 ohms.
  - Never connect the SPG conductor from the Small System to structural steel members or electrical conduit. In particular, never tie this conductor to a ground source or grounded electrode that is not hard-wired to the building reference conductor.
- Ground conductors for Small Systems:
  - must not be smaller than #6 AWG (#40 metric) at any point (see Table 5 on page 20. This table provides a list of grounding wire requirements specific to some areas)
  - must be routed through the same conduit as the phase conductors that serve the system
  - must not be smaller than any phase conductor in the same conduit
  - do not carry current under normal operating conditions
- All ground conductors in the building:
  - must be isolated from the neutral bus except at the service entrance to the building
  - must be hard-wired to the main ground reference

- Avoid spliced conductors. Continuous conductors have lower impedance, and they are more reliable than spliced conductors.
- All conductors must terminate in a permanent way. Make sure all terminations are easily visible and available for maintenance purposes.
- Tag ground connections with a clear message such as "CRITICAL CONNECTION: DO NOT REMOVE OR DISCONNECT".

Table 5
Area-specific grounding wire requirements

Area	Grounding wire requirements
Germany	#8 AWG (10 mm^2) green/yellow wire
Other areas in Europe	not smaller than #6 AWG (16 mm^2) at any point
UK	two green/yellow wires no thinner than 10 mm^2

DANGER OF ELECTRIC SHOCK

For an installed Small System, the impedance of the link between the ground post of the Chassis or Cabinet and the single-point ground to which it connects must be less than 0.25 Ohms.

CAUTION — Service Interruption

Transients in supply conductors and ground systems can damage integrated circuits. This damage can result in unreliable Small System operation. Damage caused by transients is not always immediately apparent. Degradation can occur over a period of time.

Ground bus isolation (Canada and the United States)

According to the exception to article 384-20 in the United States National Electrical Code (NEC), a panel's ground bus can be isolated from the housing. This exception applies provided that the panel is not at the main service entrance. This exception applies to some Canadian locations also. For more information about ground bus isolation, refer to local electrical codes.

DANGER OF ELECTRIC SHOCK

Do not isolate the ground bus from the housing unless permitted by local electrical codes. Do not perform work inside electrical panels unless you are a qualified electrician. Do not try to remove bonding conductors without approval from qualified personnel.

DANGER OF ELECTRIC SHOCK

Route ground conductors, between supply panels, through the same conduit as the supply conductors. This safety requirement is part of both the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

Single Point Grounding

Correct grounding of communications systems is necessary for protecting equipment from the hazards of surge and noise interference. The Single Point Grounding (SPG) method of protecting communications equipment is the Nortel Networks standard for Small Systems. Refer to Figure 1 on page 23 for an illustration of Single Point Grounding.

The requirements for Single Point Grounding are in the following major categories: Safety, Protection, Electromagnetic Compatibility (EMC), Installation and Maintenance, Powering, and Advances in Technology.

Safety

For a safe working environment, your grounding system must be able to dissipate unwanted surge energies, such as lightning on the outside plant. The grounding system must be designed so that fuse or breakers operate to disrupt the excessive current flow caused by a power fault.

Protection

Correct grounding is a necessary component of the protection system for equipment. This grounding includes grounding for outside plant cable shields and protectors, and the grounds for framework, battery, and logic references.

EMC

To make sure that there is good emission and susceptibility performance of the equipment, you must consider the EMC grounding requirements.

Installation and Maintenance

A grounding system is cost effective to install and maintain when it is part of the initial electrical installation for the customer's premises. If you try to correct violations of national codes after the initial installation, it is both difficult and costly.

Powering

The grounding system must consider the power options for the equipment. The grounding system must consider if the equipment is backed up with an Uninterruptible Power Supply (UPS). Consider the grounding and powering of all equipment that is part of the telecommunications system as one large system. Perform the installation taking this information into consideration.

Advances in Technology

The component density on circuit cards continues to increase because of the miniaturization and multi-layering of printed circuit boards. The operating speeds of the integrated circuits are ever increasing. Grounding provides protection for these components, and is very important.

The SPG of a system is the point at which telecommunications equipment bonds to the ground. A copper busbar normally acts as the system SPG.

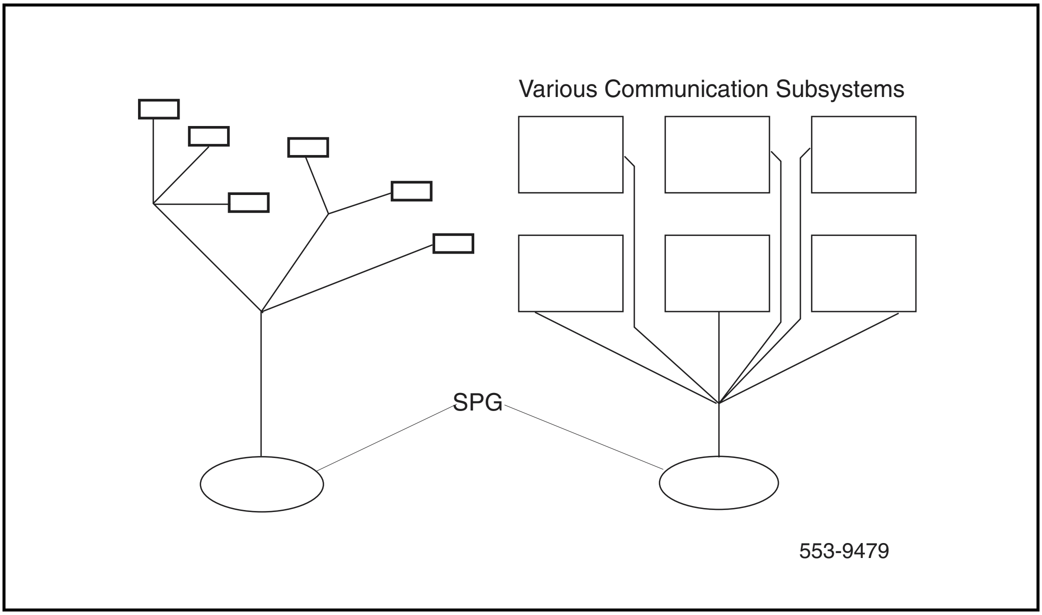
You can use any of the following busbars as a system SPG:

- building principal ground, normally in building with one floor
- floor ground bar, normally in buildings with more than one floor

- dedicated SPG bar bonded to the building grounding system
- a section of the battery return bar of the power plant

You can configure subsystems of a telecommunications system, such as groups of frames or equipment, as separate single-point ground entities connected in a star configuration to the system SPG.

Figure 1
Single-point grounding



Grounding method

> **WARNING**
>
> To prevent ground loops, power all chassis and cabinets from the same dedicated power panel. Ground all chassis and cabinets to the power panel through the grounding block. Ground the chassis expander to the chassis.

The method of grounding used for Small Systems depends on whether the same service panel powers all Chassis or Cabinet systems.

The following grounding scenarios are possible:

1. Chassis system with one chassis.
2. Cabinet system with one cabinet.
3. Chassis system with more than one chassis, powered by the same service panel.
4. Cabinet system with more than one cabinet, powered by the same service panel.
5. Chassis system with more than one chassis, powered by different service panels.
6. Cabinet system with more than one cabinet, powered by different service panels.

A system with one chassis or cabinet, or multiple chassis or cabinets powered by one service panel

For each system chassis or cabinet, connect a #6 AWG (#40 Metric Wire Gauge) ground wire from the chassis or cabinet to the NTBK80 grounding block. See Table 5 on page 20 for grounding wire requirements specific to some areas. Connect the grounding block to a ground source (the ground bus in the ac power service panel).

For a Chassis system, consider the chassis and the chassis expander as the same ground. Jumper the ground wire from the chassis expander to the chassis and then back to the grounding block.

Chassis or cabinets powered by different service panels

For each chassis or cabinet, connect a #6 AWG (#40 Metric Wire Gauge) ground wire from the chassis or cabinet to the NTBK80 grounding block. See Table 5 on page 20 for grounding wire requirements specific to some areas. If any chassis or cabinet cannot be powered from the same service panel, ground it separately from the other chassis or cabinet back to the service panel that supplies it. Power each cabinet or chassis and chassis expander pair from the same service panel.

> ***Note 1:*** If a chassis requires a separate ground, ground it using the same method that you use for a system with one chassis. A separately grounded cabinet is grounded the same as a single-cabinet system.

> ***Note 2:*** In the UK, you can connect the grounding wire from the cabinet or chassis to an NTBK80 grounding block or through a Krone Test Jack Frame.

Grounding multiple pieces of equipment in a rack/equipment cabinet

You must ground each piece of equipment in a rack/equipment cabinet. If a piece of equipment does not have a ground lug, then ground the whole rack/ equipment cabinet.

Conduit requirements

Conductive conduit linking panels and equipment are legal for use as a grounding network in most countries. For all system ground paths, use the correct size of insulated copper conductors routed inside conduit when possible. A ground link that depends on conduit can defeat the improvements made by installing dedicated panels and transformers. The following are the reasons why:

- Personnel who service different equipment can separate conduit links. If this separation occurs between the Small System and the building ground reference, the conduit cannot provide a ground path. This situation is hazardous.

- Metal conduit often corrodes, especially at threaded connections. Corrosion increases resistance. This problem becomes worse when multiple links are involved. If you apply paint over the conduit, it is possible that the corrosion process will occur more quickly.
- Always fasten conduit to secure surfaces. Often, conduit is bolted to structural steel members, which can function as ground conductors to noisy equipment (for example, compressors and motors). The coupling of these noisy signals into the Small System grounding system can damage its performance. The resulting intermittent malfunctions can be difficult to trace.

Commercial power requirements

The Succession 1000M Chassis and Meridian 1 Option 11C Chassis are available with ac power only. The Succession 1000M Cabinet and Meridian 1 Option 11C Cabinet are available in both ac-powered and dc-powered versions.

The optimal installation of the ac-powered Small System includes a direct connection to the electrical system in the building, provided some requirements are met. Refer to “Ac-powered installation” on page 27 for detailed information. The chassis and chassis expander can share the same electrical breaker.

You can use an approved Isolation Transformer for ac-powered systems when meeting the optimum requirements is not possible or is too expensive. See “Alternative ac-powered installation” on page 31.

Refer to “Power consumption worksheets for the Succession 1000M Chassis and Meridian 1 Option 11C Chassis systems” on page 39 to determine the power consumption of the Chassis system.

With the dc-powered version of a the Cabinet system, each cabinet is powered solely from a dc power source. See “Dc-powered version (Cabinet system only)” on page 37 for detailed information.

Ac-powered installation

Use a dedicated ac service panel with a Small System. Do not connect equipment that is not related to the Small System to this panel. Keep all lighting, fans, motors, air conditioning equipment, and the like as “electrically separate” from the Small System as possible. The chassis and chassis expander can share the same ac breaker.

If other data communications equipment is in the same rack/equipment cabinet as the Small System, power each piece of equipment from an isolated ground outlet. The same service panel must service all outlets.

Power from each outlet must meet the input requirements of at least one Chassis or Cabinet system power supply, as listed in Tables 6 through 9. Check power requirements for other system equipment. Install additional outlets if you need to.

Table 6
Ac input requirements for each NTDK91 chassis and NTDK92 chassis expander (North America)

Voltage	Recommended: 100-120 volts Maximum limits: 90 and 132 volts Single phase
Frequency	50-60 Hz
Power (I/P max)	550 VA maximum
Outlet Type	120 volt, 15 Amp supply

Table 7
Ac input requirements for each NTDK91 chassis and NTDK92 chassis expander (Europe and UK)

Voltage	Recommended: 208/220 volts Maximum limits: 180 and 250 volts Single phase
Frequency	50-60 Hz
Power (I/P max)	550 VA maximum
Outlet Type	208/240 volt, 15 Amp supply

Note 1: As local power specifications vary, see a qualified local electrician when planning your power requirements.

Note 2: The supplied power must be single-phase 240 or three-phase 208 Y, and must have a system ground conductor.

Table 8
Ac input requirements for each NTDK91 chassis and NTDK92 chassis expander (Germany)

Voltage	Recommended: 230 volts Maximum limits: 180 and 250 volts Single phase
Frequency	50 Hz
Power (I/P max)	550 VA maximum
Fuse	16A
Outlet Type	Receptacles by DIN regulation

Table 9
Ac input requirements for each NTDK78 cabinet power supply

Voltage	Maximum rated input voltage 100-240 Volts RMS, single phase
Frequency	50-60 Hz
Power (I/P max)	750 VA minimum
Outlet Type	NEMA IG5-15R for 120 Volt, 15 Amp supply NEMA IG6-15R for 208/240 Volt, 15 Amp supply

Site requirements

The following is a list of required site features for an optimal ac-powered Small System installation.

If a dedicated panel cannot provide the conditions listed below, use an Isolation Transformer. Refer to "Alternative ac-powered installation" on page 31.

- **Dedicated circuit breaker panel**

  A dedicated circuit breaker panel provides power only to the Small System and its related hardware, such as TTYs and printers.

  Note: You cannot always power a complete system from a single circuit-breaker panel. For example, when expansion chassis or expansion cabinets are located remotely.

- **Insulated copper ground conductor**

  The insulated copper ground conductor connects the ground bus in the dedicated panel to the main service panel ground or building ground reference. Route the insulated copper ground conductor through the same conduit as the supply conductors that feed the panel.

- **Isolated-ground receptacles**

  All outlets connected to the dedicated panel must be of the isolated-ground type. Use a separate circuit for each device connected to the panel. Outlets that provide service to the chassis or cabinet must be close enough so that the power cord can reach the chassis or cabinet power supply.

  For systems equipped with expansion cabinets or chassis, a separate outlet for each cabinet or chassis must be provided. Each outlet must be from separate circuits in the same panel.

- **Isolated ground bus in the electrical panel, where permitted by local codes**

Location of power outlets

The maximum distance between a power outlet and the system chassis or cabinet depends on the length of the power cord. In North America, the power cord is 9 ft 10 in. (3000 mm). In countries outside North America, the power cord is 8 ft 2 in. (2490 mm).

Alternative ac-powered installation

If a dedicated panel cannot provide optimal conditions, use an Isolation Transformer with the following characteristics:

- 120/208/240 V input, over-current protected at primary.
- 120/208/240 V available at secondary outputs, each circuit breaker-protected.
- Completely isolates primary and secondary windings from one another.
- Approved for use locally as a stand-alone user product (CSA, UL, or other locally recognized clear markings).
- Capable of providing power to all Small System equipment operating at the same time at full load.
- Equipment not related to the Small System must not be powered from a transformer that provides service to the Small System.

Uninterruptible Power Supply

For backup ac power, you can use an Uninterruptible Power Supply (UPS) to feed the Small System. The power requirement for a UPS is 550 VA per system. The maximum power requirement for a chassis and a chassis expander on the same breaker is 1100 VA. Install the UPS according to the manufacturer's instructions.

Isolation Transformer ground

The transformer ground must have the following characteristics:

- Separate grounds for primary and secondary windings, rather than a common ground.
- A "clean" and permanent SPG reference at the transformer secondary for the Small System.

Make sure that the ground conductors inside the transformer are sized correctly.

> ***Note:*** Do not ground the transformer or Small System to structural steel or water pipes. Connect them to a known building ground reference.

Receptacles

Receptacle requirements are as follows:

- When installed on the wall, install receptacles within reach of the chassis or cabinet power cords.
- All receptacles served by the secondary must be of the isolated-ground type.
- The ground prong of each outlet must be connected by an insulated conductor to the system SPG.

If the transformer has an isolated secondary ground lug, use it as the SPG. If it does not, use the chassis ground lug of the transformer as the SPG.

Installing an Isolation Transformer

Transformers with pluggable power cords:

1 Connect the power cords of all Small System equipment to the outlets on the transformer secondary.

2 Secure an insulated conductor between the ground lug on the chassis or main cabinet of the Small System and the SPG lug on the transformer. Place a "DO NOT DISCONNECT" tag on it.

Do not fasten or tie this conductor to the power cable feeding the chassis system or cabinet power supply (NTAK04, NTDK70, or NTDK78).

Note: Power all equipment related with the Small System from the secondary of the transformer only. Ground all equipment to the secondary isolated ground lug. Do not connect equipment that is not related to the Small System to the Isolation Transformer that powers it.

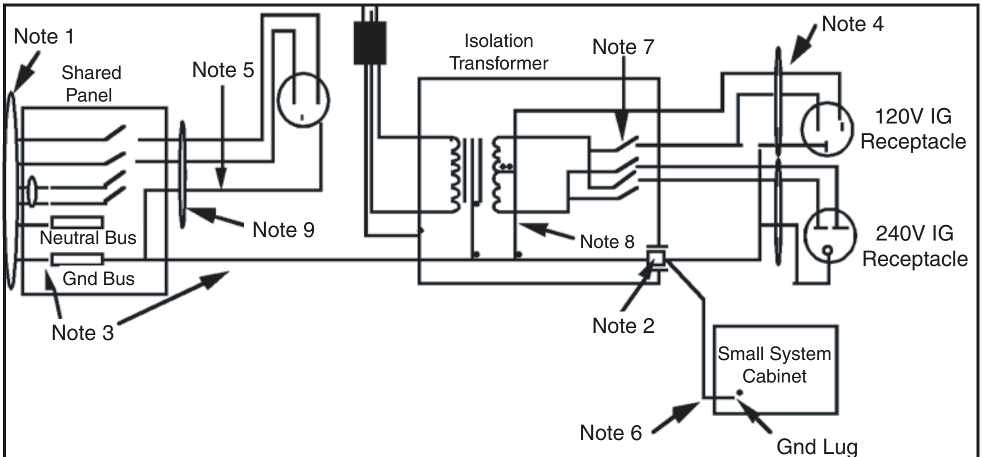
Power the transformer primary through a dedicated circuit. If the primary has a pluggable cord, make an additional ground connection between the Small

System SPG and a known building ground reference. This connection is very important for safe and reliable operation.

WARNING

Do not connect any system ground lines of the Small System to structural steel or water pipes, or other unreliable ground paths. Use a ground point known to be "clean" and permanent. Place a "DO NOT DISCONNECT" tag on it. Figure 2 on page 34 shows the pluggable cord connections.

Figure 2
Typical pluggable cord Isolation Transformer wiring plan



Notes:

1 Power source is site dependent. It may be from a shared panel or transformer. Wiring may vary accordingly. Wiring to panel must be housed in conduit.

2 Make SPG at the transformer secondary. If the transformer secondary has no isolated secondary ground lug, make SPG by tieing all system ground lines to the chassis lug on the transformer case. An insulated ground connection must be ade between the SPG and a known building ground reference as per Note 3.

3 Terminate the small system SPG insulated ground conductor as near as possible to the main building ground reference. Isolate the ground bus from panel housing if permitted by local codes. Conductor should be minimum AWG (metric #40) at all points.

4 Wiring to receptacles must be in conduit unless they are mounted on the transformer case.

5 Connection may be made by metallic conduit. Additional copper conductor recommended.

6 Minimum AWG #6 (metric 40) insulated copper conductor connected to FGND lug on the small system cabinet. Route separately from AC power cable.

7 Separate breaker required for each small system cabinet. Breakers must be mounted on transformer if the receptacles are. If they are in a panel served by the transformer secondary, all connections between the receptacles and transformer must be in conduit.

8 Connect secondary neutral (XO) to system SPG.

9 Conduit required.

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Transformers without pluggable power cords

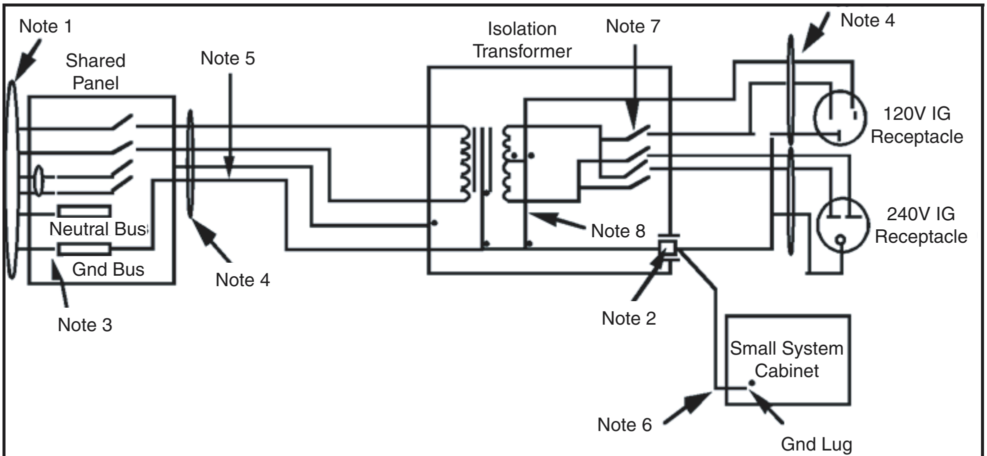
If the transformer does not have a pluggable cord, hard-wire the transformer to an electrical panel. Route all wires (including grounds) through a single conduit.

Some electrical codes permit the use of conduit as the only ground conductor between pieces of equipment.

Run a separate insulated ground conductor through the conduit to hold transformer chassis grounds together. Such a conductor maintains the safety ground connection in the event that the conduit becomes corroded or disconnected.

Run all ground lines through the same conduit as the phase conductors that serve the equipment. Figure 3 on page 36 shows the Isolation Transformer connections.

Figure 3
Typical hardwired Isolation Transformer wiring plan



Notes:

1 Power source is site dependent. It may be from a shared panel or transformer. Wiring may vary accordingly. Wiring to panel must be housed in conduit.

2 Make SPG at the transformer secondary. If the transformer secondary has no isolated secondary ground lug, make SPG by tieing all system ground lines to the chassis lug on the transformer case. An insulated ground connection must be made between the SPG and a known building ground reference as per Note 3.

3 Terminate the small system SPG insulated ground conductor as near as possible to the main building ground reference. Isolate the ground bus from panel housing if permitted by local codes. Conductor should be minimum AWG #6 (metric #40) at all points.

4 Transformer primary wires must be in conduit. Wiring to receptacles must be in conduit unless they are mounted on the transformer case.

5 Connection may be made by metallic conduit. Additional copper conductor recommended.

6 Minimum AWG #6 (metric 40) insulated copper conductor connected to FGND lug on the small system cabinet. Route separately from AC power cable.

7 Separate breaker required for each small system cabinet. Breakers must be mounted on transformer if the receptacles are. If they are in a panel served by the transformer secondary, all connections between the receptacles and transformer must be in conduit.

8 Connect secondary neutral (XO) to system SPG.

553-AAA1088

Dc-powered version (Cabinet system only)

Each cabinet in a Cabinet system may be powered solely from a dc source if it is equipped with the following:

- NTDK72 dc power supply
- NTAK28 Junction Box

Table 10
Dc power requirements for each NTDK72 dc power supply

	Minimum	Nominal	Maximum
Input Range	-44 V dc	-52 V dc	-54 V dc
Noise (CMESS)	—	—	25 dBrnc
Current	—	—	12 Amps
ac Ripple	—	—	100 mv RMS

Note: The NTDK72 has a built-in circuit breaker that will trip if the voltage difference at its input terminals drops below -42.5 V dc + - 1.0 V dc.

WARNING

Do not allow the voltage difference between the input terminals of the NTDK72 to exceed 57 V dc. Doing so may result in damage to the equipment and a safety hazard to personnel.

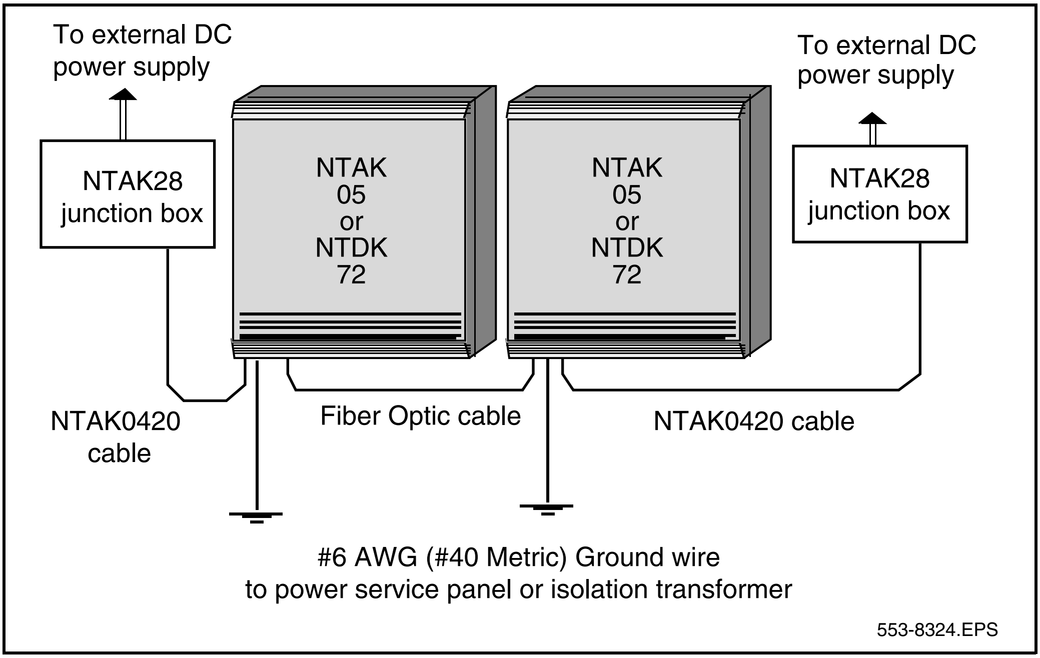
The minimum size of the conductors required between the dc source and the Junction Box is shown in Table 11.

Table 11
Recommended wire size

Size (AWG)	Size (Metric)
6	#40
8	#35
10	#25

Connect these components together as shown in Figure 4 on page 39. Make sure the main cabinet ground post is connected to the building ground reference by a minimum AWG #6 (metric #40) insulated conductor. Connect the input terminals of the NTAK28 Junction Box to a clean dc power source meeting the requirements shown in Table 10 on page 37.

Figure 4
Dc power supply connections



Power consumption worksheets for the Succession 1000M Chassis and Meridian 1 Option 11C Chassis systems

Use the worksheets (Table 13 on page 41) in this section to determine the power consumption for the Succession 1000M Chassis and Meridian 1 Option 11C Chassis. Refer to Table 12 for the circuit card power consumption.

Table 12
Circuit card power consumption

Circuit card	Type	% active sets (off-hook)	Power consumption
NT6R16	Meridian Mail or Call Pilot	steady state	35W
NT5K02	Flexible analog line card	50%	26W
NT8D02	Digital line card	100%	25W
NT8D03	Analog line card	50%	26W
NT9D09	Message-waiting line card	50%	26W
NT8D14	Universal trunk card	DID-enabled	28W
NT8D15	E&M trunk card	N/A	29W
NTDK16	48-port Digital Line Card	100%	75w
NTDK20	Small System Controller	N/A	15 w
NTAK02	SDI/DCH card	N/A	10W
NTAK03	TDS/DTR card	N/A	8W
NTAK09	1.5Mb DTI/PRI card	N/A	10W
NTAK10	2.0 Mb DTI card	N/A	12 W
NTAK79	2.0 Mb PRI card	N/A	12 W
NTBK50	2.0 Mb PRI card	N/A	12 W
NTBK22	MISP card	N/A	12 W
NTRB21	1.5 Mb DTI or PRI card	N/A	10 W

Table 13
Chassis System power consumption: Chassis

Slot	Circuit card	Type	Power consumption from Table 12
0	NTDK20	SSC	15 w
1			
2			
3			
4, 5, 6	NTDK16	48-port DLC	75 w
7			
8			
9			
10			
P*out* Main (total for slots 1-6 in chassis)			
P*out* Expan (total for slots 7-10 in the chassis expander)			
		Total	

Auxiliary equipment power

Terminals, printers, modems, and other data units used with Small Systems require special wiring considerations.

Power for system equipment in the switch room must:

- be powered from the same panel or transformer as the Small System
- be grounded to the same panel or transformer as the Small System
- be labeled at the panel to prevent interruption that is not authorized
- not be controlled by a switch between the breaker and the equipment

Service receptacles for ac-powered Small Systems and related equipment must be:

- of the isolated ground type, such as NEMA IG5-15
- rated for 120 or 240 V, 15 or 20A, 50-60 Hz, 3-pole, 3-wire, grounded
- grounded to the same location so as to form a SPG

Modem requirements

Equip the system with a modem to allow remote access. Refer to the section on modem setup requirements in *Small System: Installation and Configuration* (553-3011-210) for information about setting up the modems recommended for use with Small Systems.

> ***Note:*** In the UK, British Telecom RACE modems require a Modem Eliminator (NULL Modem without hardware handshaking) A0378652 F-F converter or A0381016 M-F converter.

With or without Meridian Mail

The minimum requirement is a 1200 bps auto-answer modem.

If an error-correcting modem is connected to the Small System, all flow-control and error-correcting functionality of the modem must be disabled to ensure correct operation. Refer to the modem manufacturer's instructions for information.

Maintenance and administration terminals

Refer to *Small System: Installation and Configuration* (553-3011-210) for information about setting up terminals recommended for use with a Small System.

Under some conditions, you require a Modem Eliminator (NULL Modem without hardware handshaking) A0601397 F-F converter or A0601396 M-F to interface the TTY to the system.

The following describes the minimum requirements for a TTY device.

Without Meridian Mail

When the system does not have Meridian Mail installed, and it will not have Meridian Mail installed in the future, the minimum requirement is a VT100 compatible device.

With Meridian Mail

With Meridian Mail installed, use a VT220 compatible device.

On-site access

Equip each system with an M2616 or M2008 telephone with display. These telephones act as maintenance telephones.

You can use many different TTY terminals to access the Small System. However, a VT220 terminal is recommended as an on-site terminal. You can use this terminal to perform service changes, maintenance and diagnostic functions, and Meridian Mail administration activities.

Remote access

Although you can use several types of modems to access the system, a 2400 baud auto-answer modem is the recommended modem. A 1200 baud modem is the minimum requirement. You can use the modem to perform service changes, maintenance and diagnostic functions, and Meridian Mail administration activities from a remote location.

Note: You can perform additional maintenance functions through remote access on a Small System. For additional information, refer to *Small System: Maintenance* (553-3011-500).

Optivity Telephony Manager (OTM)

The Small System supports the OTM application. For information about OTM requirements , refer to *Optivity Telephony Manager: System Administration* (553-3001-330) or *Using Optivity Telephony Manager Release 2.1 Telemanagement Applications* (553-3001-331).

Cross-connect terminal requirements

Allow for future expansion and equipment changes at the cross-connect terminal.

The cross-connect terminal must have enough space for connecting blocks to terminate the following wires:

- ten 25-pair cables from each cabinet (the main cabinet and, if equipped, each expansion cabinet)
- six conductors comprising the AUX cable from the main cabinet
- five 25-pair cables from each Chassis
- four 25-pair cables from the Chassis Expander
- four conductors for the AUX cable from the Chassis
- one 25-pair cable from each QUA6 PFTU
- wiring from telephone sets and trunks

The BIX cross-connect system is recommended for use with the Small System. However, use of this system is not mandatory. You can use some other cross-connect systems (for example, the Krone Test Jack Frame for the UK and the Reichle Masari cross-connect terminal for Germany).

Only allow authorized personnel to access the Krone Test Jack Frame. Install the Krone Test Jack Frame in a locked room or in an environment that prevents free access to the equipment. The Krone Test Jack Frame must meet this safety requirement to receive approval.

You can find information about the BIX cross-connect system in the following documents:

- *BIX In-Building Cross-Connect System Material Description* (631-4511-100)
- *BIX In-Building Cross-Connect System Material Installation and Servicing* (631-4511-200)

Refer to *Small System: Installation and Configuration* (553-3011-210) for additional information about the BIX, Krone Test Jack Frame, and Reichle Masari cross-connect terminals.

IP installation requirements for Small Systems

Connectors for IP cabinets or chassis equipped with 100BaseF or 100BaseT daughterboards must be identified in advance in order to secure the proper cabling cross-connect. These connectors are the responsibility of the customer.

100BaseF daughterboards

The 100BaseF expansion cabinets or chassis can be located up to 2 km from the main cabinet/chassis or customer-supplied LAN equipment.

100BaseT daughterboards

IP expansion cabinets or chassis equipped with 100BaseT or 100BaseF daughterboards can be located up to 100 m from the main cabinet, chassis, or customer-supplied LAN equipment.

> ***Note:*** For IP connections greater than the 100BaseT or F solutions, third-party media convertors are required.

Creating equipment layout and card slot assignment plans for Cabinet systems

Contents

This section contains information on the following topics:

Equipment layout plan

Before installing the Small System, you need to develop an equipment layout plan to determine where each system component will be positioned.

Consideration should be given to the lengths of the various cables in order to make the best use of space available. Refer to Table 11 on page 38 for a complete description of Small System cable and wire specifications.

Preparation of the site according to the plan is critical. Site preparation consists of making sure the site is ready to accept the equipment and that items such as power outlets and backboards are correctly installed.

General layout guidelines

DANGER

The mounting surface must be able to support at least 100 lb (45 kg). For wall-mounted systems, it is recommended that you secure a backboard consisting of 3/4 in. (20 mm) plywood, or other similar material, to the surface of the wall to hold the equipment.

Follow the guidelines below to assist you in positioning the system equipment. If you plan on installing one or more expansion cabinets, read the section called “Additional considerations for multiple-cabinet systems” on page 49.

- The recommended method of system cabinet installation is wall-mounting. If you cannot mount the cabinets on the wall (for example, if there is not enough wall space), you can mount each cabinet on an optional pedestal. However, you will still need wall space for installing a cross-connect terminal and other optional equipment.
- Each NTAK11 cabinet measures 25 in. (635 mm) high by 22 in. (560 mm) wide by 12 in. (305 mm) deep, or 14 in. (356 mm) deep with the newer cabinet door.
- Leave adequate space for one or more expansion cabinets. When possible, mount the expansion cabinets next to each other horizontally (horizontal expansion) to ensure proper heat dissipation.
- If horizontal expansion is not possible, vertical expansion is permitted for two cabinets. Make sure the expansion cabinet is mounted above the main cabinet.

  Vertical expansion of three or more cabinets is not recommended. Such a configuration makes reaching the topmost cabinet difficult.

  Note: Temperature limits are more stringent when expanding vertically. Review the temperature limits stated in “Environmental requirements” on page 16 of this document before deciding to expand vertically. Do not install an expansion cabinet on top of an existing floor-mounted cabinet.

- When planning for a system that is equipped with DTI/PRI capability, allow space on the backboard for the channel service unit (CSU).
- Leave at least 6 in. (155 mm) above the mounting bracket and any obstruction (such as a pipe or conduit) so that there is room to lift the cabinet on and off the bracket.
- Leave at least 12 in. (305 mm) between the top of a cabinet and the ceiling to ensure proper ventilation.
- Leave 10 in. (255 mm) between the bottom of the lower cabinet and the floor to prevent water damage and to allow for convectional cooling.
- Do not place the cross-connect terminal above a cabinet. Debris from the cross-connect terminal may drop into the cabinet through the top ventilation slots and cause damage.
- Allow adequate space for the battery backup unit, accounting for the cable-length limitation as determined by the choice of a wall-mounted or floor-mounted battery back-up unit.
- If the NTAK92 Off-Premise Protection Module is used, allow for proper installation (according to local practices).
- Ensure power outlets are within reach of each system cabinet. Cable and wire specifications are shown in Table 11 on page 38, and in the chapter entitled "Cable specifications and interfaces" on page 287.

Additional considerations for multiple-cabinet systems

For multi-cabinet systems the following guidelines apply for both horizontal and vertical expansion:

- The maximum distance between the main cabinet and each expansion cabinet is 1.8 mi (3 km).
- The minimum distance between cabinets when mounted above one another (vertical expansion) should be 12 in. (305 mm).
- The minimum distance between cabinets when mounted next to each other (horizontal expansion) is defined by an alignment bracket as shown in Figure 7 on page 53. However, this is the minimum distance; the cabinets can be positioned further apart to suit site requirements.

Note: The equipment layout plans shown in this chapter are applicable to fiber-optic connected cabinets installed within close proximity to each other (such as on the same wall). These layout guidelines are not as stringent if the cabinets are located in separate rooms, on different floors, or in different buildings.

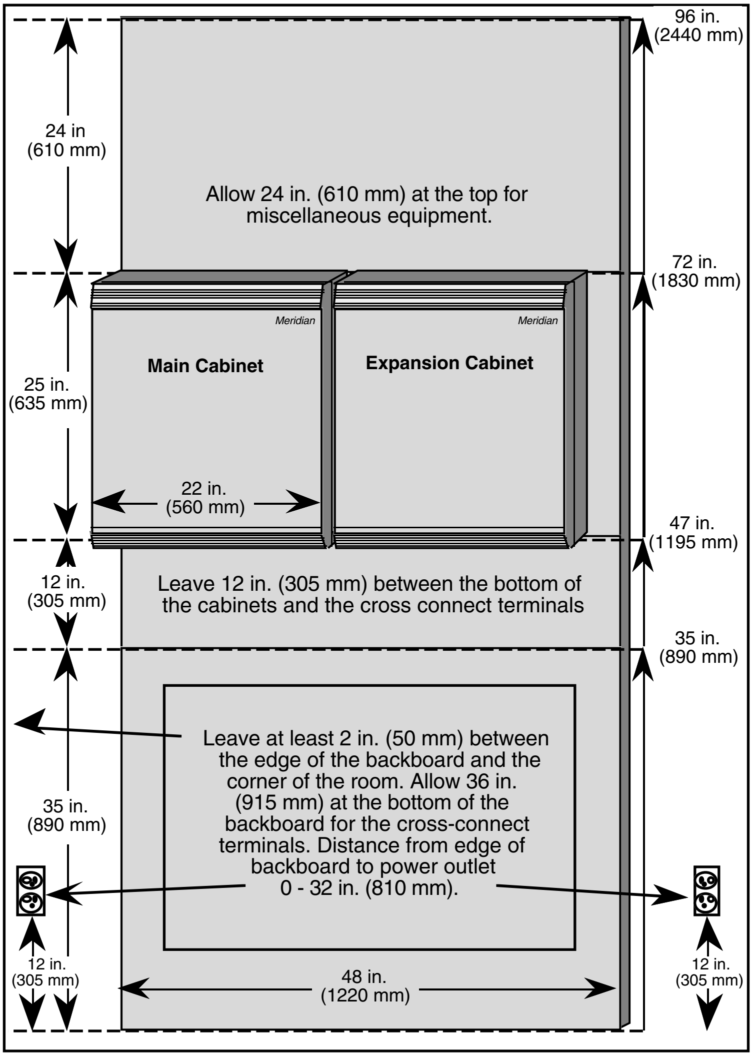
Systems using NTAK75 or NTAK76 reserve power

The mounting location of either the NTAK75 or the NTAK76 backup-up unit is governed by the location of the cabinets and the length of the NTAK0410 cable. The NTAK0410 cable is 6 ft (1830 mm) long.

Equipment layout plan for wall mounting

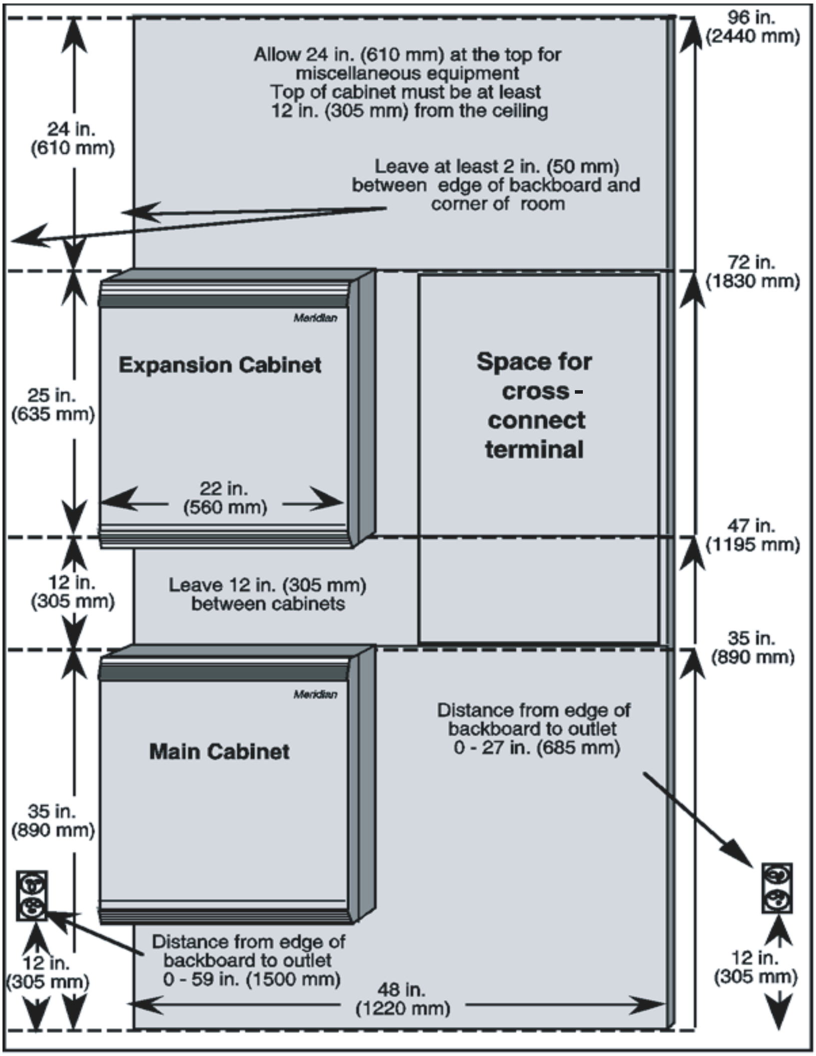
Typical wall layouts using BIX cross-connection equipment are shown in Figure 6 on page 52 and Figure 8 on page 55. Use of other types of terminal blocks and equipment will alter the layout. As a result, you may need to adjust the height at which you place the cabinets in relation to other equipment. You may also need to adjust the distances the power outlets are from the backboard on ac powered systems. The positions for the mounting brackets are shown in Figure 7 on page 53.

Figure 5
Typical minimum distance layout of wall-mounted cabinets (horizontal expansion)



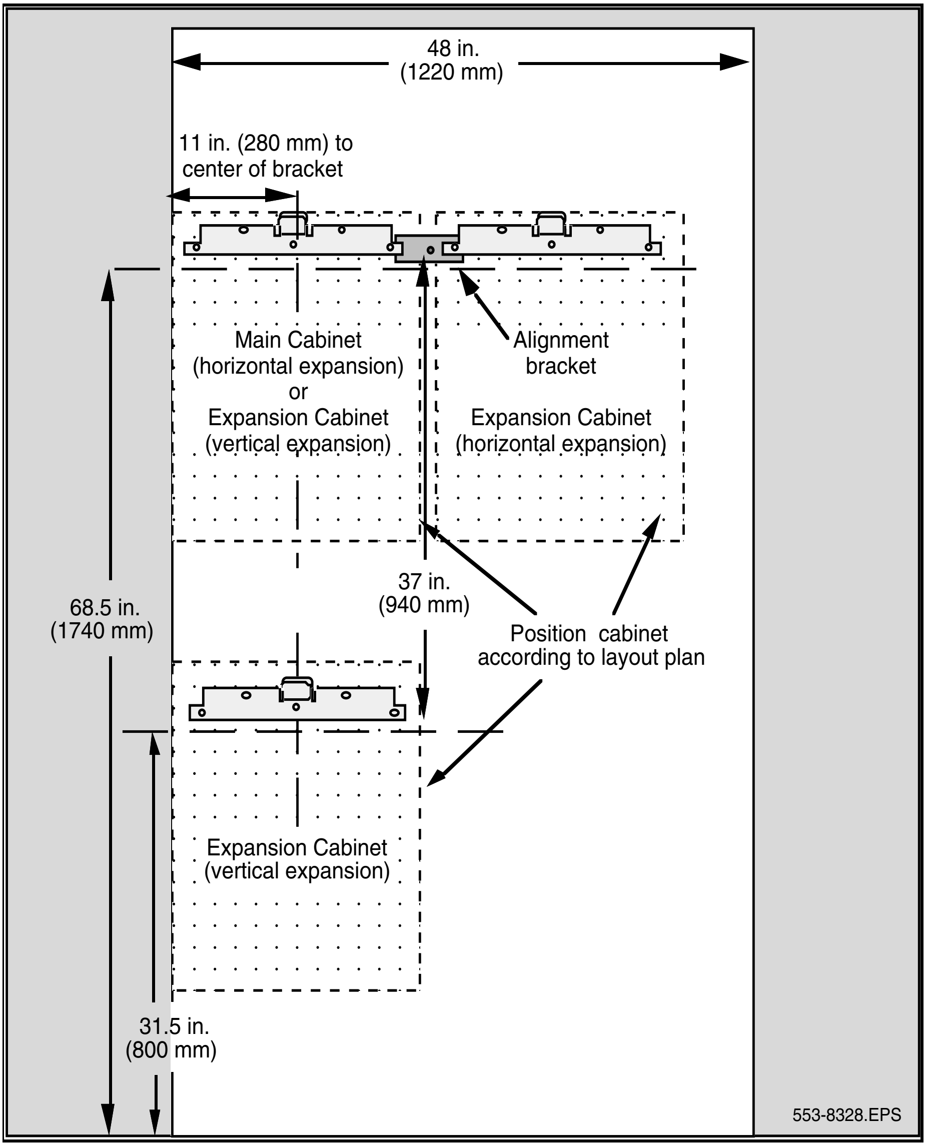
553-8326.EPS

Figure 6
Typical minimum distance layout of wall-mounted cabinets (vertical expansion)



553-AAA1089

Figure 7
Mounting bracket position



The equipment layout plan for floor mounting

An optional cabinet pedestal is used for floor-mounting when it is not possible to mount the cabinets on a wall.

The available floor space must be large enough to accommodate the main cabinet and one or more expansion cabinets, as shown in Figure 8 on page 55.

> ***Note:*** Although you may be installing only a main cabinet at this time, leave enough space for expansion cabinets to avoid problems in the future.

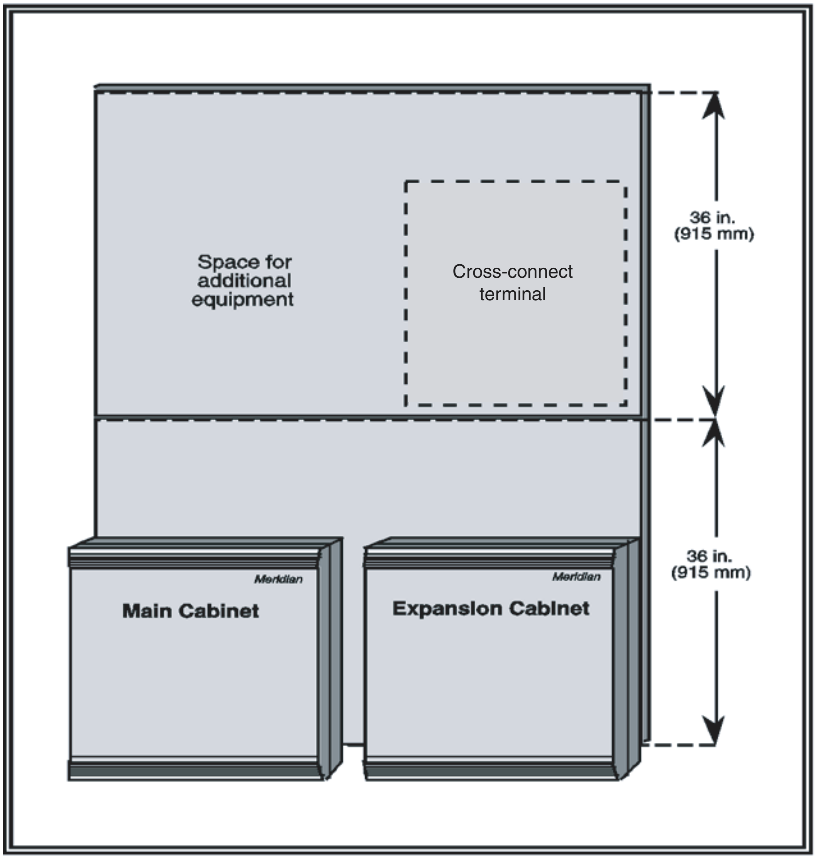
Wall space must be available for the cross-connect terminal, the cross-connect cables, the NTAK75 or NTAK76 battery unit if required, and any miscellaneous equipment (such as a power supply for digit displays on telephones).

WARNING

Make sure that cabinet placement does not allow debris from sources such as cross-connect terminal activities to fall into the ventilation slots located at the top of the cabinet.

Leave at least 12 in. (305 mm) of space between the top of the cabinet and any obstruction (such as a shelf) to permit adequate air circulation.

Figure 8
Typical layout of floor-mounted cabinets

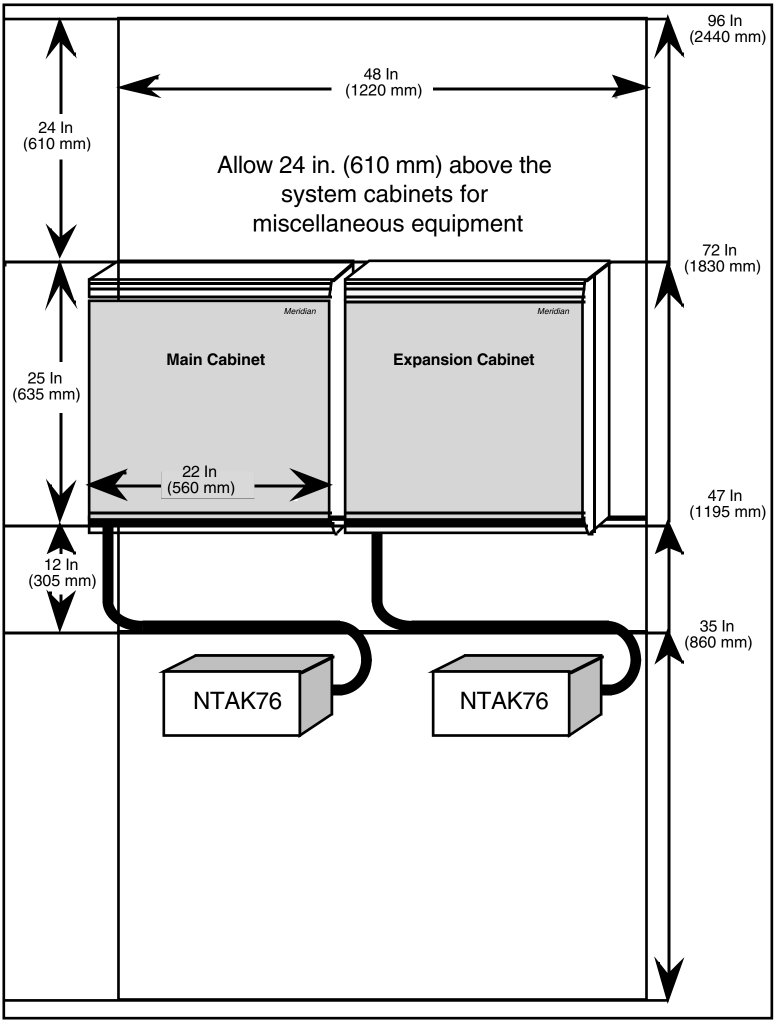


553-AAA1090

Reserve power supply layout and installation planning

The mounting location of either the NTAK75 or the NTAK76 reserve power unit is governed by the location of the main and expansion cabinets, and the length of the NTAK0410 cable (the NTAK0410 cable is 6 ft [1830 mm] long). Below each of the figures on the following pages, you will find information detailing the maximum distance the center line of the battery unit may be placed from the cabinet center line.

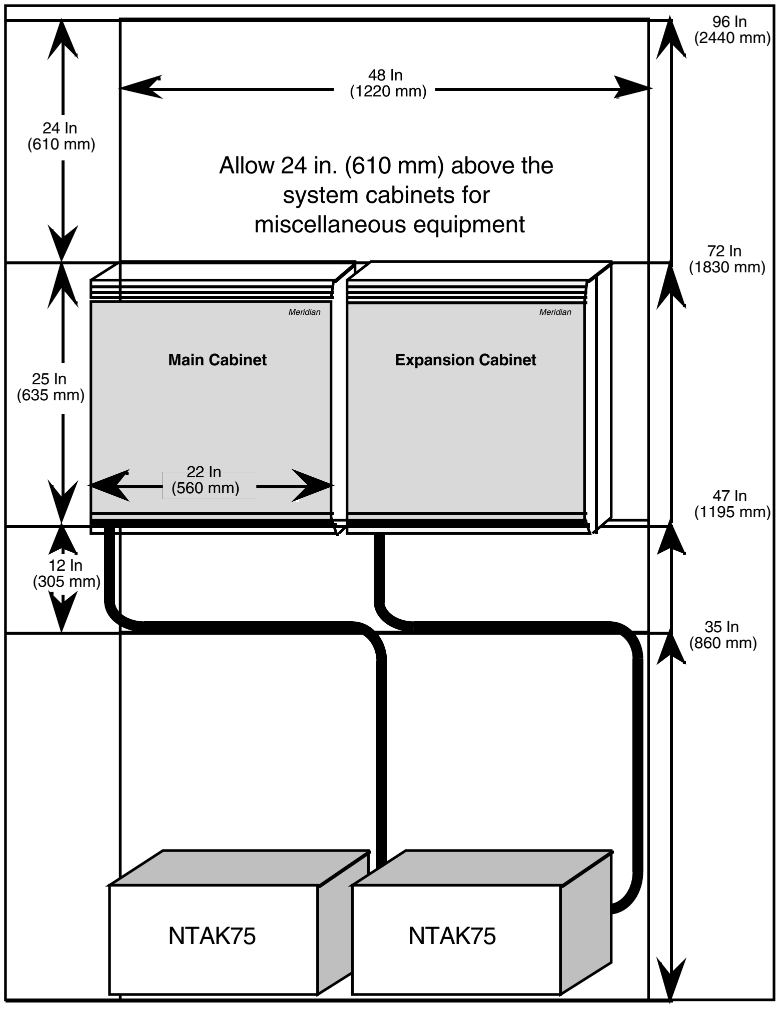
Figure 9
Typical placement of NTAK76 (horizontal cabinet expansion)



553-8330.EPS

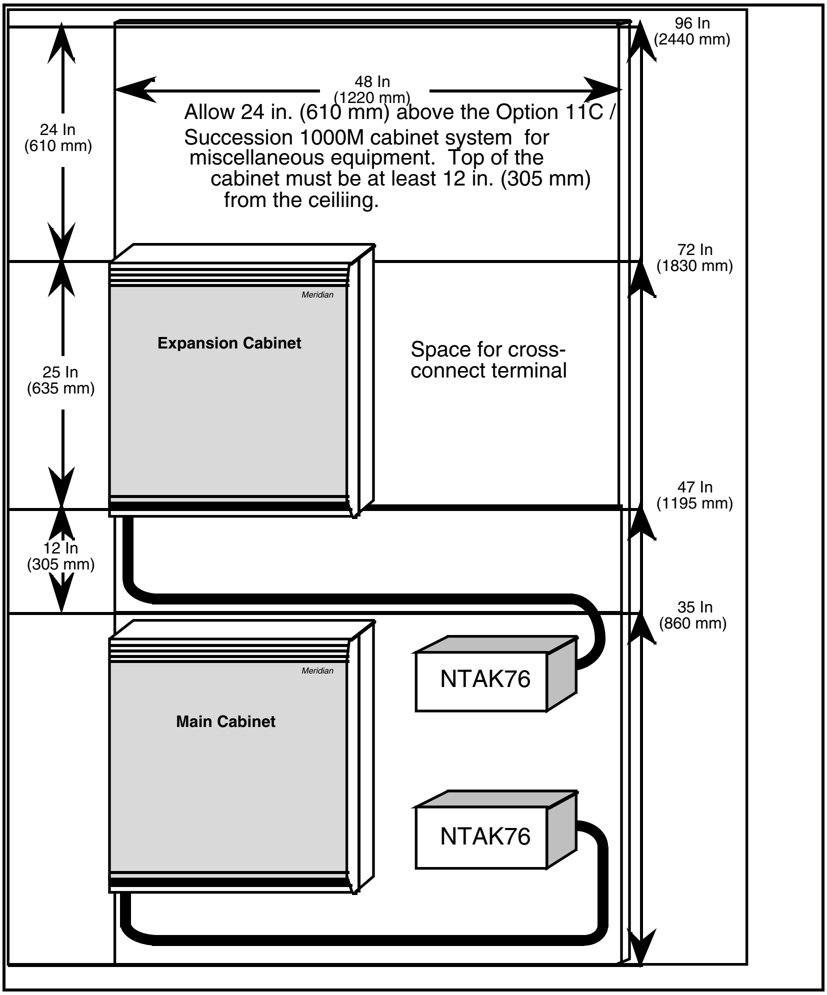
The center line of the NTAK76 may be placed a maximum of 2 ft (610 mm) to the right and 4 ft (1220 mm) to the left of the cabinet center line. These distances are based on the top of the NTAK76 being positioned 1.5 ft (460 mm) below the bottom of the cabinet.

Figure 10
Typical placement of NTAK75 (horizontal cabinet expansion)



The center line of the NTAK75 may be placed a maximum of 0.5 ft (152 mm) to the right and 2.5 ft (760 mm) to the left of the cabinet center line. These distances are based on the cabinets being mounted at the recommended mounting heights, shown in the diagram above, for the horizontal mounting configuration.

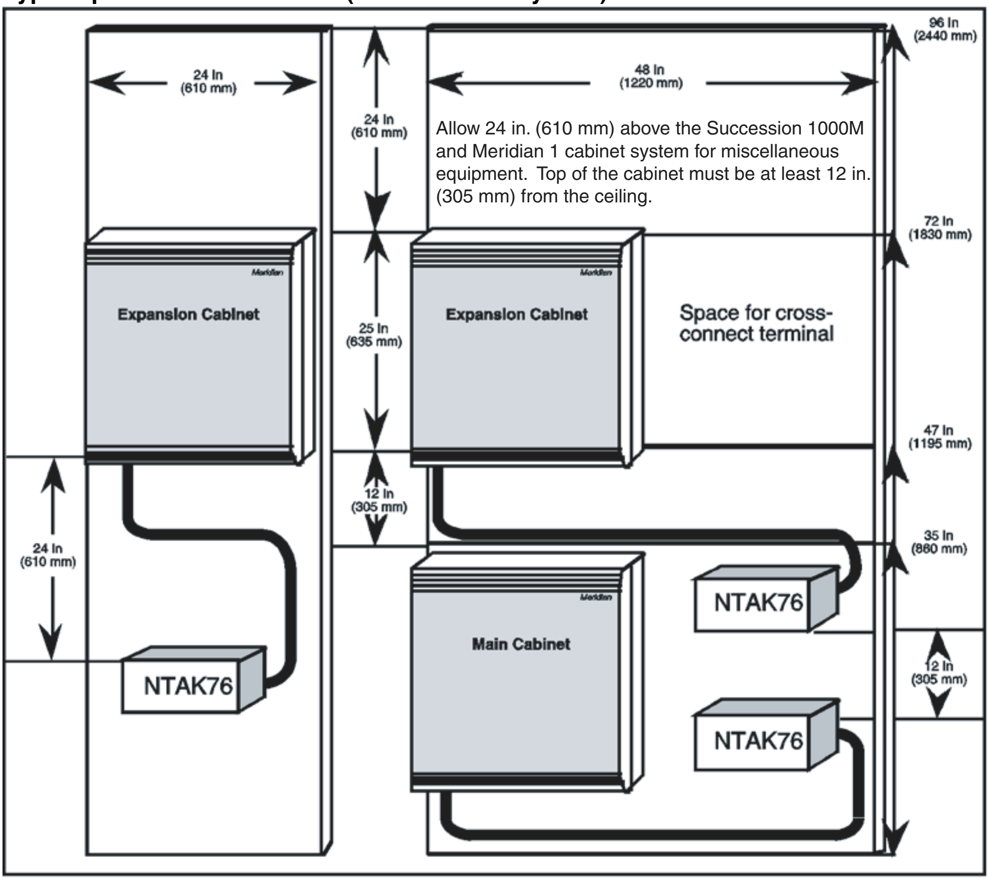
Figure 11
Typical placement of NTAK76 (Vertical cabinet expansion)



The center line of the NTAK76 may be placed a maximum of 2 ft (610 mm) to the right and 4 ft (1220 mm) to the left of the cabinet center line.

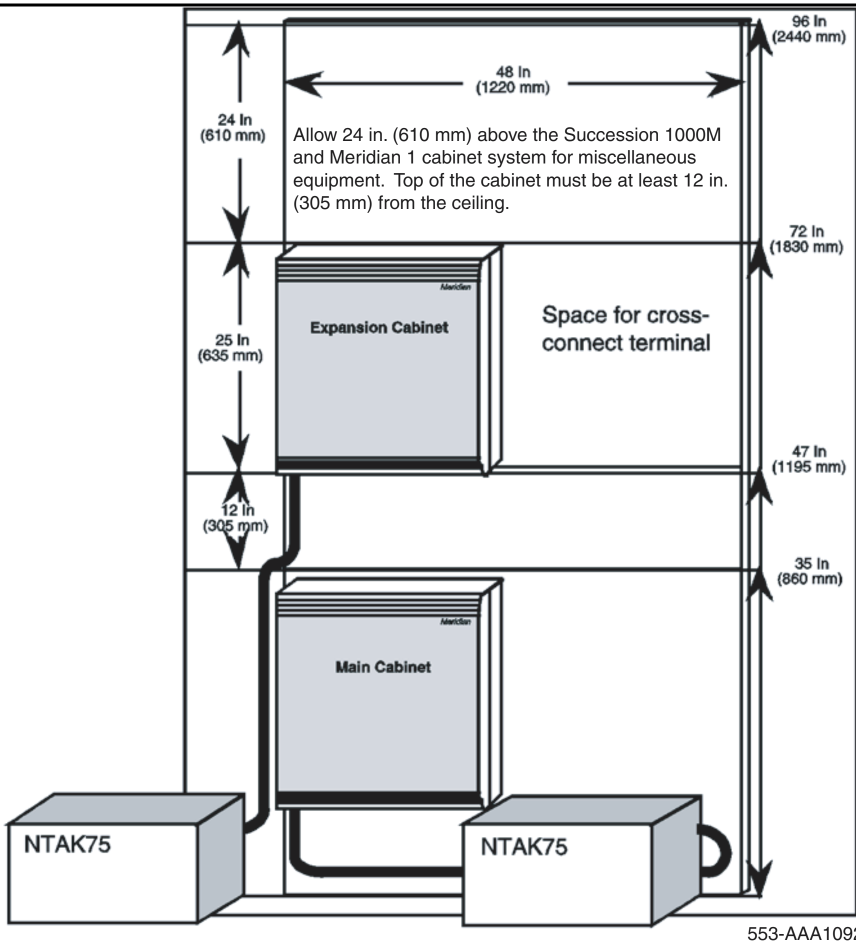
These distances are based on the top of the upper NTAK76 being positioned 1.5 ft (460 mm) below the bottom of the expansion cabinet, and the bottom of lower NTAK76 being positioned 1.5 ft (460 mm) below the bottom of the main cabinet.

Figure 12
Typical placement of NTAK76 (Three-cabinet system)



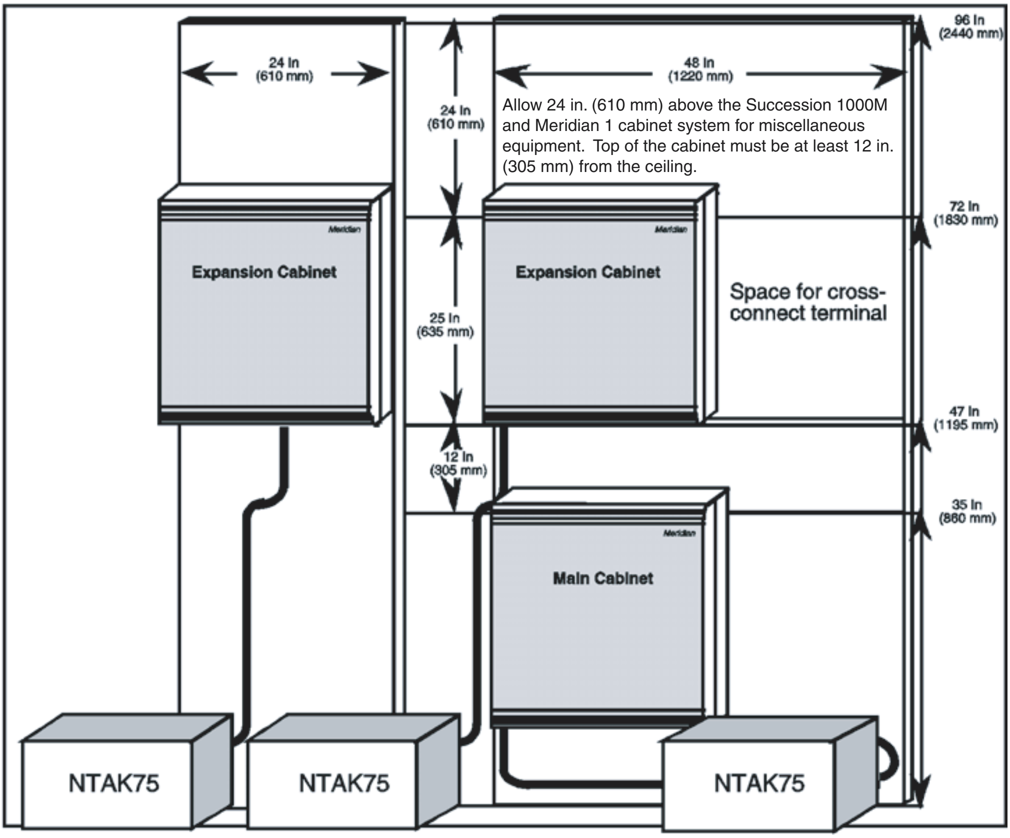
553-AAA1091

Figure 13
Typical placement of NTAK75 (Vertical cabinet expansion)



The center line of the NTAK75 for the expansion cabinet can be placed a maximum of 2.5 ft (760 mm) to the left of the center line of the cabinet. The center line of the NTAK75 for the main cabinet can be placed a maximum of 2 ft (610 mm) to the right of the center line of the cabinet. These distances are based on the cabinets being mounted at the recommended heights, as shown in the diagram above, for the vertical mounting configuration.

Figure 14
Typical placement of NTAK75 (Three-cabinet system)



Card slot assignments

A card slot allocation plan showing circuit card to slot assignments should be prepared in advance for each cabinet. See the most current Small System product bulletins for minimum vintage requirements.

Be sure to allocate the cards to the main cabinet which must reside there first. Fill in the remaining card slots as required.

The NTDK20EA / GA (or later) Small System Controller (SSC) card must be installed in the SSC slot (slot 0) of the main and IP expansion cabinets.

The following card MUST be installed in the main cabinet slots 1-9:

- NT6D70 when used as a clock controller.

If you plan on using the preassigned numbering plan with consecutive numbers, it is important to assign all line cards in consecutive card slots.

To prepare the plan, list the total number of the following circuit cards required for the installation:

Used only in the main cabinet

NT6D70 SILC _______ (if clock controller is active)

Call Pilot ________

Used only in expansion cabinets

NTDK23 10 m Fiber Receiver card ________

NTDK25 or NTDK80
3 km Fiber Receiver card ________

Used in the main and expansion cabinets

NTDK20EA (or later) SSC ____1___ (one per cabinet)

NTAK02 SDI/DCH ________

NTAK03 TDS/DTR ________

NTAK09 1.5 Mb DTI/PRI ________

NTDK79 2.0 Mb PRI ________

NTDK10 2.0 Mb DTI ________

NTRB21 1.5 Mb TMDI ________

NTDK50 2.0 Mb PRI	________
NTBK22 MISP Main Cabinet only	________
NT8D02 Digital line card	________
NT8D03 Analog line card	________
NT8D09 Message waiting	________
NT8D14 Universal Trunk	________
NT8D16 Digitone Receiver	________
NT8D15 E&M Trunk	________
NT7D16 Data Access	________
NT6D70 SILC (see)	________
NT6D71 UILC	________
NT5K02 XFALC	________
NT5K18 XFCOT	________
NT5K17 XDDI	________
NT5K19 XFEM	________
NT5K36 XDID/DOD	________
NT5K21 XMFC/MFE	________
NTAG26 XMFR	________

Note 3: The NT6D70 SILC card must be installed in the main cabinet (slots 1 through 9) if it is used as a clock controller.

Note 4: The NTDK20EA (or later) SSC card must be installed in slot 0 in the main and IP expansion cabinets.

Note 5: Each fiber expansion cabinet must have either an NTDK23, NTDK25, or NTDK80 Fiber-Receiver card positioned in slot 0.

WARNING

If NE-A25B cables are used instead of NTAK19AA and NTAK19BA cables with the NTAK02 and NTAK03 cards, proceed with care. NE-A25B cables are not wired out to station equipment or trunk circuits. They may only be wired out to SDI circuits.

Figure 15
Main cabinet card slot assignments

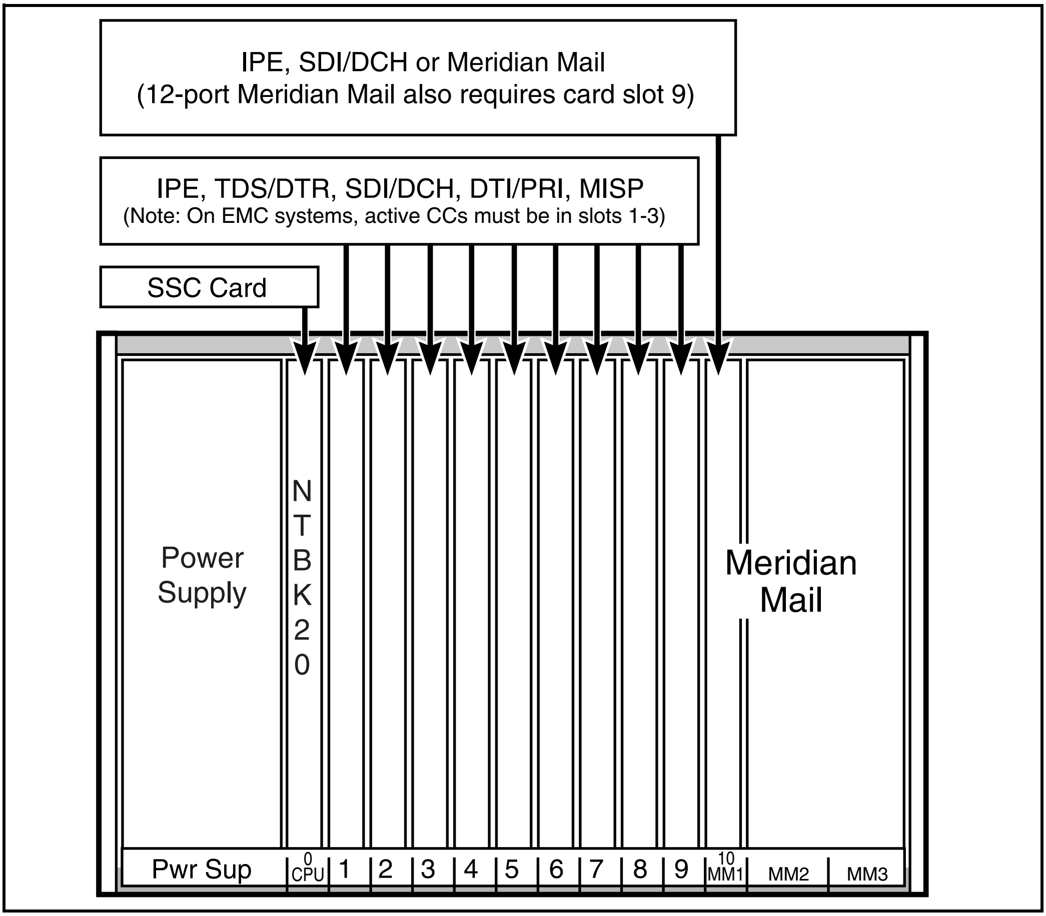
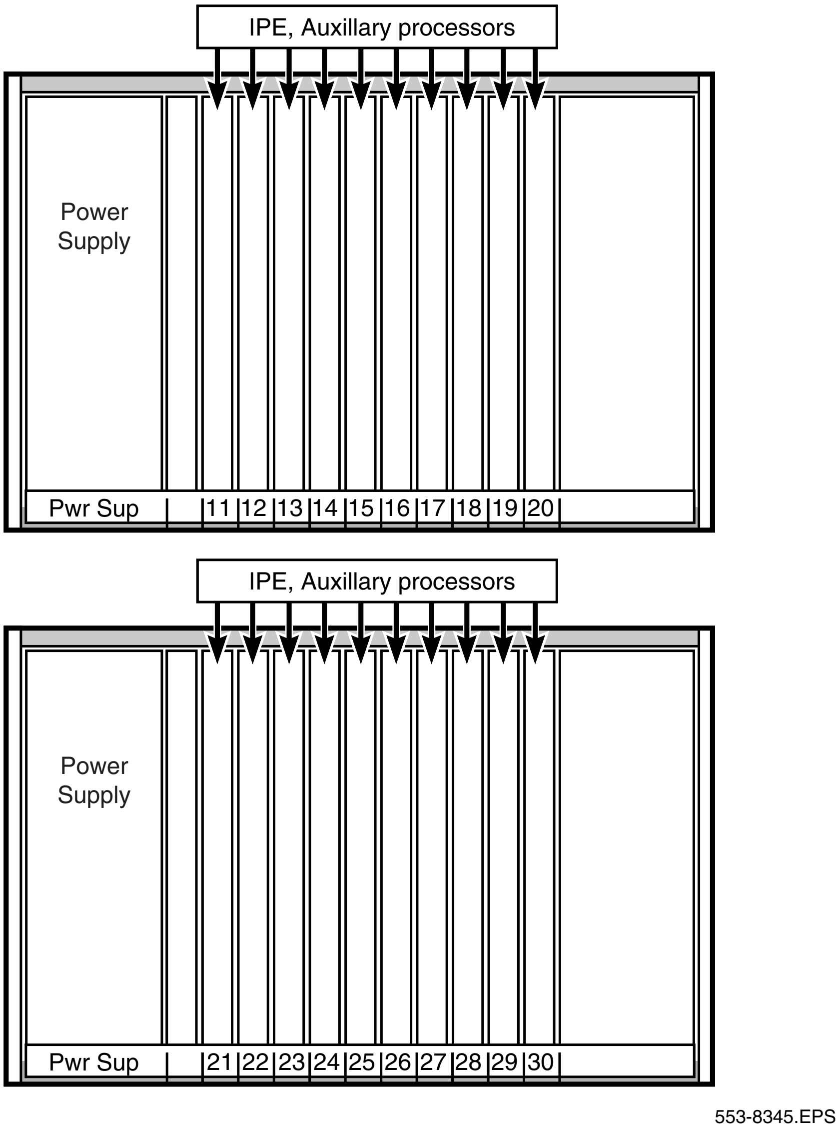


Figure 16
IP expansion cabinet card slot assignments



Creating equipment layout and card slot assignment plans for Chassis systems

Contents

This section contains information on the following topics:

Introduction

Take some time to plan the installation of the Chassis system. This preparation helps to make sure the system performs correctly. Develop a layout plan for the equipment to determine where you will position each system component.

Give consideration to the lengths of the different cables, so that you make the best use of available space. Refer to *Small System: Installation and Configuration* (553-3011-210) for a description of Chassis system cable and wire specifications.

Preparation of the site according to the plan is very important. Make sure that the site is ready to accept the equipment. Make sure that items, such as power outlets and backboards, are installed correctly.

Equipment layout plan

General layout guidelines

WARNING

Make sure that the mounting surface can support at least 100 lb (45 kg).

The following are the Meridian 1 Option 11C Chassis installation options:

- wall installation
  - vertically on a wall
  - horizontally on a wall
- in a rack/cabinet

Each chassis measures 8.4 in. (213 mm) high by 17.2 in. (437 mm) wide by 12.8 in. (325 mm) deep.

Additional considerations for multiple-chassis systems

If you are combining Small Systems, the following minimum standards must be followed:

- A horizontal installation of Succession 1000M Chassis and Meridian 1 Option 11C Chassis requires 10 inches of free space on either side of the chassis.
- A vertical installation of Succession 1000M Chassis and Meridian 1 Option 11C Chassis requires 12 inches of free space on the card side and 6 inches of free space on the cable side of the chassis.

For multi-chassis systems, the following guidelines apply for both horizontal and vertical expansion:

- The maximum distance between the main chassis and each fiber expansion chassis is 1.8 mi (3 km).
- The minimum distance between the main chassis and the chassis expander, when mounted above one another (vertical expansion), is 4 in. (102 mm).

  Note: The equipment layout plans shown in this chapter are applicable to fiber-optic connected chassis installed within close proximity to each other (such as on the same wall). These layout guidelines are not as stringent if the chassis are located in separate rooms, on different floors, or in different buildings.

Equipment layout plan for installing the chassis on a wall horizontally and vertically

Figure 17 on page 71 shows a typical wall layout, using BIX cross-connect equipment, for installing the chassis on a wall in a horizontal position. Figure 18 on page 72 shows a typical wall layout, using BIX cross-connect equipment, for installing the chassis on a wall in a vertical position. Use of other types of terminal blocks and equipment can change the layout. As a result, if required, adjust the height at which you place the chassis in relation to other equipment. If required, also adjust the distances between the power outlets and the backboard.

Use the following guidelines to position the system equipment on a wall:

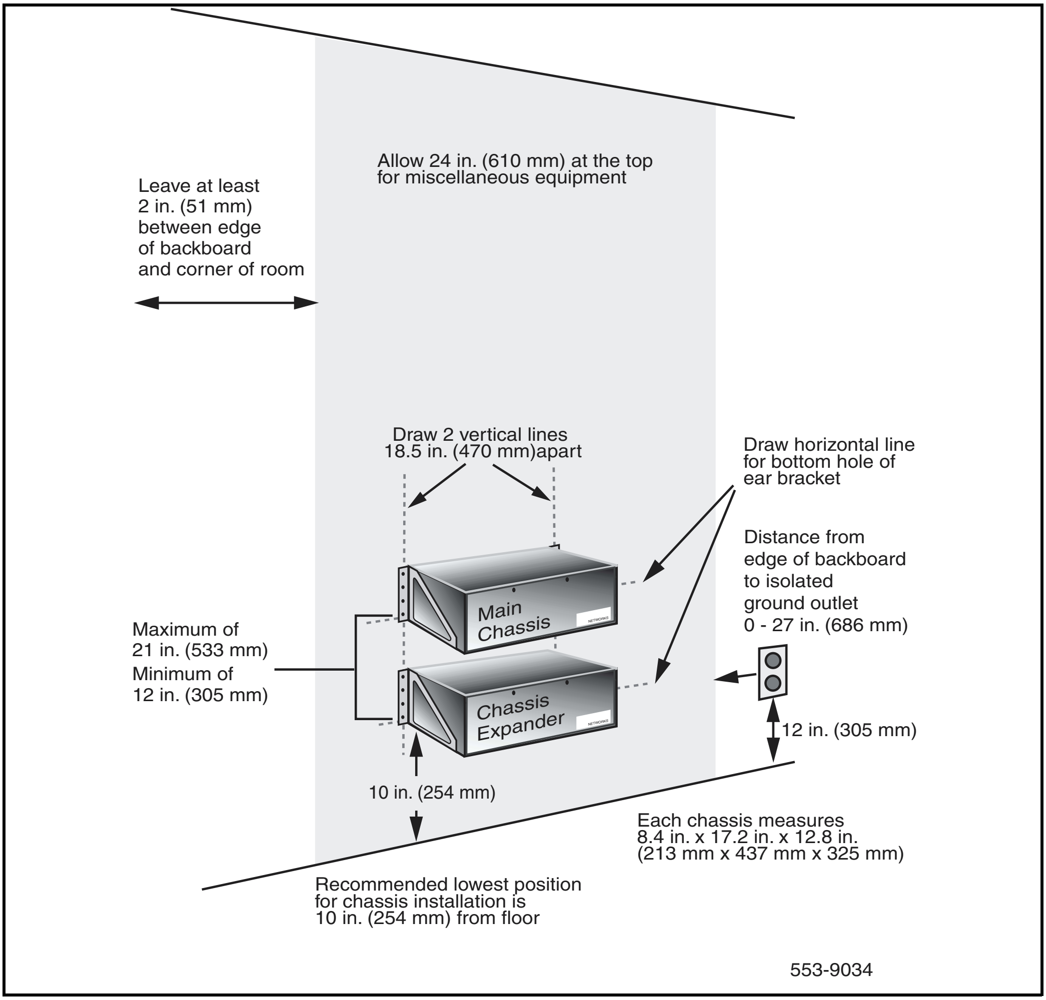
- It is recommended that you fasten a 3/4 in. (20 mm) plywood (or other material like plywood) backboard to the surface of the wall. Fasten the Chassis system equipment to this backboard.
- When planning for a system with DTI/PRI capability, allow space on the backboard for the Channel Service Unit (CSU).
- Leave at least 6 in. (155 mm) above the mounting bracket and any obstruction (such as a pipe or conduit) so that there is room to lift the chassis on and off the bracket.

- Leave at least 12 in. (305 mm) between the top of a chassis and the ceiling to make sure that there is enough ventilation for the system.
- Leave 10 in. (255 mm) between the bottom of the lower chassis and the floor to prevent water damage.
- If you use the NTAK92 Off-Premise Protection Module, allow for correct installation (according to local practices).
- Make sure power outlets are within reach of each system chassis. See *Small System: Installation and Configuration* (553-3011-210) for cable and wire specifications.

If you are combining cabinets and chassis in a mix-and-match configuration, the following minimum standards must be followed:

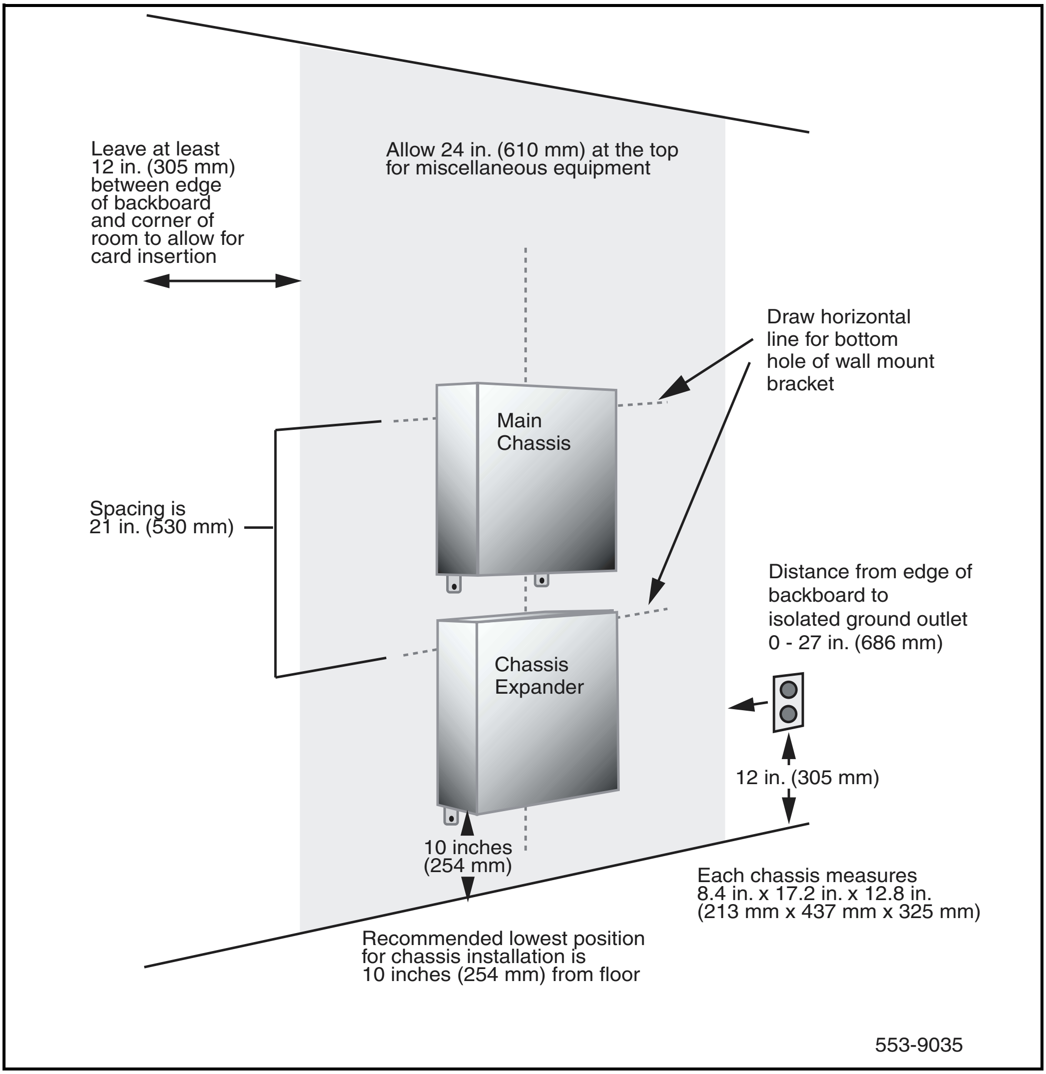
- For horizontal installation, the chassis requires 10 inches of free space on either side of the chassis.
- For vertical installation, the chassis requires 12 inches of free space on the card side and 6 inches of free space on the cable side of the chassis.

Figure 17
Typical layout for installing the chassis on a wall in a horizontal position



Note: Leave wall space for the cross-connect terminal.

Figure 18
Typical layout for installing the chassis on a wall in a vertical position



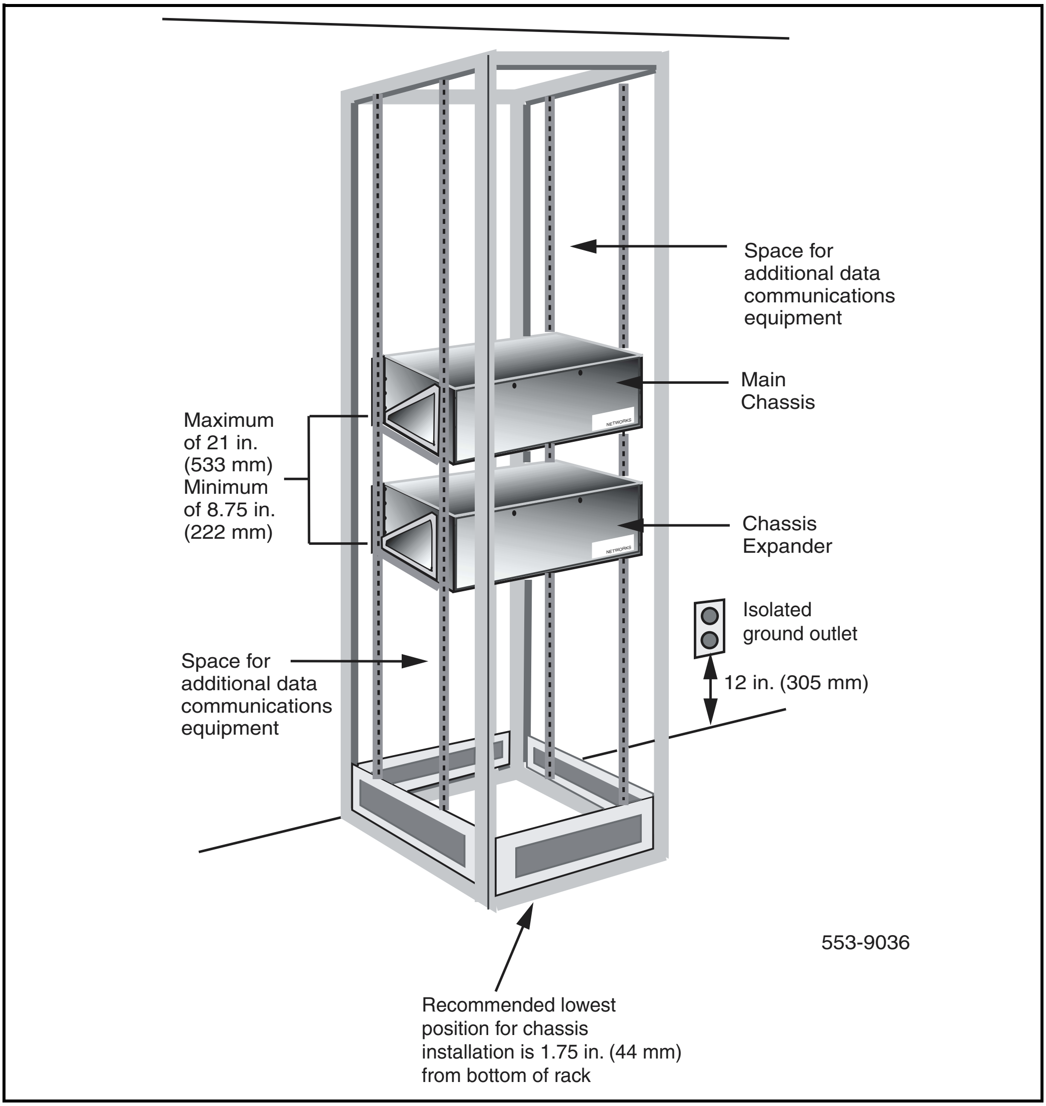
Note: Leave wall space for the cross-connect terminal.

Equipment layout plan for installing the chassis in a rack/equipment cabinet

You can install the chassis and chassis expander in a 19-inch rack/equipment cabinet. There is also space in the rack/equipment cabinet for additional pieces of Data Communications Equipment. In a rack/equipment cabinet configuration, the lowest recommended installation position for the chassis is 1.75 inches (44 mm) from the floor. See Figure 19 on page 74.

> ***Note:*** The 19-inch rack/equipment cabinet does not come with the Chassis system.

Figure 19
Typical layout for installing the chassis in a rack/equipment cabinet



Note: Leave wall space for the cross-connect terminal.

Card slot assignments

Prepare a card slot assignment plan in advance. The card slot allocation plan shows circuit card to slot assignments. See the most current Small System product bulletins for minimum version requirements.

> ***Note 1:*** You must insert the NTDK20 Small System Controller (SSC) card in Slot 0 of the chassis, and any IP expansion chassis.

Slot 4 accepts the NTDK16 48-port Digital Line Card (DLC) only. However, you can place a card that takes two slots in slot 3, and it can overlap into slot 4. When expanding older Option 11C Mini systems using fiber daughterboards, the NTDK97 Mini System Controller (MSC) card in the chassis must be replaced by NTDK20 SSC card. The SSC card supports the following optional daughterboards:

- the NTDK22 10 m Single Port Fiber Expansion Daughterboard
- the NTDK24 3 km Single Port Fiber Expansion Daughterboard (Multimode)
- the NTDK79 3 km Single Port Fiber Expansion Daughterboard (Single Mode)
- the NTDK84 10 m Dual Port Fiber Expansion Daughterboard
- the NTDK85 3 km Dual Port Fiber Expansion Daughterboard (Multimode)

> ***Note 2:*** Dual Port Fiber Expansion Daughterboards require NTDK20CA or later versions of SSC card.

You can install the following cards in slots 1, 2, and 3 of the chassis:

- NTAK09
- NTAK10
- NTBK50
- NTAK79
- NTBK22

- NT6D70 (when used as a clock controller)
- NTRB21

The NTAK09 supports the following optional daughterboards:

- the NTAK20 Clock Controller
- the NTAK93 D-channel Interface
- the NTBK51 DDCH Daughterboard

The NTBK50 supports the following optional daughterboards:

- NTAK20 Clock Controller
- NTBK51 DDCH daughterboard or the NTAK93 D-channel Interface

To prepare a plan for card slot assignment, write the total number of circuit cards required for the installation in Table 14.

Table 14
Card slot assignment plan (Part 1 of 3)

Card	Card slot	Number of cards
Used only in the Chassis		
NTDK20 SSC	0 only	1
NTDK16 48-port DLC	4 only	
NTAK02 SDI/DCH		
NTAK03 TDS/DTR		
NTAK09 1.5 Mbit DTI/PRI		
NTRB21 1.5 Mbit DTI/PRI		
NTAK10 2.0 Mbit DTI		
NTAK79 2.0 Mbit PRI		
NTBK50 2.0 Mbit PRI		

Table 14
Card slot assignment plan (Part 2 of 3)

Card	Card slot	Number of cards
NT5K20 Tone Detector		
NT5K48 Tone Detector		
NTBK22 MISP		
NT6D70 SILC		
Used only in the Chassis Expander		
NT6R16 Meridian Mail Mini	10 only	
Used only in the Fiber Remote Chassis		
NTDK23 10 m. Fiber Receiver		
NTDK25 or NTDK80 3 km. Fiber Receiver		
NTDK16 48-port Digital Line Card (in Slot 4 only)		
Used only in the fiber expansion chassis		
NTDK23 10 m Fiber Receiver card		
NTDK25 or NTDK80 3 km Fiber Receiver card		
NTDK16 48-port Digital Line Card (in Slot 4 only)		
Used in the chassis and the chassis expander		
NT8D02 Digital Line Card		
NT8D03 Analog line card		
NT8D09 Message Waiting		
NT8D14 Universal Trunk		
NT8D16 Digitone Receiver		
NT8D15 E&M Trunk		
NT7D16 Data Access		

Table 14
Card slot assignment plan (Part 3 of 3)

Card	Card slot	Number of cards
NT6D70 SILC (See Note 1)		
NT6D71 UILC		
NT5K02 XFALC		
NT5K18 XFCOT		
NT5K17 XDDI		
NT5K19 XFEM		
NT5K36 XDID/DOD		
NT5K21 XMFC/MFE		
NTAG26 XMFR		

Note: Install the NT6D70 SILC card in the chassis (Slots 1, 2, or 3) if it is used as a clock controller.

WARNING

If you use NE-A25B cables instead of NTAK19AA and NTAK19BA cables with the NTAK02 and NTAK03 cards, continue with caution. NE-A25B cables are not wired out to station equipment or trunk circuits. NE-A25B cables can only be wired out to SDI circuits.

For expanded Chassis systems, the SSC card must be provisioned with either Fiber Expansion or IP Expansion daughterboards.

Each Fiber expansion chassis must have an NTDK23, NTDK25, or NTDK80 Fiber Receiver Card positioned in slot 0.

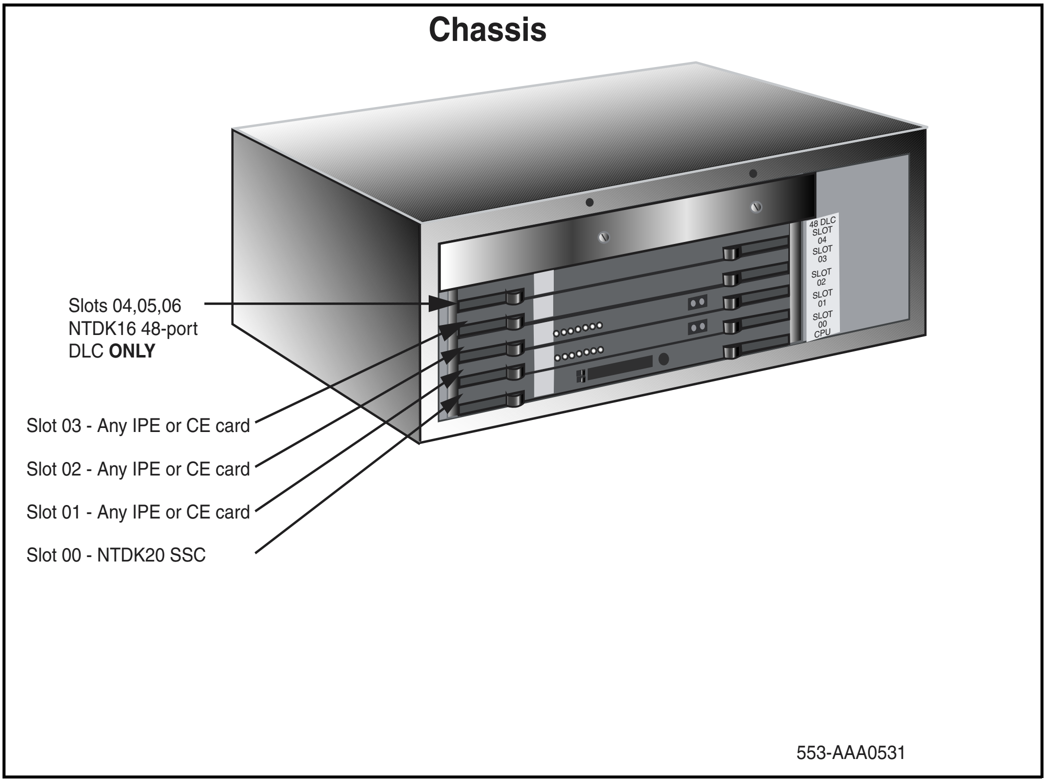
Each IP expansion chassis must have an SSC card provisioned with an IP Expansion Daughterboard.

Make sure to first allocate the cards that you must install in the chassis. Fill the remaining card slots as required.

If you plan on using the preassigned numbering plan with consecutive numbers, make sure you assign all line cards in consecutive card slots.

See Figure 20 and Figure 21 on page 80 for the card slot assignments in the chassis and chassis expander.

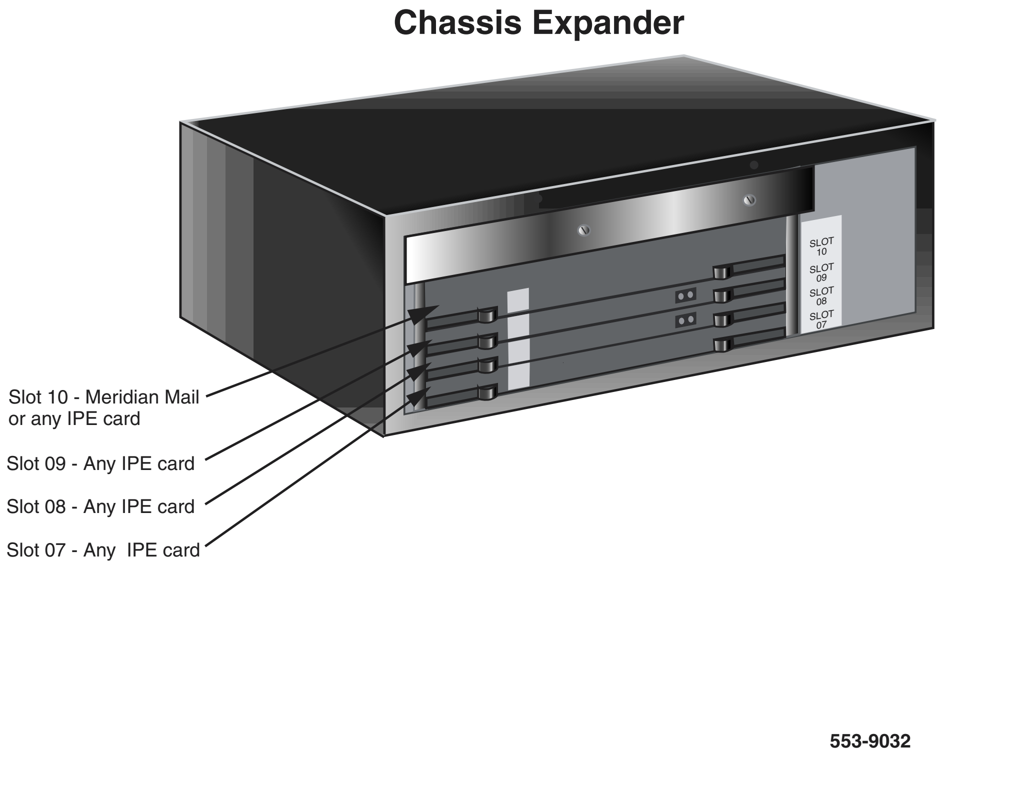
Figure 20
Card slot assignments for the chassis



Note 1: Refer to Table 14 on page 76 for a list of cards that you can insert in the chassis.

Note 2: Slot 4 accepts the NTDK16 48-port DLC card only. However, you can place a card that takes two slots in slot 3, and it can overlap into slot 4.

Figure 21
Card slot assignments for the chassis expander



Note: Refer to Table 14 on page 76 for a list of cards that you can insert in the chassis expander.

Memory, storage, and CPU capacity

Contents

This section contains information on the following topics:

Introduction

This chapter presents an outline of Real Time CPU capacity for Small Systems. It describes Small System data storage, loading and restoring, as well as the unprotected and protected memory requirements for features applicable to these systems.

Small System data storage, loading, and restoring

For the Small System, configuration data is both stored and loaded by accessing LD 43 and LD 143. The sequence of events where data is copied from one area to the next depends on the status of the switch — new installation, software upgrade — and the purpose of the data transfer, such as to make a backup copy of the customer database.

A Small System with IP expansion can be made up of both cabinets and chassis. When an existing Option 11C Mini chassis is used, the NTDK97 Mini System Controller (MSC) card is replaced with an NTDK20 Small System Controller (SSC) card and an appropriate IP Expansion Daughterboard.

Small System software is stored in various areas of the NTDK20 SSC card. In terms of customer data, there are four possible areas where these records can be stored (see Figure 22 on page 83):

- DRAM — stores and accesses the active version of customer records, system data, and overlay data.
- Primary flash drive c: — contains two copies of customer records (primary and backup records).
- Backup flash drive z: — retains the true backup copy of the customer database.
- PC card device a: or b: — if equipped, this 40 Mbyte device can store a complete backup copy of the customer database.

Data storage

The Small System datadump, performed in LD 43, is the system's method of backing up configuration data to its file storage devices. By invoking one of the several datadump commands in the overlay, the user is ensured that at least one backup copy of configuration data exists in a location other than DRAM (see Table 15).

Table 15
LD 43 data dump commands (Part 1 of 2)

Command	Description
BKO	Customer records in the primary flash drive are copied to the PC card device.
EDD	Customer data in DRAM is written to the primary and backup flash drives on the NTDK20 SSC.

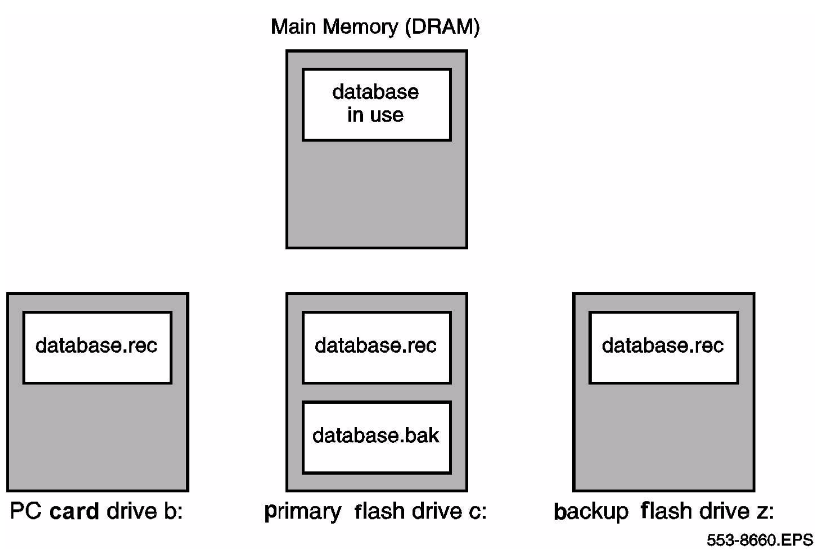
Table 15
LD 43 data dump commands (Part 2 of 2)

Command	Description
EDD NBK	Customer data in DRAM is written to the primary and backup flash drives on the NTDK20 SSC. (Same as the EDD command).
SWP	A swap or exchange of database records is completed between the primary flash drive's main and secondary databases (Refer to Figure 22 on page 83).

The effects of the LD 43 commands described above are better illustrated by referring to Figure 22.

> ***Note:*** Refer to *Software Input/Output: Maintenance* (553-3001-511) for a complete listing and description of LD 43 commands.

Figure 22
Data storage on the NTDK20 SSC card



Small Systems offer one additional area of data storage that is truly external to the switch. This storage device can be an IBM-type PC or Macintosh-type computer, running a Small System software feature called “Customer Configuration Backup and Restore” (CCBR). Through the use of LD 143 and the CCBR feature, the user can transfer customer records between the SSC’s primary flash drive to either an on-site or remote computer system (Refer to Table 16 on page 84 for a listing of CCBR commands supported in LD 143).

Table 16
LD 143 CCBR commands

Command	Description
XBK	Customer database records in the primary flash drive are backed up to an external computer hard-drive.
XRT	Customer database records are restored from an external computer hard drive to the backup flash drive and on the NTDK20 SSC card.
XSL	The Small System is remotely “sysloaded” with customer records stored in the primary flash drive.
XVR	Customer files stored on an external computer are verified for validity and integrity with records in the backup flash drive.

Note: Refer to *Software Input/Output: Administration* (553-3001-311) and *Software Input/Output: Maintenance* (553-3001-511) for a complete listing and description of LD 143 commands.

Data loading

A Small System “SYSLOAD” is a sequence of events whereby the switch loads and verifies system and customer records into the NTDK20 SSC card’s active memory area, or DRAM. The flow of data depends on the status of the software — new installation, software release upgrade, or a user-initiated sysload — or the commands initiated in either LD 143 or the Install Setup Program.

Despite the various ways to initiate a Sysload, the flow of data generally follows the path described below (Refer to Figure 23 on page 86 for a graphical illustration):

1 The Small System searches for customer records in the primary flash drive. If the files are located and verified, data is loaded into the NTDK20 SSC card's DRAM.

2 If the records are corrupt or cannot be found in the primary flash drive, the system searches the backup flash drive. If the customer records are located and verified, the Small System loads the data into DRAM.

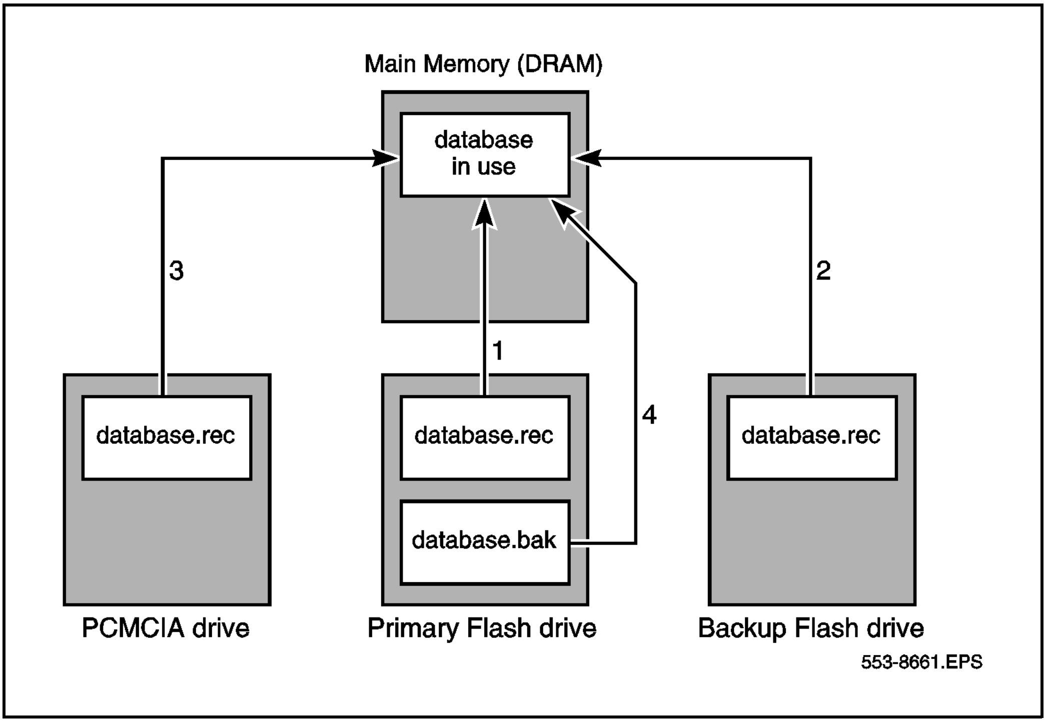
3 If the customer records cannot be located in the backup flash drive, the Small System automatically searches the PC card drive. If customer records are located and verified, data is loaded into DRAM.

4 If the customer records cannot be located in the PC card drive, the Small System searches the primary flash drive for the secondary backup (.bak) file. If the customer records are located and verified, data is loaded into DRAM.

Sysload and a new Small System installation

Software for new Small Systems is delivered on a preprogrammed Software Daughterboard, or loads from a Software Delivery card. Once this hardware is installed and the system is powered up (SYSLOAD), the Install Setup and Loader program (LD 143) is automatically invoked. This program is menu driven and assists in loading the software into the system.

Figure 23
Flow of data during a Small System Sysload



Data restoring

In the unlikely event that configuration data becomes corrupted, a backup copy of the current database can be restored to the Small System. There are four possible areas of where a backup of configuration data can be restored from — the secondary primary database, the backup flash drive, the PC card drive, or an external computer hard drive. (Refer to Table 16 on page 84 for a description of the commands used to restore backup data.)

Table 17
Commands used to restore data to Small Systems

Command	Overlay	Description
SWP (see note)	43	Secondary primary files are "swapped" with the contents of the primary flash drive (Refer to database.bak in Figure 23 on page 86).
RES	43	Restore files to the primary flash drive from the PC card drive.
RIB	43	Restores the missing files in primary flash drive from the internal backup drive.
XRT	143	Customer database records are restored from an external computer hard drive to the primary and backup flash drives on the NTDK20 SSC card.
Note: The SWP command in LD 43 does not "restore" data to the primary flash drive: it swaps or replaces the contents of the primary drive with the data stored in the primary drive's secondary database.		

Preprogrammed data

When a Small System is initially installed, customer data must be entered into the overlay programs. Telephones, for example, must be assigned features on their keys to allow them to function properly.

However, the SSC can be preprogrammed with customer data. If you load preprogrammed data into the system during installation, some overlay entries will be automatically configured on the telephones. For example, you can choose a telephone model that has predetermined feature and key assignments and a preassigned class of service. This can be a significant time-saver if you have to program numerous types of telephone models.

Preprogrammed data is not mandatory for software installation. In fact, the NTDK20 can be programmed with the minimum number of files to allow the Small System to operate.

During start-up, the Software Installation Program is automatically invoked. The Small System loads system data from the NTDK20 SSC card and prompts the user for a variety of information, including the time and date, type of installation, feature set required, and type of database. At this point, if the user selects any response other than "Default database," preprogrammed data will not be loaded on the system.

Preprogrammed data cannot be removed from the Small System once it is loaded into the system. However, preprogrammed data can be bypassed during first-time system installations.

> ***Note:*** The preprogrammed data on the system can provide an effective starting point for programming telephone and trunk information. Before bypassing the option of loading preprogrammed data, take the time to determine whether the default data can be used at this site.

For information on upgrading to Succession 1000M, refer to *Small System: Upgrade Procedures* (553-3011-258).

Components of preprogrammed data

The following items are preprogrammed in the Default database on the NTTK13 Software Daughterboard:

- Model telephones
- Trunk route data and model trunks
- Numbering plan

- SDI ports
- Tone and digit switch

Model telephones

A model telephone can be thought of as a default set of features and Class of Service (CoS) assigned to a telephone.

Telephone models simplify telephone installation. During telephone activation, the telephone prompts you to accept a default model. If a model is chosen, all keys are automatically assigned a feature and no further key programming is required. (The extension number is also predefined using the default numbering plan.)

If you do not want to accept the default model, you can create other models by following the procedures in *Small System: Installation and Configuration* (553-3011-210).

> ***Note:*** Off-Premise Station (OPS) telephones do not have their own telephone models. You can, however, create OPS models by entering DD in response to the CDEN prompt in LD 10.

Trunk route data and model trunks

Preprogrammed trunk routes and trunk models simplify trunk installation procedures. A preprogrammed trunk route supports a certain trunk type, has a default access code, and must be assigned a trunk model. A trunk model supports a certain card type, trunk type, and signaling arrangement.

Trunk models are assigned to default trunk routes using the administration telephone. You can create other models by following the procedures in *Small System: Installation and Configuration* (553-3011-210).

Numbering plan

The preprogrammed numbering plan automatically assigns default extension numbers to the following (this list may not be representative of all countries):

- Local extension numbers

- Attendant extension
- Night number
- ACD queues
- Meridian Mail and Call Pilot extensions
- Call park extensions

If the default numbering plan does not suit this system's needs, you can change it using the procedures in *Small System: Installation and Configuration* (553-3011-210).

SDI ports

There are three preprogrammed SDI ports on Small Systems. The NTDK20 SSC card provides TTY ports 0, 1, and 2. All three SDI interfaces can be used as either modem or maintenance ports for TTY terminals.

Tone services

The SSC card provides 30 channels of tone and cadence transmission to the system.

The SSC card also provides tone detection. Units 0-7 can be configured to support DTR/XTD. Units 8-15 can also be configured to support DTR/XTD.

Optionally, units 8-11 can be configured to support other tone detection functions in lieu of DTR/XTD on units 8-15. These other tone functions include one of MFC/MFE/MFK5/MFK6/MFR.

LD 56 contains default tables used for tone and cadence generation.

Table 18
LD 56 tone and cadence data

Preconfigured TDS/DTR data	
TDS loop	Channels 1-30
DTR or XTD	Card 0, units 0-7

Benefits of preprogrammed data

The main benefit of preprogrammed data is that it simplifies installation and activation procedures. Table 19 compares how a task would be performed using preprogrammed data and how it would be performed without preprogrammed data.

Table 19
Benefits of pre-programmed data

Task	Task performed using preprogrammed data	Task performed without using preprogrammed data
Activating telephones	Plug telephone into socket, lift handset, choose model, choose extension	Enter LD 10 or 11, enter telephone type, specify TN, assign class of service, assign a feature to each key on telephone LD 10 has approximately 120 prompts LD 11 has approximately 160 prompts
Activating trunks	Use the administration menu to add a trunk: • enter a route access code • enter a TN • enter a trunk model	Enter LD 16, enter trunk type, access code, signaling arrangements Enter LD 14, enter TN, route member number, signaling arrangements, Class of Service, and so on LD 16 has approximately 200 prompts LD 14 has approximately 50 prompts
Establishing a numbering plan	No effort required. Default extension numbers become active when telephones are activated. Default plan is sequential.	A numbering plan must be developed to map TNs to DNs.

Software Installation program and preprogrammed data

The Software Installation program is automatically invoked when the new Small System is started up (SYSLOAD). After successfully responding to various prompts in the program, you are given the option of selecting a database to be loaded.

Detailed information about the Software Installation program can be found in *Small System: Installation and Configuration* (553-3011-210) used for first-time installations or the *Small System: Upgrade Procedures* (553-3011-258) used for upgrades from an Option 11 or 11E to a Small System.

Removing preprogrammed data

Preprogrammed data cannot be removed from the Small System once it is loaded into the system. However, preprogrammed data can be bypassed during first-time system installations.

During start-up, the Software Installation Program is automatically invoked. The Small System loads data from the Software Daughterboard and prompts the user for a variety of information, including the time and date, type of installation, feature set required, and type of database. At this point, if the user selects any response other than "Default database," preprogrammed data will not be loaded on the system.

> ***Note:*** The preprogrammed data on the Small System can provide an effective starting point for programming telephone and trunk information. Before bypassing the option of loading preprogrammed data, take the time to determine whether the default data can be used at this site.

Customer Configuration Backup and Restore

The Customer Configuration Backup and Restore (CCBR) feature provides the ability to store the configuration database of the Small System on an external hard drive of an IBM-type PC or Macintosh-type computer.

The CCBR feature can be invoked on-site with the use of a modem eliminator, or remotely over a modem connection.

Operations performed

The CCBR feature performs two different functions of safeguarding customer programmed data. The first involves storing the configuration database in the unlikely event of a system failure — such as a continuous SYSLOAD or INI — or data corruption. To correct this problem, the backup copy of the configuration database can be restored to the Small System.

The second function of the CCBR feature has to do with the role it plays in software upgrades. To illustrate, if the CCBR feature is invoked in LD 43 of an Option 11C Mini, its configuration data can be backed up on a hard drive of an external computer. When the new Meridian 1 Option 11C Chassis hardware is fully installed, and the PC card is inserted in the SSC card, the backup copy of the configuration data — stored on the computer — can be transferred back to the upgraded Chassis system as part of the software upgrade process.

> ***Note:*** Whenever the CCBR feature is used, configuration data is always backed up to the primary flash drive. Prior to invoking the CCBR command, a datadump should be performed to ensure the primary database is current.

File transfer time

Depending on the number of records in the configuration database, it can take over 30 minutes to backup or restore data at a rate of 1200 bps. CCBR access time can be significantly decreased using a 19200 baud modem; 19200 baud is the maximum data transfer rate supported by the Small System.

Equipment requirements

Communications software

Communications software compatible with XModem CRC protocol is required to operate the CCBR feature. This requirement applies to on-site and remote access.

On-site access

On-site access to the Small System can be made by directly connecting a computer to SDI port 0, 1, or 2.

> ***Note:*** You will need to connect a modem eliminator between the SDI cable and the computer cable for on-site computer access.

Remote access

Remote access to the Small System is established by connecting SDI port 0, 1, or 2 on the SSC card to an analog line (Central Office line) through an on-site modem. This will allow the computer to dial directly into the system from a remote location.

Detailed information about the CCBR feature can be found in *Small System: Maintenance* (553-3011-500).

Real time CPU capacity

Table 20
Small System Controller CPU capacity

Release	SSC (No IP Expansion Cabinet) (Equivalent Basic Call per hour)	SSC (Using IP Expansion Cabinet) (Equivalent Basic Calls per Hour)
25.40	42000	n/a
CSE 2.0	n/a	35000
Succession 3.0	42000	35000

Small System memory requirements are calculated using the following tables:

- Table 25 on page 97 - Unprotected data store requirements
- Table 34 on page 113 - Protected data store requirements

Record the memory requirements on “Worksheet D: Unprotected memory calculations” on page 214 and “Worksheet E: Protected memory calculations” on page 215.

Network Delay

There is some impact on real-time performance (estimated to be 20%) when digital trunks are installed in IP expansion cabinets or chassis. However, there is still sufficient real-time to support five fully configured cabinets in a typical business configuration.

Table 21
Basic LAN requirements for Excellent Voice Quality

LAN requirement	Value for Excellent Voice Quality
Packet loss rate	<0.5%
PDV jitter buffer (maximum)	RTD<5 ms
Round trip Delay	<5 ms
PDV jitter buffer (minimum)	RTD<12 ms
100BaseT/F Layer 2/Layer 3 switch	Full Duplex connection

Memory size

The Small System has a separate Flash EPROM memory for program store and DRAM for Data store. Flash EPROM and the primary flash drive (“C” drive) reside on the same flash daughterboard.

Memory options

Table 22
Maximum supported memory configuration for SSC

Flash daughter card	DRAM
48 MB (32 MB program store, 16 MB primary flash drive)	16 MB

The SSC has 1 SIMM slot for DRAM.

Memory requirements

Table 23
Succession 3.0 memory requirements for the SSC

Flash daughterboard	DRAM
48 MB	16 MB

Memory considerations

Table 24
Recommended Call register count

Call register count	Memory required (SL-1 words)	Memory required
800	180 000	0.69 MB

Call registers are 225 SL-1 words long. One SL-1 word is 4 bytes.

> *Note:* Sites experiencing memory shortages during an upgrade should check that the call register counts are within the bounds displayed in this table.

Data store requirements

Unprotected data requirements

Table 25 lists the unprotected data store requirements per item in words.

Table 25
Unprotected data store requirements (Part 1 of 3)

Data Store by Feature	Fixed Number of 1k Words per Item	Calculated number of Words Per Item
Fixed Address Globals	27948	-
Analog (500/2500-type) telephones	43.5	-
Add-on K/L Strips	15	-
Data Service/VMS Access TNs	-	"Note 7" on page 107
Analog Trunks	-	"Note 13" on page 111
BRI Trunks	148	-
DTI	109	-
JDM/DTI2	97	-
ISDN PRI/PRI2/ISL	-	"Note 9" on page 108
Attendant	142	-
Customers	243	-
Console Presentation Group (CPG) Data Block	29, 35	#Customer, #CPG
Trunk Routes	230	-
Network-Location Code	69	-
Tone and Digit Switch	59	-
Conference	191	-

Table 25
Unprotected data store requirements (Part 2 of 3)

Data Store by Feature	Fixed Number of 1k Words per Item	Calculated number of Words Per Item
Digitone Receivers	12	-
MFR - MF Receiver	-	"Note 14" on page 111
Tone Detect	12	-
Low Priority Input Buffers (LPIB) (from note 4)	4	"Note 8" on page 107
High Priority Input Buffers (HPIB) (from note 4)	4	"Note 8" on page 107
AML (CSL)	-	"Note 15" on page 112
MSDL	1395	-
Automatic Call Distribution (ACD)	-	"Note 2" on page 100
ACD Enhancement	-	"Note 2" on page 100
ESN Communication Management Center (CMAC)	350	-
NARS/BARS/CDP	-	"Note 3" on page 102
BGD Terminal Time	13	-
BGD/AWU Traffic Block	100	-
Call Register	225	"Note 4" on page 103
Call Park	-	"Note 5" on page 105
Integrated Message System Link (IMS)	16	-
Auxiliary Processor Link (APL)	179	-
Automatic Trunk Maintenance (ATM) Schedule Block	-	No impact

Table 25
Unprotected data store requirements (Part 3 of 3)

Data Store by Feature	Fixed Number of 1k Words per Item	Calculated number of Words Per Item
Digital Telephones	-	"Note 6" on page 106
Multi-Tenant	36	-
Background Terminal	96	-
Display Messages	16	-
ISDN Basic Rate Interface (BRI)		"Note 12" on page 110
ISDN Primary Rate Access (PRA)	81	-
ISDN Signaling Link (ISL)	81	-
Enhanced Busy Lamp Field (EBLF)	-	"Note 10" on page 109
Enhanced Night Service	1	-
Flexible Feature Codes (FFC)	3	-
Group Hunt	17	-
Model Telephones	-	"Note 11" on page 109
Model Trunks	-	"Note 11" on page 109
IP Expansion cabinets	-	"Note 16" on page 112
TTY	-	"Note 1" on page 100

Notes for Table 25

The following notes are referred to in Table 25 on page 97.

Note 1

The size of a TTY block (in words) is calculated from:

t + x,

where: t = 2085 and

x is defined in Table 26:

Table 26
Reference table for Note 1

Input Buff Data	Output Q
CDR Link	128
HS Link	128 + 15
APL Link	128 + 179 + 4
PMS Link	128 + 2
Other	512

Note 2

For ACD features, the following additional storage per system is required:

K0 * [(K1 * CROUT) + (K2 * CPID) + (K3 * CDN) + CTM + (K4 + CRT) + (K5 * CCUST)] + (K6 * DN1) + (K7 * PID) + (K8 * DN2)

Where: the multiplication constants (Ki) are:

K0 = 0 if ACD-C package is not equipped

K0 = 1 if ACD-C package is equipped

K1 = 46

K2 = 14 if long report is selected

K2 = 42 if short report is selected

K3 = 80

K4 = 34

K5 = 240

K6 = 149

K7 = 32

+ 2 for DN Expansion

+ 1 for ACD ACNT CODE

+ 1 for 500/2500 ACD set feature

+ 1 for MQA feature

K8 = 0 if priority agent package (PAGT) is not equipped

K8 = 49 for Cabinet system with PAGT

And the variables represent the following:

CCUST = total number of customers with ACD-C package

CDN = total number of ACD DNs for ACD-C customers

CPID = total number of AGENT POSITIONs for ACD-C customers

CROUT = total number of ACD routes in ACD-C customers

CTM = total number of TRUNK members in CROUT

DN1 = total number of ACD DNs and CDNs (for system)

DN2 = total number of ACD DNs (for the system)

PID = total number of AGENT POSITIONs (for the system)

CRT = total number of ACD CRTs

Note 3

If the NTRF package is equipped, the unprotected data store requirements (on a per customer basis) for NARS/BARS/CDP are as follows:

COS = TRAFSIZE + RLSIZE + NCOSIZE + QROUTSIZE

where:

Table 27
Reference table for Note 3

	If OHQ or MCBQ is equipped	If OHQ and MCBQ not equipped
TRAFSIZE	216	200
RLSIZE =	2 * (45 * RL)	2 * (40 * RL)
NCOSIZE =	2 * (12 * NCOS)	2 * (6 * NCOS)
QROUTSIZE =	2 * (12 * QROUT)	0

QROUT = number of routes with either CBQ or OHQ

RL = number of route lists

NCOS = number of NCOS defined

Note 4

The total number of Call Registers may not exceed 1850. See Table 24 on page 96 for factory defaults on a new small system.

The recommended number of Call Registers is:

(T + 815)/33.8 + M + X + Y

where:

T = (A/2 * C * 1.42) - (M * L)

A = the total voice loop traffic in CCS

C = the call register factor
= 1
+ 0.037 if CDR Charge Account
+ 0.150 if NARS/BARS/CDP
+ 0.150 of FCBQ and OHQ
+ 0.033 if ACD RAN
+ 0.019 if Telset Messaging
+ 0.140 if Integrated Messaging System
+ 0.083 if Ring Again
+ 0.033 if Music Trunk
+ 0.067 if Call Park
+ 0.003 if New Flexible Code Restriction
+ 0.039 if ESN signalling
+ 0.000 if Stored Number Re-dial (negligible impact)

L = average CCS per ACD trunk

M = the number of ACD incoming trunks

X = 0 if no Network ACD (NACD)
= the number of ACD calls which overflow out of Source ACD DNs

on this node
=(# Source ACD DNs) * (average overflow from Source ACD DNs)

Y = 0 if no Network ACD (NACD)
= the number of ACD calls which overflow into Target ACD DNs in this node
= (# Target ACD DNs) * (average overflow into Target ACD DNs)

The averages for NACD overflow must be estimated, and should be engineered for peak periods.

Assumptions for Call Register Factors:

- The peak day traffic = 1.42 x ABSBH for business offices.
- All outgoing calls require authorization (worse case assumption).
- An additional call register is required for 20 seconds to hold the authorization code.
- 50% percent of outgoing calls use the charge account feature (worse case assumption).
- An additional call register is required for 20 seconds to hold the charge account.
- The additional holding time of the call register for CDR purposes is 5 seconds.
- The average number of ports used in the multiple CDR ports feature is 2.
- A call register is required for each incoming ACD trunk.
- The intra-office ratio R = 0 (worse case assumption).
- The number of originating calls equals the number of terminating calls.
- The blocking peak of the day traffic is P0.01.
- The average NARS/BARS call takes 20 seconds to dial and 20 seconds to complete outpulsing and delay for answer.
- The average holding time of a RAN is 15 seconds.
- The average Telset Message takes 6 seconds to dial and 20 seconds to complete outpulsing and delay for answer.

- The average IMS call takes 8 seconds to dial, 15 seconds ringing and 40 seconds with message attendant. During the busy hour, 60 percent of terminating calls are unanswered, of which 50 percent require IMS.
- A call register is required for active Ring Again call.
- Music Trunk holding time is 30 seconds.
- Average Call Park holding time is 1 minute.
- Average holding time for New Flexible Code Restriction is 4 seconds.
- ESN Signaling Feature holding time is 15 seconds and 25 percent of calls need the signaling feature.

Note 5

Size per item for Call Park:

k + ceiling (s/16)

where:

s = number of System Park DN's per customer.

k = 6

Note 6

Unprotected data store (size in words) for digital telephone ports:

Table 28
Reference table for Note 6

	Voice or Data Ports without Digit Display	Voice or Data Ports with Digit Display
M2006	68	70
M2008	68	70
M2009	71	73
M2016	75	77
M2018	92	94
M2112	73	75
M2216	75 + 24 * #AOM	77 + 24 *#AOM
M2317	90.25	92.25
M2616	75 + 24 * #AOM	77 + 24 * #AOM
M3000	100.25	102.25
M3900	85 + 24 * #AOM	87 + 24 * #AOM
i2004	75	77
i2050	75	77

#AOM = Number of Add-on Modules

Note 7

The additional unprotected data store for a virtual terminal (DS access TN, or VMS access TN) is dependent on the card to which the terminal is assigned. The increment in words are as follows.

Table 29
Reference table for Note 7

	Preallocated card	Otherwise
DS/VMS Access TN:	15	16.25

Where: a preallocated card is one of the following: 0/1-0/7, 1/1-1/8, 2/1-2/8 or 3/8 on a Digital Line Interface (DLI) loop. See Note 9 on page 108.

Note 8

The size of Input/Output buffers is specified in “messages”. Each message uses four words of unprotected data store. The factory default size for I/O buffers is:

LPIB (Low Priority Input Buffers) = 450 messages

HPIB (High Priority Input Buffers) = 450 messages

500B = n/a

SL-1B = n/a

NCR = 800

MGCR = 25

CSQI = 200

CSQO = 200

Prompt Switch AML

T1 = 4

T2 = 10

T3 = 5

N1 = 128

N2 = 8

K = 7

Prompt Switch VAS

SECU = yes

INTL = 1

MCNT = 300

Note 9

The DCHI supports both 1.5 Mb PRI and 2.0 Mb PRI.
Each DCHI consists of the following unprotected data blocks.

Table 30
Reference table A for Note 9

DCH_U_BLOCK	107 words
DCH Aux block	107 words
Output Request Buffers	40
Output Buffer	266 words
Input Buffer	261 words
Unprotected call reference table	2 + M
Unprotected message link table	1 + M

M is computed for each DCHI, depending on Mode, as follows.

Table 31
Reference table B for Note 9

PRA Mode	M =	If PRI is defined: **M = NChan * (nn + 1)** If PRI is NOT defined: **M = NChan * [1 (for primary channel) + 1 (if backup channel is on)]** where: nn = Highest Loop Interface ID (defined in LD 17 by PRI lll nn), and NChan = 24 for PRI and 31 for PRI2.
ISL Mode	M =	maximum number of ISL trunks defined
Shared Mode	M =	the sum of the values for PRA and ISL mode

2Mb PRI only: unprotected data block = 91 words.

Note 10

If Enhanced Busy Lamp Fields (EBLF) is on (LD 15), there is a bit required to indicate the busy or idle status of each DN. This amounts to 7 words per hundred groups defined.

Note 11

Model telephones and trunks require card block components only.

Model trunks — average 5 words
Model telephones — average 2 words

Note 12

The following tables show unprotected memory requirements for ISDN Basic Rate Interface.

Table 32
ISDN BRI

Function	Memory Requirements
MISP	298 words per system
MISP	2271 words per MISP
DSL	264 words per DSL
BRSC	144 words per BRSC
Line	5 words per line card

Note 13

The size of the trunk block is calculated from:

CT + x + y + z (words)

where:

CT = 10 words

x = (see the following table) --> line block

y = 9 CDR extension

z = 0 if the trunk belongs to a route which does not have the Timed Forced Disconnect option, or

z = 7 if the trunk belongs to a route which has the Timed Forced Disconnect option

Table 33
Reference table for Note 13

Trunk Type	Memory Requirements
RLA	20 words
ADM	136 words
IDA (DPN and DASS)	114 words
Autovon	128 words
OTHERS (including ISA)	125 words

Note 14

Memory requirement are calculated for MFR from:

7 * (# MFR Cards) + 4 * (# MFR Units)

Note 15

Memory requirements are calculated for AML from:

147 + (510 * # AML Links)

Note 16

To support IP expansion in IP expansion cabinets or chassis, an additional 2.0 Mb of memory is required on the main cabinet or chassis and each survivable IP expansion cabinet or chassis.

An additional 0.5 Mb (only) is required on any non-survivable IP expansion cabinets or chassis.

Memory requirements are calculated as follows:

Total memory = 2K + (5.25K + Number of Maintenance Connections) + (16K + Number of I/O Connections)

Protected data requirements

Table 34
Protected data store requirements (Part 1 of 4)

Data Store by Feature	Fixed Number of Words per Item	Calculated number of Words Per Item
Fixed Address globals	11 019	-
Analog 500/2500-type sets	-	"Note 1" on page 117
Digital and IP sets	-	"Note 46" on page 141
Delta-II M2000 Series	-	"Note 58" on page 150
DS/VMS Access TNs	-	"Note 23" on page 131
Template Head Table	-	"Note 46" on page 145
Templates	-	"Note 46" on page 145
Trunks	54	"Note 19" on page 130
Attendant	-	"Note 2" on page 119
Auxiliary Customer	213	-
Customers	-	"Note 30" on page 134
CPG Level Services	57	-
Trunk Routes	-	"Note 27" on page 133
New Flexible Code Restriction	-	"Note 16" on page 129
Peripheral Signaling	30	-
Digitone Receivers	11	-
Tone Detectors	3	"Note 50" on page 146
DLI/DTI	-	"Note 17" on page 129
DN Translators	-	"Note 3" on page 119
Serial Data Interface	(N x 8)	-

Table 34
Protected data store requirements (Part 2 of 4)

Data Store by Feature	Fixed Number of Words per Item	Calculated number of Words Per Item
Application Module Link	(N x 18)	-
Dial Intercom Group (DIG) Translator	-	“Note 4” on page 121
Speed Call Master Head	-	“Note 31” on page 135
Speed Call Head Table	-	“Note 14” on page 128
Speed Call List	-	“Note 5” on page 121
Configuration	84	-
Configuration - Aux.	112	-
Basic Automatic Route Selection (BARS)	-	“Note 6” on page 121
Flexible Tones and Cadences (FTC)	-	“Note 35” on page 136
Enhanced FTC (EFTC)	-	“Note 35” on page 136
Network Automatic Route Selection (NARS)	-	“Note 7” on page 123
Coordinated Dialing Plan (CDP)	-	“Note 8” on page 124 and “Note 47” on page 145
Automatic Call Distribution (ACD)	-	“Note 9” on page 125
Network ACD (NACD)	-	“Note 36” on page 136
Group Do Not Disturb (DND)	-	“Note 10” on page 126
Direct Inward System Access (DISA)	-	“Note 11” on page 126
Authority Code	-	“Note 12” on page 127
CAS - Main	0	
CAS - Remote	15	-

Table 34
Protected data store requirements (Part 3 of 4)

Data Store by Feature	Fixed Number of Words per Item	Calculated number of Words Per Item
History File	-	"Note 13" on page 127
Logical I/O	-	"Note 53" on page 147
Physical I/O	-	"Note 54" on page 147
Integrated Message System Link (IMS)	350	"Note 15" on page 128
Code Screening	-	"Note 18" on page 130
Multi-tenant		"Note 21" on page 130
ATM Schedule Block	-	"Note 22" on page 131
Enhanced Serial Data Interface (ESDI)	16 + N * 9 (N = # of ports)	-
Command Status Link (CSL)	4	-
Value Added Server (VAS)	32 + N (N = # of servers)	-
VAS DSDNs	-	"Note 24" on page 131
Automatic Modem Pools (AMP)	1 + highest modem pool #	-
Call Party Name Display (CPND)	-	"Note 25" on page 131
Line Load Control (LLC)	5	-
ISDN BRI	-	"Note 44" on page 139
ISDN PRA / PRI2	-	"Note 26" on page 133 and "Note 51" on page 146
JDMI / DTI	-	"Note 52" on page 147
Automatic Wakeup (AWU) Count	288	-
ISDN Signaling Link (ISL)	-	"Note 30" on page 134

Table 34
Protected data store requirements (Part 4 of 4)

Data Store by Feature	Fixed Number of Words per Item	Calculated number of Words Per Item
Enhanced Busy Lamp Field (EBLF)	-	“Note 33” on page 135
BGD Automatic Timed Job	-	“Note 48” on page 146
Pretranslation	-	“Note 32” on page 135
LAPW	-	“Note 55” on page 148
Name Display for DMS	-	“Note 56” on page 148
FGD ANI Database	-	“Note 57” on page 149
Trunk Barring	-	“Note 37” on page 136
Periodic Pulse Metering (PPM)	-	“Note 38” on page 137
Flexible Feature Code (FFC)	-	“Note 39” on page 137
Network Attendant Console Service	-	“Note 40” on page 137
Group Hunt	10	-
ABCD	-	“Note 41” on page 138
Model Telephones	-	“Note 42” on page 138
Model Trunks	-	“Note 43” on page 139

Notes for Table 34

The following notes are referred to in Table 34 on page 113.

Note 1

The size of the protected line block for analog (500/2500-type) telephones is determined from the following:

Basic Line Block = 24 words

Basic Line Block (ODAS) = 13 words

Card Block component = 2 words (1/4 pcard block)

The key layout portion of the template requires (4 + nf)/rs where: “nf” is the number of features defined for the set, and “rs” is the number of sets sharing the same template. The template area can be 4 - 487 words.

In addition to the basic line block, each feature requires extra data space as follows (sizes are in SL-1 words).

Table 35
Data space requirements for PBX set features - units are SL-1 words (Part 1 of 2)

Feature	Size
ACD	17
Associate Set (AST)	2
Authcode	6-24
Automatic Wakeup	8
Call Forward Number	1-8
Call Park	2
Call Party Name Display	1
CFCT	2
CFNA/Hunting Number	4

Table 35
Data space requirements for PBX set features - units are SL-1 words (Part 2 of 2)

Feature	Size
Dial Intercom Group	2
DN	3
EFD DN	4
Enhanced Hot Line DN	2-10
FAXS	17
FFC SCP PASS	2
Hot Line DN	2-10
HUNT	4
Internal Call Forward	19
Last Number Redial	1-8
Manual Line	2
Message Center DN	2
Offhook Interdigit Index	1
Pre-translation Enhancement	1/2 word
SCI / CCOS / RMS	2
Speed Call Controller	1
Speed Call User	1
Stored Number Redial	1-8
System Speed Call User	1
Tenant Number	1

Note 2

The size of the protected line block for attendant telephones is determined from the following:

- Primary Line Block = 207 words
- Secondary Line Block = 6 words
- Card Block Component = 10 words

In addition to the basic line block, each feature requires extra data space as defined in Table 35 on page 117 and Table 38 on page 142.

Note 3

The memory requirements for the Directory Number (DN) Translator are shown in the table below. The memory requirements are formulated as a sum, for which each row in the table describes an additive term; a term consisting of factor * item. Factors and items are represented by constants, variable descriptions and combinations of these. Units are words of protected data store.

Table 36
Directory Number (DN) data space requirements (Part 1 of 2)

Factor	Factor Description	Item	Item Description
2		S	# of different DNs appearing on Meridian 1 proprietary/500/2500 sets
1			# of appearances of DNs within S
12	size (DNXBLOCK)	Sum N's	1+N1+N2+N3+N4+N5+N6: see below
	number of ACD DNs	2	
	number of ACD DNs	2 * AI	size (ACD_ID_DNBLOCK) * # ACD position ids in each ACD DN
	# DISA DNs	2	size (DISA_DNBLOC)
1			number of System Park DN's
1			number of listed DNs

Table 36
Directory Number (DN) data space requirements (Part 2 of 2)

Factor	Factor Description	Item	Item Description
	# defined DNs	2	
1		66	1 + size (ATTN_DNBLOC)
1	If special service prefix defined.	1	
	If special service prefix defined.	3	
1	If RSANI access code defined.	11	size (RSANI_BLK).
1	If CAS hold DN defined.	2	1+size (CAS_HOLD_DNBLOCK)
1	If CAS hold DN defined.	2	1+size (CAS_RLT_DNBLOCK).
	# CDP steering codes defined	3	size (CDP_DATA_BLOCK)
	# Testline DNs	2	size (TSTLINE_DNBLK)
	# ACD DN's defined	3	size (ACD_DNBLOCK)
	# DIG groups defined	2	size (DIG_DATA_BLK)
	# SL1 DNs	2	size (BCS_DNENTRY)

where:

Nn = number of different sequence of the first n digits in the numbering plan (if DN is more than n digits).

Note 4

The equation for calculating the protected memory requirement for dial intercom data is shown in the table below. The memory requirements are formulated as a sum, for which each row in the table describes an additive term consisting of factor * item. Factors and items are represented by constants, variable descriptions, and combinations of these. Units are words of protected data store.

Table 37
Protected memory for dial intercom data

Factor	Factor Description	Item	Item Description
1			1 + configured max # of DIGs (OV 15)
	actual # of DIGs configured	2	
	actual # of DIGs configured	2 * avg	size(DIG_DATA_BLK) * avg # members in each DIG

Note 5

The size of a speed call list is:

((NB - 1) * 256) + (NBR * WE)

where:

NB and **WE** are calculated as described in Note 14 on page 128 under the Speed Call List Head Table, and **NBR** is the remainder of the calculation to determine **NB**, which is:

NB = EL/EB

Note 6

The protected data store requirements for BARS (on a per-customer basis) are:

BASIC_ESN + SUM + RL * (8 + 3 * RLE) + DME * (4 + I/4)
+ FCAS + SDRR * (3 + 2 * SDE) + ITGE

where:

BASIC_ESN = Size(ESN_DATA_BLOCK) + Size(NCTL_DATA_BLOCK)

SUM = (Size(ESN_TRAN_BLOCK) x $\dfrac{[(10 * (\#digits\ (0\text{-}9)) * R) * N] -1}{(10 * R) -1}$

Size(ESN_TRAN_BLOCK) = 21

Size(ESN_DATA_BLOCK) = 131

Size(NCTL_DATA_BLOCK) = 706

n = maximum level of tree (n>0)

R = the rate of digits equipped in each level of the tree (translator)

RL = number of route lists

RLE = average number of route lists entries per route list

DME = number of distinct digit manipulation entries (including the default 0th entry)

I = average number of digits that must be inserted as part of digit manipulation

FCAS = (N + 1) + N(M + 1) + MN[4 + (100P + 15)/16]

where:

N = number of defined FCAS tables

M = average number of NPA codes per table

P = average number of the first digits in 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 * ITEI, where: ITEI is the number of Incoming Trunk Group Exclusion Index

This number is based on the assumption that the NPA/NXX translation tree is half full and distributed evenly. This should represent the typical case. For a more precise calculation, use the NARS formula.

Note 7

The protected data store requirements for NARS (on a per customer basis) are:

BASIC_ESN + SUM1 + SUM2 + SDRR * (3 + 2 * SDE) +
RL * (8 + 3 * RLE) + DME * (4 + I/E) + LOC * 6 + FCAS + SCC + ITGE
+ MDID

where:

BASIC_ESN = Size(ESN_DATA_BLOCK) + Size(NCTL_DATA_BLOCK)

Size(ESN_DATA_BLOCK) = 131

Size(NCTL_DATA_BLOCK) = 706

SUM1 = (SUM of network translator 1)

SUM2 = (SUM of network translator 2)

SUM = $\frac{11 \text{ x } [(10 * R) * n] - 1}{(10 * R) - 1}$

n = maximum level of tree (n > 0)

R = the rate of digits equipped in each level of the tree (translator)

RL = number of route lists

RLE = average number of route lists entries per route list

DME = number of distinct digit manipulation entries (including the default 0th entry)

I = 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 = number of defined FCAS tables

M = average number of NPA codes per table

P = average number of the first digits in 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 * ITEI, where: ITEI is 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). A maximum of 20 ranges of office codes can be defined per locations code. (That is, one office code and 20 ranges, or 20 office codes and one range for each office code.)

Note 8

The protected data store requirements for CDP (on a per customer basis) are:

BASIC_ESN + SC * 3 + RL * (8 + 3 * RLE) + DME * (3 + I/4)

where:

BASIC_ESN = Size(ESN_DATA_BLOCK)
+ Size(NCTL_DATA_BLOCK)

BASIC_ESN = 131 + 706 = 837

SC = number of steering codes

RL = average number of route lists

RLE = average number of route lists entries per route

DME = number of distinct digit manipulation entries

I = average number of digits that must be inserted as part of digit manipulation

CDP steering Codes also occupy SL-1 DN tree spaces. This portion of data store is calculated in DN tree formulas. See "Note 3" on page 119.

Note 9

The ACD feature requires the following additional data store (total for system):

For ACD-C not equipped:

(K3 * DN) + (K4 * PID) + AID + (K5 * CUST)

For ACD-C equipped:

[K1 + (K2 * CCUST)] + (K3 * DN) + (K4 * PID) + AID + (K5 * CUST)

Where: the multiplication constants (Ki) are:

K1 = 33 = Size (P_ACD_I_BLK)

K2 = 8 = Size (P_ACD_SCHED_BLK)

K3 = 93 = Size (P_ACD_BLOCK) (=76) + ptr to blk from ACD_L:IST (=1) + word offset (ACD_POS_TN) (=16)

K4 = 32 = Size (P_ACD_KEY_DATA) (=14) + store for ACD_POS_TN (=1) + 14 for MQA validations (only if MQA pkg)

K5 = 3 = header (ACD_LIST) (=1) + header (ACD_AGENT_ID_TBL) (=2)

And the variables represent:

AID = total number of AGENT IDs (for the system)

CCUST = total number of customers with ACD-C package

CUST = total number of customers with ACD-C/D packages

DN = total number of ACD DNs (for the system)

PID = total number of AGENT POSITIONs (for the system)

Note 10

The protected store requirements for Group DND (on a per customer basis) are:

1 + G * (1 + (2 * M))

where:

G = number of groups

M = number of members in each group (2 words per member)

Note 11

The protected store requirements for DISA (on a customer basis) are:

241 + (DN * 18)

DN is the number of DISA DNs.

Note 12

The protected store requirements for Authorization Code (on a per customer basis) are:

> Size(AUTH_TABLE_BLOCK) + (A * (L/4 * 128)) + 64
> + (B * [Size(AUTH_BLOCK) + (C * Size (RESOLUTION_BLOCK))])

where:

> **Size(AUTH_TABLE_BLOCK)** = 183 words
>
> **Size(AUTH_BLOCK)** = 1018 words
>
> **Size (RESOLUTION_BLOCK)** = 64 words

L = digit length

T = total auth code

A = number of overflow blocks

B = number of auth blocks

C = number of resolution blocks per auth block

For L less than or greater than 7:

A = (T/128) + 1

B = 0

C = 0

For L less in the range of 4 - 7

A = (0.2 * T)/128 + 1

B = (0.8 * T)/1000 + 1

C = 8

Note 13

The History file buffer can be 1 - 64 K per customer option.

Note 14

For System Speed Call List Head Table the requirements are as follows:

k + NB/4 + NB (Round NB/4 up)

where:

K = 3, and includes:
SCLENTRYS_BLK (0.5)
SCHTBLKLNGTH (0.5)
SCLHTWD (1.0)
SCLENTRYS_LST, SCLNUMDIGITS, and SCLWORDS_ENTRY (1.0)

NB = number of blocks = EL/EB (round up any remainder)

EL = entries per list (given)

EB = entries per block, 256/WE (round up remainder)

WE = words per entry, DNS/4 (round up)

DNS = DN size (given)

Note 15

IMS protected memory requirements:

APP_SIZE_TBL = 10

MSG_SIZE_TBL = 20

LTN_TN_TBL = 255

LTN_LINK_TBL = 65

Note 16

If New Flexible Code Restriction (NFCR) is chosen for a customer, the following memory requirements are also needed:

- A 512 word block
- A table that contains the pointers to the NFCR trees. Its length will be defined by the maximum number of trees (defined in the customer data block).
- Four words will be required for each route that has defined FRL codes.
- Storage for customer defined trees. Amount of memory used depends on the size of 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:

- The INIT condition occupies 14 words
- For each digit sequence after the INIT condition:
    - if the digit sequence is greater than 1 digit, then memory required for digit sequence increases by 1
    - if the digit sequence has a count field, then memory required for digit sequence increases by 1
    - if the digit sequence is from a BYPS, then memory required for digit sequence increases by 1

Note 17

DTI/DLI protected data store (in words) is comprised of:

PDD_BLOCK + (N * P_DTI_TSET_BLOCK)
+ ((T + L) * local network data)
+ (L * (P_LOOP_DLI + preallocated card data))

= 52 + (N x 11) + ((T + L) x 70) + (L x (19 + 144))

where:

N = the number of Threshold telephones

T = the number of DTI loops

L = the number of DLI loops

Note 18

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 per location code - 80 words pds)

Note 19

The trunk block size is 54 words with ODAS.

Note 20

Requirements for the voice/data port are the same as an SL-1 basic telephone except the key layout portion of the template requires 10 + (# of non-key features) / (# of telephones sharing the same template).

Note 21

Protected data store required by the Multi-Tenant Service feature includes the following:

- 1415 words per customer that enables Tenant Service
- 42 words per tenant access map
- 42 words per outgoing route access map

Note 22

The protected data store requirements for ATM schedule block are as follows:

= 24 + ((9 * NC + 33) x NH) + 13 * AR

where:

NC = number of customers

NH = number of hours to be scheduled

AR = number of routes schedules to be tested

Note 23

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 a digital set with one exception. For any of the two TN types, the Card Block Component is dependent on the card to which the terminal is assigned. The component is 0 if the TN is on a preallocated card, and 2.5 words otherwise. See "Note 17" on page 129.

Note 24

Protected data store requirements per customer for VAS Data Services (for each customer having at least one DSDN) are:

DSDN_VAS_TBL + (DSDN_LIST * N)

= 16 + (77 * N)

where:

N = the number of VAS having at least one DSDN is defined.

Note 25

Protected data store requirements for CPND per system in words is:

32 + (14 * C) + SP + (DIG_TBL_SIZE * DIG) + ((2 + n/2) * NA) * LANG) + SL

where:

C = number of customers configured with CPND

SP = number of single appearance analog (500/2500-type) DNs with name defined

DIG_TBL_SIZE = 11 for 1 digit DIG groups, 101 for 2 digit DIG groups

DIG = number of DIG groups

LANG = number of Lanuages (up to 2)

n = average name length

NA = number of names

SL = number of non-analog (500/2500-type) DNs (including trunk routes, ACD, ATTN) with or without name defined.

Note 26

Protected memory requirements for ISDN PRA are as follows:

Per system with DCHIs: P_DCH_TBL = 16 words
Per DCHI: P_DCH_BLOCK = 134 words

If	Protected call reference table:
If DCHI is in “PRA” mode	1 + M * (# of PRI or 2Mb PRI loops controlled by DCHI) where: M = 24 for PRI, and 31 for 2Mb PRI
If DCHI is in “ISL” mode	1 + (maximum number of ISL trunks defined)
If DCHI is in “SHARED” mode	1 + (M x # of PRI/2Mb PRI loops controlled by DCHI) + (maximum # of ISL trunks defined) where: M + 24 for PRI and 31 for 2Mb PRI

Note 27

The equation for calculating the protected memory required for trunk routes is:

B + (X * 241)

where:

B = 256

X = number of routes actually defined

For each ISA route configured for any IFC, add 18 words.

Note 28

A pointer has been added to fix memory. The name of the pointer is “ISA_SID_MTHPTR” and is set to nil when SID is not defined for ISDN routes.

A data block of 32 words is defined and accessed through the pointer if SID is defined for at least one ISDN route in the system. This data block contains the pointer to SID tables for each customer. The structure mapping onto this data block is “ISA_CUSTID_TPTR”.
(size (ISA_CUSTID_TPTR = 100))

A data block of 128 words is allocated to each customer if at least one route is defined as having SID. The structure mapping onto this data block is “ISA_SID_RT_LIST”. The size of this data block is 512.

Note 29

Protected ISL trunk TN table = 1 + maximum number of ISL trunks defined.

Note 30

The equation for calculating the protected memory requirements for customer data is:

B + (X * (P + A))

where:

B = 320

X = number of customer groups actually defined

P = protected customer data = 266

A = auxiliary customer data = 213

If a background terminal is equipped, an additional auxiliary data block is allocated which requires 73 words. This brings the total memory requirement to 552 words.

Note 31

If the system is equipped with Speed Call package (66) and MSCL defined by LD 17 as being greater than zero, the protected memory required for the SCL main header table is:

N + A

where:

N = # of header words = 1

A = number of SCL as defined in LD 17 (MSCL), otherwise no protected storage is required

Note 32

For each customer, an additional 256 words is needed for PREXL_SCLN.

Note 33

Additional protected memory is required, depending on the system configuration, and is allocated only if EBLF is turned on.

Words required:

XX * ((ZZ - 3) * YY * 11)

where:

XX = number of customers who will have EBLF

YY = average number of hundreds group per customer

ZZ = average DN length (4, 5, 6, 7)

There are 104 words allocated in the fixed protected memory even if EBLF is not being used.

Note 34

Flexible Tones and Cadences (FTC):

FTC Pointers: 32 words

FTC tables: 202 * (# of FTC tables) (default = 1, others can be allocated using LD 56)

Note 35

Enhanced Flexible Tones and Cadences (EFTC)

MCAD pointers: 256 words

MCAD table: 256 * (# of MCAD tables) (default = 15, others can be allocated using LD 56)

Note 36

Network ACD has resulted in an increase of 7 words to the Protected ACD block (already accounted for in "Note 9" on page 125).

In addition, add 174 words per Source ACD-DN, as shown in the associated target table {0,2}, and 115 words per target ACD-DN.

Note 37

The protected data store for TRUNK BARRING consists of two structures:

TBAR_BLOCK 66 words

RCDT_BLOCK3 + number of access restriction tables (ARTs)

Note 38

The total protected data store increases by the following amount per system:

(12 * BGD) + (5 * CUST) + (3 * ROUTE) + TRUNK

where:

BGD = number of background terminals

CUST = number of customers

ROUTE = number of trunk routes

TRUNK = number of trunks

Note 39

The protected data store for FFC consists of three structures:

Structure name	Increase in number of words
FFC_DNXL_BLOCK	13
FFC_GRHP_BLOCK	2
FFC_ELK_PASS	3

Note 40

NAS has one protected data structure added:

Structure name	Increase in number of words
NAS_SCHED_BLK	32 + (3 x schedule period)

Note 41

The protected data store for ABCD consists of two structures:

Structure name	Increase in number of words
ABCDHT	256
ABCDDATABLOCK	120

Note 42

Model telephones require the same protected memory as the corresponding telephone type.

Note 43

Model trunks require the same protected memory as the corresponding trunk type.

Note 44

The following table shows protected memory storage requirements for ISDN BRI.

Per System:

HT + DATA * G + MT + BT

where:

HT = 16

DATA = 5

G = # of groups

MT = 256

BT = 96

HT = BRI protocol group table

DATA = BRI protocol group data block

BT = system BRSC pointer table

LAPD Protocol:

LAPD protocol, add 15 words

Per MISP:

MLB + MMB + SID + PIO + IO

where:

MLB = 145

MMB = 50

SID = 49

PIO = 5

IO = 259

and:

PIO is Physical IO block

IO is IO table

A typical large system will support about 5 MISPs.

Per DSL (Digital Subscriber Loop):

BB + ODAS + CLS + DD + BD + USID + TB + TF

where:

BB = 26

ODAS = 3

CLS = 12

DD = 17

BD = 40

USID = 16

TB = 15

TF = 16 = Template(features): LTID, EFD, HUNT, EHT @ 4w each

Each MISP can control up to 4 line cards. Each line card can hold up to 8 DSLs.

Per TSP (Terminal Service Profile):

TSP + BRIDN * NDN

where:

TSP = 180

BRIDN = 47

NDN = # BRI DN's

Each DSL can hold up to 16 TSP’s. Each TSP supports 8 physical sets and 20 logical units.

Per BRSC ():

BB

where:

BB = 34

Each MISP can control 8 BRSC cards. Each BRSC can control 15 line cards.

Note 46

The size of the protected line block for SL-1 sets is determined from the following (size in SL-1 words):

Feature	Memory Requirements
Basic Line Block	46
Basic Line Block (ODAS)	24
Card Block Component	2.5

The key layout portion of the template for :

M2006 10 + (# of non-key features) / rs

M2008 10 + (# of non-key features) / rs

M2216 20 + 30 * (#AOM) + (# of non-key features) / rs

M2616 20 + 30 * (#AOM) + (# of non-key features) / rs

M2016 20 + (# of non-key features) / rs

M3900 34 + (# of non-key features) / rs

i2004 20 + (# of non-key features) / rs

i2050 20 + (# of non-key features) / rs

where: rs = the number of sets sharing the same template, and #AOM = the number of add-on modules.

In addition to the basic line block requirement, each feature requires extra data space in the template as follows:

Table 38
Data space requirements for Meridian 1 proprietary set features - units are in SL-1 words (Part 1 of 4)

Feature	Size
ACD Agent and ID Key	17
ACD Display Calls Waiting Key	2
ACD Agent Key (for supervisor_	2
ACD Enable Interflow Key	2
ACD Night Service DN	2
Associate Set (AST)	3
Authcode (non-key)	6-24
Autodial Key	1-8
Busy / Forward Status Key	1
Call Forward Key	1-8
No Hold Conference and Autodial	1-8
No Hold Conference and Direct Hotline	4-12
No Hold Conference and Hotline List	4
No Hold Conference and Speed Call	1
Dial Intercom Group Key	2
DID Route Control	1
Group Call Key	1
Hotline - One Way, Two Way or Intercom	4-12
Hotline - One Way or Two Way List	4
Internal Call Forward Key	1-8

Table 38
Data space requirements for Meridian 1 proprietary set features - units are in SL-1 words (Part 2 of 4)

Feature	Size
Loudspeaker	4
Multiple Call Non-ringing DN	4
Multiple Call Ringing DN	4
Message Registration Key	1
Message Waiting Key	4
Call Park Key	2
Private Line Non-ringing Key	4
Private Line Ringing Key	4
Stored Number Redial Key	2-8
Ringing Number Pickup Key	1
Radio Paging	4
Speed Call Controller Key	1
Single Call Non-ringing Key	4
Single Call Ringing DN	4
Speed Call User Key	1
Signaling Key	4
System Speed Call Controller Key	1
System Speed Call User Key	1
Voice Call Key	4
Non-key Features	
Data Equipment Mode (flex voice / data TN	1
Flexible CFNA DN for External Calls	4

Table 38
Data space requirements for Meridian 1 proprietary set features - units are in SL-1 words (Part 3 of 4)

Feature	Size
Hunt DN for External Calls	4
Flexible Call Forward No Answer	4
Offhook Alarm Security DN Index for Forced Out of Service	1
Hunt DN (chain) for Internal Calls	4
Alternate Hunt DN (chain) for Internal Calls	4
Alternate Hunt DN for External Calls	4
Alternate Flexible CFNA DN for External Calls	4
Number of Key Lamp Strips	1-7
Last Number Redial Size	1-8
Second DN Sharing Voice Mailbox	3
Station Control Password	2
Tenant	1
Template area uses for which commands are implicit or entered outside of LD 11	
Ringing Change Key	5
Notification Key Lamp	1
Hospitality Data	2
Hotel / Motel Info	8
Campon Priorities	1
Sar Group	1
Boss-Secretary Filtering - boss	3

Table 38
Data space requirements for Meridian 1 proprietary set features - units are in SL-1 words (Part 4 of 4)

Feature	Size
Boss-Secretary Filtering - sec'y	1
Call Party Name Display	1
FAXS	17
Xdata Unit Downloadable Parameters	2

Note 46

The following calculation applies to Template memory requirements:

HDT + (# of templates) * (avg. template length)

Where:

HDT = 4097

Note 47

The protected data store requirements for Coordinated Dialing Plan (CDP) (on a per-customer basis) are:

BASIC_ESN + SC * 3 + RL * (8 + 3 * RLE) + DME * (3 + I/4)

where:

BASIC_ESN = SIZE(ESN_DATA_BLOCK) + SIZE(NCTL_DATA_BLOCK)

SIZE(ESN_DATA_BLOCK) = 131

SIZE(NCTL_DATA_BLOCK) = 506

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

CDP Steering Codes also occupy DN tree spaces. This portion of data store is calculated in DN tree formula. (See“Note 2” on page 100).

Note 48

Protected data store for the BGD Automatic Timed Job feature:

= 1 + 13 * ATJE Words

Where:

ATJE = number of Automatic Timed Job Entries ranges from 1 to 12.

Note 49

Protected memory requirements for MFRs:

MFRs will use 7 words per card + 2 words per unit (up to 2 units per card)

Note 50

Protected memory requirements in words for Tone Detectors:

= size (PTDET_BLOCK) = 2 +1 word from TDET_LIST

= 3 * (# TDET's)

Note 51

For each PRI or PRI2 loop configured, add 7 words for the P_PRILP_BLOCK to the PTERM LOOP_BLOCK (= 78)

Note 52

The protected data store requirements for DTI2 is as follows:

DTI2_SYSTEM_DATA = 25 words

DTI2_SCAT_HT = 16 words

DTI2_SCAT = 98 words

DTI2_PDCA_HT = 16 words

DTI2_PDCA = 12 words

Note 53

The logical applications are AML, DCH, and SDI.

logical master head table = 4 words

logical application head table for

SDI = 16 words

AML = 16 words

DCH = 64 words

Total (if all three applications are used) = 100 words

Note 54

Memory requirements for physical I/O table:

I/O polling table = 3 + (# of serial I/O devices) + (# of service loops)

In addition to the above, memory is also allocated for each existing physical card for a service loop or serial I/O device as follows:

Service loops:

TDS = 4 MISP = 5 MSS = 4 XCT = 4PMON = 4

I/O Serial Devices:

ESDI, DCH, SDI, SDI2, SDI3, SDI4 = 7

MSDL = 13

Note 55

Limited Access to Overlays (LAPW)

The number of words required to store protected data for this feature can range from 38 to 5950, as listed below:

Fixed Address Globals (already accounted for in the first table item):

> Protected pointer to the main LAPW data structure = 1 word
>
> "Invalid login threshold" and "lock-out time" = 1 word
>
> System defined passwords (PWD1 and PWD2) = 16 words
>
> Port lock-out information (MAX_NUM_OT_TTYS = 16) = 2 words per TTY
>
> Audit trail (size of configured buffer) = 0 - 1000 words

Dynamically allocated storage per Limited Access Password (LAPW):

> Configured optional data = 1 word
>
> Password = 8 words
>
> Overlay restriction data = 7 words
>
> Customer and Tenant restriction data (1 word per Customer/Tenant) = 0-32 words
>
> Pointer to password blocks = 1 word

= 17 + # of tenants

Note 56

Protected data store for the Name Display DMS feature. Dynamically allocated per terminating number of a DMS number (= 3 words per DMS number).

Note 57

FGD ANI database memory requirements:

guide = ANI = xxx-xxx-xxxx (10 digits) = npa-nxx-sub

Up to 31 different ANI data blocks (tables) per system could be configured in order to provide flexibility of ANI screening. Once an ANI data block (table) is created:

ANI HEAD BLOCK (FGDANI_HEADER) (fixed size):

1 word +

31 words (contains pointers to each of the 31 ANI datablocks)

NPA BLOCK (dynamically allocated by # of NPAs configured):

6 words (TRMT_INFO in NPA_BLK) + (3 words (NPATYPE) * (# NPAs configured for this ANI data block));

up to 160 NPAs can be configured in a NPA block

NXX HEAD BLOCK (Dynamically allocated by # of NXX blocks):

1 word + (3 words (HDBLKTYPE) * (# NXX blocks configured));

Up to 7 NXX blocks can be configured under one NPA block.

NXX BLOCKS (NXX_BLK) (Fixed size 255 words)

SUB HEAD BLOCK (Dynamically allocated by # of SUB blocks):

1 word + (3 words (SUBTYPE) * (# SUB blocks configured));

Up to 118 SUB blocks can be configured under one NXX block.

SUB BLOCKS (SUB_BLK) (Fixed size 256 words)

Note 58

Requirements for voice/data port are the same (see“Note 1” on page 100) except the key layout portion of the template requires 34 + (# of nonkey features) / (# of sets sharing the same template).

Succession Signaling Server

Contents

This section contains information on the following topics:

Introduction

Succession 1000M systems use a Succession Signaling Server. The Succession Signaling Server provides a central processor to drive the signaling for Internet Telephones and IP Peer Networking. The Succession Signaling Server is an industry-standard, PC-based server. It provides signaling interfaces to the IP network using software components that operate on the VxWorks™ real-time operating system.

The Succession Signaling Server can be installed in a load-sharing redundant configuration for higher scalability and reliability.

Elements of Succession Signaling Server

The Succession Signaling Server is comprised of four basic elements:

- Terminal Proxy Server (TPS)
- H.323 Gateway Signaling software
- H.323 Gatekeeper software (optionally redundant)
- Succession1000 Element Manager web server

The TPS, GateKeeper, and Gateway can co-exist on one Succession Signaling Server or reside individually on separate Succession Signaling Servers, depending on traffic and redundancy requirement. Table 39 describes the function and engineering requirements of each element.

Table 39
Elements in Succession Signaling Server (Part 1 of 2)

Element	Function and engineering requirements
Terminal Proxy Server (TPS)	— Handles initial signaling exchanges between an Internet Telephone and the Succession Signaling Server. — Capacity is limited by a software parameter limit of 5000 Internet Telephones. — Hardware processor capacity limit is unknown, but expected to be higher than the software limit. — The redundancy of TPS is under the mode of N+1. Therefore one extra Succession Signaling Server can be provided to cover TPS functions from N other servers.

Table 39
Elements in Succession Signaling Server (Part 2 of 2)

Element	Function and engineering requirements
GateKeeper	— Capacity is limited by the endpoints it serves and the number of entries at each endpoint. — Potential hardware limits are the Succession Signaling Server processing power and memory limits. — Since the Gatekeeper is a network resource, its capacity is a function of the network configuration and network traffic (IP calls). Some basic network information is required to engineer a Gatekeeper. — The redundancy of the Gatekeeper is in a mode of 2 × N. Therefore an alternate Gatekeeper can only serve the Gatekeeper it is duplicating.
Gateway	— The IP Peer H.323 Gateway trunk, or H.323 Trunk, provides the function of a trunk route without a physical presence in the hardware. The H.323 Trunk is limited by a software limitation of 382 virtual trunks per route. Beyond that, a second Succession Signaling Server is required. — Deciding to combine the Terminal Proxy Server, Gatekeeper, and H.323 Trunk is determined by traffic associated with each element, and the required redundancy of each function. The redundancy mode of the Gateway is 2 × N. Two Gateways handling the same route can provide redundancy for each other, but not other routes.
Element Manager	— Has a negligible impact on capacity and can reside with any other element. This section therefore concentrates on the first three software elements of the Succession Signaling Server.

Data

- Sync/Async CP
- Async Modem Pool
- Sync/Async Modem Pool
- Sync/Async Data
- Async Data Lines

RAN

The default value for AHT_{RAN} is 30 seconds.

Music

The default value for AHT_{MUSIC} is 60 seconds.

Resource calculations

Table 40 lists the resource calculations.

Table 40
Resource calculations

Name	Calculation
Non-IP set CCS	Number of digital sets + Number of analog sets = CCS per set
IP set CCS	Number IP sets CCS per IP set
Total line CCS (L_{CCS})	Non-IP set CCS + IP set CCS
Non-IP trunk CCS	Number of analog trunks + Number of digital trunks = CCS per trunk
H.323 Trunk CCS	(Number of Virtual Trunks) CCS per VT
Total system CCS (TCCS)	Total line CCS (L_{CCS}) + Total trunk CCS (T_{TCCS})

Converting CCS to calls:

$$WAHT = R_I * AHT_{SS} + R_T * AHT_{TT} + ([I * AHT_{TS}]+[O * AHT_{ST}])$$

AHT_{SS} is the Average Holding Time of set to set call in seconds. The subscript “ST” on AHT denotes the call initiated from a set and terminates on a trunk, similarly for other combination of calls.

Total Calls (TCALL) = TCCS * 100 ÷ (2 * WAHT)

The system calls are comprised of four different types of traffic: Intraoffice Calls (set-to-set) (C_{SS}), Tandem Calls (trunk-to-trunk) (C_{TT}), Orig/outg (set-to-trunk) Calls (C_{ST}) and Term/incg (trunk-to-set) Calls (C_{TS}). All equations are existing equations, except the ones involving Virtual Trunks which are new.

1 Intraoffice Calls (C_{SS})

$= \text{Total Calls (CALLS)} * \text{Intraoffice Ratio } (R_I)$

This parcel can be further broken down to three types:

— Intraoffice IP-IP Calls
$= C_{SS} * P^2$ (require no DSP, no VT)
$pf1 = C_{SS} * P^2 \div TCALL$, pf1 is the penetration factor for the intraoffice IP-IP calls.

— Intraoffice IP-NonIP Calls
$= C_{SS} * 2 * P * (1 - P)$ (require DSP)
$pf2 = C_{SS} * 2 * P * (1 - P) \div CALLS$, pf2 is the penetration factor for the intraoffice IP to non-IP calls.

— Intraoffice non-IP to non-IP
$= C_{SS} * (1 - P)^2$ (require no DSP, no VT)
$pf3 = C_{SS} * (1 - P)^2 \div CALLS$

2 Tandem Calls (C_{TT})

$= \text{Total Calls} * \text{Tandem Ratio} = CALLS * R_T$

The tandem calls can be further broken down into:

— Tandem VT-NonVT Calls
$= 2 * \text{Tandem VT Calls} * (1 - V)$
$= 2 * C_{TT} * V * (1 - V)$ (require DSP and VT)
$pf4 = 2 * C_{TT} * V * (1 - V) \div CALLS$

— Tandem non-VT – non-VT Calls
$= C_{TT} * (1 - V)^2$ (require no DSP, no VT)
$pf5 = C_{TT} * (1 - V)^2 \div CALLS$

3 Orig/outg Calls (C_{ST})

$= \text{Total Calls} * \text{Outgoing ratio} = TCALL * O$

— IP to VT calls
= C_{ST} * (fraction of IP calls) * (V)
= C_{ST} * P * V (require VT)
pf6 = C_{ST} * P * V ÷ CALLS

— IP to non-VT calls
= C_{ST} * (IP calls) * (1 – V)
= C_{ST} * P * (1 –V) (require DSP)
pf7 = C_{ST} * P * (1 – V) ÷ CALLS

— Non-IP set to VT
= C_{ST} * (1 – fraction of IP calls) * (V)
= C_{ST} * (1 – P) * V (require DSP, VT)
pf8 = Cst * (1 – P) × V ÷ CALLS

— Non-IP set to non-VT (Cstdd)
= C_{ST} * (1 – fraction of IP calls) * (1 – V)
= C_{ST} * (1 – P) * (1 – V) (require no DSP, no VT)
pf9 = C_{ST} * (1 – P) * (1 – V) ÷ CALLS

4 Term/incg (C_{TS})

= Total Calls * Incoming ratio = CALLS * I

— VT to non-IP set
= C_{TS} * (V) * (1 – fraction of IP calls)
= C_{TS} * V * (1 – P) (require DSP, VT)
pf10 = C_{TS} * V * (1 – P) ÷ CALLS

— VT to IP set
= C_{TS} * (V) * (fraction of IP calls)
= C_{TS} * V * P (require VT)
pf11 = C_{TS} * V * P ÷ CALLS

— Non-VT to IP set
= C_{TS} * (1 – V) * (fraction of IP calls)
= C_{TS} * (1 – V) * P (require DSP)
pf12 = C_{TS} * (1 – V) * P ÷ CALLS

— Non-VT to non-IP set
= C_{TS} * (1 – V) * (1 – fraction of IP calls)
= C_{TS} * (1 – V) * (1 – P) (require no DSP, no VT)
pf13 = C_{TS} * (1 – V) * (1 – P) ÷ CALLS

Calculating Succession Call Server load

Real-time capacity (load) of a Succession Call Server depends on the number and type of calls that it handles. The following equation can be used to convert CCS to calls:

Calls = CCS for Succession Media Gateway x 100 ÷ Holding time in seconds

The Succession Call Server load can be calculated using total CCS of different call types from earlier calculations using the following formula:

Total EBC = nIT to IT * (1+f1) + nIT to TIE * (1+f0+f2+f5+f6) + nIT to AT *(1+f3) + NIT *(1+f4) + nIT to VT * (1+ f11)

Where:

- Total EBC = Succession Call Server load
  See “Equivalent Basic Call” on page 159.
- nIT to IT = number of Internet Telephone to Internet Telephone calls
- nIT to TIE = number of tie trunk calls served by ACD agents using Internet Telephones
- nIT to AT = number of Internet Telephone to analog (500/2500-type) telephone calls
- nIT to VT = number of Internet Telephone to Virtual Trunk calls
- NIT = non-Internet Telephone calls
- f0 to f11 = See Table 41 on page 160 for the values f0 to f11.

Equivalent Basic Call

The real-time capacity of a switch can be specified in terms of Equivalent Basic Calls (EBC).

> ***Note 1:*** Real-time capacity: The ability of the Succession Call Server to process instructions resulting from calls that meet service criteria.

> ***Note 2:*** Basic Call: A call without features between two 2500 telephones on the same switch. Any other call is a Feature Call.

When the capacity of a switch is stated in EBC, it is independent of such variables as configuration, feature mix, and usage patterns. Capacity still varies from release to release, and between processors. EBC is a good way to compare the relative call processing capability of different machines running the same software release.

The symbol **fi** is the ratio of a featured call to a basic call excluding the basic call. The **i** in the symbol **fi** can be any of the values 0 to 11, as shown in Table 41 on page 160. The processor capacity is denoted by the EBC at rated capacity. All featured calls in a system are converted into EBC to determine whether the total sum exceeds the designated EBC capacity of a processor. The rated capacity of the Succession Call Server is measured at 35,000 EBC.

The recommended major real-time factors are as shown in Table 41 on page 160.

Table 41
Sample real-time factor

Call Type	Description	Real-Time Factor	Comment
f0	In-bound ACD call	0.13	Added to call center calls
f1	Two-way Internet Telephone to Internet Telephone	1.15	Internet Telephone to Internet Telephone call (no VGMC involved)
f2	One-way Internet Telephone to digital trunk	0.68	Internet Telephone to PRI
f3	One-way Internet Telephone to analog (500/2500-type) telephone or analog trunk	0.48	Internet Telephone to analog (500/2500-type) telephone or trunk
f4	Non-Internet Telephone to digital trunk	0.18	No Internet Telephone involved in the call
f5	In-bound routed to RAN or Music by SCCS	2.06	In-bound call routed to RAN or Music cycle by Symposium
f6	In-bound to IVR then transferred by CallPilot	3.68	Call interacts with IVR then transferred to an agent
f7	In-bound routed to RAN trunk or Music trunk	0.63	Queued incoming call given RAN or Music by RAN trunk
f8	In-bound routed to RAN or Music or IVR by SCCS	5.74	Inbound call routed by SCCS only to RAN or Music or IVR (CallPilot)
f9	CDR for telephone to telephone	0.39	CDR internal call
f10	CDR for telephone to trunk	0.32	CDR external call
f11	Internet Telephone to Virtual Trunk	0.90	Direct connection on a LAN or WAN (no VGMC involved)
Note: Only incoming calls are treated by SCCS.			

Real-time factors

Real-time factors for basic call types are mutually exclusive (for example, f1, f2, and f3). The real-time factor is calculated from the following formula:

fi = (real-time of a featured call in milliseconds - real-time of a basic call in milliseconds) ÷ real-time of a basic call in milliseconds

Real-time factors for applications are additive (for example, f0+f2+f5, f3+f6, f0+f4+f5+f6, and so on). Real-time factors for features with similar functions (for example, RAN and IVR) are usually mutually exclusive. For a complete list of features and real-time factors, see *Large System: Planning and Engineering* (553-3021-120).

EBC rating for Succession Call Server

The rated capacity for a Succession Call Server is 35,000 EBC.

Call Server utilization = [number of call type 1 * (1+f0+f1+...+f11) + number of call type 2 * (1+f0+f1+...+f11) +...] ÷ 32,000

Note: The 1 preceding f0 represents the basic call. A complete feature call is a basic call plus the sum of applicable real-time factors.

Calls from a telephone that terminate on many different terminals make calculating CCS difficult. For example, Internet Telephone calls terminate on other Internet Telephones, on analog (500/2500-type) telephones, on T1 trunks, on analog trunks.

To calculate differences in terminations accurately, other parameters are needed, such as intra-office ratio, inter-office ratio, tandem call ratio, incoming/outgoing breakdown. Accounting for the above parameters make the real-time calculations difficult to complete. A simpler way to calculate CCS with reasonable accuracy is to divide all traffic by two. This is somewhat accurate because CCS on a telephone/trunk is half incoming and half outgoing.

Note: Every connection involves two terminals but appears on the processor as one call. For example, 6 CCS for each Internet Telephone means 2.5 originating calls and 2.5 terminating calls ($= 6 \times 100 \div 120 \div 2$). It can also represent five originating calls per telephone, and no terminating call. The important point is not to double count traffic during the conversion of CCS to calls.

Calculating TLAN bandwidth for IP voice traffic

Use the following formula to calculate the bandwidth requirement for voice traffic on the TLAN:

Bandwidth in Bit/s = Erlangs on TLAN * 95 kbit/s

For calculating traffic on the TLAN, refer to *Succession 1000 System: Planning and Engineering* (553-3031-120).

The calculated data rate is the incremental data bandwidth a TLAN has to reserve for the IP traffic to prevent QoS of VoIP traffic from deteriorating. The most conservative bit rate requirement is used here, which corresponds to using G.711 codec (64 kbit/s per channel) with a typical payload (20 ms). The following table shows the bandwidth required for one Erlang using a G.711 codec or G.729A codec.

Table 42
TLAN bandwidth for one channel (one Erlang)

Codec	Payload	TLAN
G.711	10 ms	126 kbit/s
G.711	20 ms	95 kbit/s
G.711	30 ms	85 kbit/s
G.729A	10 ms	70 kbit/s
G.729A	20 ms	39 kbit/s
G.729A	30 ms	29 kbit/s

WAN engineering

Specific network architecture details are required to properly engineer a Wide Area Network. For details on data networking, see *Data Networking for Voice over IP* (553-3001-160).

The Succession 1000 system can serve as a Branch Office to feed traffic over a data network to a Main Office for advanced services. The link between two offices can be a data network or traditional PSTN routes, such as PRI or TIE trunks. The data network can be LAN or WAN which is discussed here.

A Succession Call Server can route packets from Internet Telephones to a remote Main Office directly over a data network. The packet route is known as a Virtual Trunk. The Virtual Trunk traffic is an extension of the originating TLAN traffic. Virtual Trunk traffic routes to the destination node through LAN or WAN without transcoding. The Virtual Trunk requirement is calculated based on the same procedure and table used for regular trunk or PRI trunk. Data from Table 43 can be used to calculate incremental WAN bandwidth requirement to carry a one Erlang voice channel from a voice network.

Table 43
WAN bandwidth for one channel (one Erlang)

Codec	Payload	WAN
G.711	10 ms	48 kbit/s
G.711	20 ms	40 kbit/s
G.711	30 ms	37 kbit/s
G.729A	10 ms	20 kbit/s
G.729A	20 ms	12 kbit/s
G.729A	30 ms	9 kbit/s

For assumption details, refer to *IP Line: Description, Installation, and Operation* (553-3001-365).

Incremental WAN bandwidth = inter-office traffic in Erlangs x WAN kbit/s.

> ***Note:*** Using Table 43, determine WAN kbits/s based on the selected codec and payload.

Basic assumptions are that Internet Telephones generate data packets to Succession 1000 system through the TLAN. If the traffic is network traffic, that traffic can route through traditional PRI trunks or Virtual Trunks.

T1 trunks generate traffic to the VGMC and PRI, but no traffic to the WAN route. Virtual Trunks do not use a VGMC channel or PRI, but create packet data to the WAN route. If Virtual Trunk traffic uses the same TLAN to reach a router, add the traffic to the TLAN calculation. For mixed PRI and Virtual Trunk traffic, calculate for both. TLAN and WAN bandwidth requirements are incremental, since existing data network can be unknown.

Measure an existing data network to determine whether it has enough spare bandwidth to carry the additional data packets generated by the Internet Telephone voice traffic.

Succession 1000M capacities

Table 44 contains a summary of Succession 1000M capacities.

Table 44
Succession 1000M capacities summary

Call server	Platform name	Pure TDM	IP access to PSTN	Pure IP no access to PSTN	Mixed	Max VTNs
SSC	Succession 1000M Chassis	128	1000	1000	112 TDM 300 IP	1248
SSC	Succession 1000	480	1000	1000	400 TDM 700 IP	1248
SSC	Succession 1000M Chassis	720	1000	1000	640 TDM 800 IP	1248
SSC	Succession 1000M Cabinet	720	1000	1000	600 TDM 1000 IP	1248

Provisioning

Contents

This section contains information on the following topics:

Introduction

This chapter outlines the procedures required to determine equipment requirements.

Provisioning a new system

The following summarizes the tasks required to provision a new system:

1. Define and forecast growth (page 167).
2. Estimate CCS per terminal (page 169).
3. Calculate number of trunks required (page 173).
4. Calculate line, trunk, and console load (page 174).
5. Calculate DTR requirements (page 175).
6. Calculate total system load (page 178).
7. Calculate number of loops required (page 178).
8. Calculate number of IPE cards required (page 179).
9. Provision Conference/TDS loops (page 185).
10. Calculate memory requirements (page 186).
11. Assign equipment and prepare equipment summary (page 187).
12. Calculate battery backup time (page 187).

Defining and forecasting growth

The first step in provisioning a new system is to forecast the number of telephones required at two-year and five-year intervals.

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 two-year and five-year growth forecast, then an estimate of annual personnel growth in percent is used to estimate the number of telephones required at the two-year and five-year intervals.

Example

A customer has 180 employees and needs 100 telephones to meet the system cutover. The customer projects an annual increase of 5 percent of employees based in future business expansion. The employee growth forecast is:

- 180 employees x 0.05 (percent growth) = 9
- 189 employees x 0.05 = 10 additional employees at 1 year
- 199 employees x 0.05 = 10 additional employees at 2 years
- 209 employees x 0.05 = 10 additional employees at 3 years
- 219 employees x 0.05 = 11 additional employees at 4 years
- 230 employees x 0.05 = 12 additional employees at 5 years

The ratio of telephones to employees is 100/180, which equals 0.556.

To determine the number of telephones required from cutover through a five-year interval, the number of employees required at cutover, one, two, three, four and five years is multiplied by the ratio of telephones to employees (0.556).

- 180 employees x 0.556 = 100 telephones at cutover
- 189 employees x 0.556 = 105 telephones at 1 year
- 199 employees x 0.556 = 111 telephones at 2 years
- 209 employees x 0.556 = 116 telephones at 3 years
- 219 employees x 0.556 = 122 telephones at 4 years
- 230 employees x 0.556 = 128 telephones at 5 years

This customer requires 100 telephones at cutover, 111 telephones at two years, and 128 telephones at five years.

Each DN assigned to an analog (500/2500-type) telephone requires a TN. Determine the number of analog (500/2500-type) TNs required for each customer and enter this information in "Worksheet A: Growth forecast" on page 208. Perform this calculation for cutover, two-year and five-year intervals.

Estimating CCS per terminal

Estimate the station and trunk CCS per terminal (CCS/T) for the installation of a system using any one of the following methods:

- comparative method
- manual calculation
- default method

Comparative method

Select three existing systems which have a record of traffic study data. The criteria for choosing comparative systems are:

- similar line size (± 25 percent)
- similar business (such as bank, hospital, insurance, manufacturing)
- similar locality (urban or rural)

Once similar systems have been selected, their station, trunk, and intra CCS/T are averaged. The averages are then applied to calculate trunk requirements for the system being provisioned (see the example in Table 45).

Table 45
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	3.50	12.60	4.20
Trunk CCS/T	2.60	3.0	2.0	7.60	2.50
Intra CCS/T	1.70	1.75	1.50	4.95	1.65

If only the trunk CCS/T is available, multiply the trunk CCS/T by 0.5 to determine the intra-CCS/T (assuming a normal traffic pattern of 33 percent incoming calls, 33 percent outgoing calls, and 33 percent intra-system calls). The trunk CCS/T and intra CCS/T are then added to arrive at the line CCS/T (see the example in Table 46).

Table 46
Example of CCS/T averaging when only trunk CCS/T is known

Trunk type	Number of trunks	Grade of service	Load in CCS	Number of terms	CCS/T
DID	16	P.01	294	234	1.20
CO	14	P.02	267	234	1.14
TIE	7	P.05	118	215	0.54
Paging	2	10 CCS/trunk	20	207	0.09
Out WATS	4	30 CCS/trunk	120	218	0.54
FX	2	30 CCS/trunk	60	218	0.27
Private line	4	20 CCS/trunk	80	4	20.00
			Total: 959		Total: 23.78

The individual CCS/T per trunk group is 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.

From the preceding information, trunk CCS/T can be computed as follows:

trunk CCS/T = total trunk load in CCS/ (number of lines) = 959/234 = 4.1

Assuming a 33 percent intra-calling ratio:

intra CCS/T = 4.1 * 0.5 = 2.1

line CCS/T = 4.1 (trunk CCS/T) + 2.1 (intra CCS/T) = 6.2

Manual calculation

Normally, the customer can estimate the number of trunks required at cutover and specify the grade of service to be maintained at two-year and five-year periods (see Table 47). (If not, use the comparative method described on page 169.)

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 that are accessing the group at cutover are divided into the estimated usage. The result is the CCS/T which can be used to estimate trunk requirements.

Example:

- Line CCS/T = 6.2
- Trunk CCS/T = 4.1
- 2 consoles = 30 CCS

Table 47
Example of manual calculation of CCS/T

Cutover	Line CCS = 275 * 6.2 = 1705 Trunk CCS = 275 * 4.1 = 1128 Subtotal = 2833 Console CCS = 30
Total system load = 2863	
2 years	Line CCS = 304 * 6.2 = 1885 Trunk CCS = 304 * 4.1 = 1247 Subtotal = 3132 Console CCS = 30
Total system load = 3162	
5 years	Line CCS = 352 * 6.2 = 2183 Trunk CCS = 352 * 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 (such as TIE, WATS, and FX trunks). Normally, the customer will tolerate a lesser grade of service on these trunk groups. Table 48 lists the estimated usage on special services trunks.

Table 48
Estimated load per trunk

Trunk type	CCS
TIE	30
Foreign exchange	30
Out WATS	30
In WATS	30
Paging	10
Dial dictation	10
Individual bus lines	20

Default method

Studies conducted estimate that the average line CCS/T is never 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 are not 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 two to incorporate the trunk CCS/T. However, 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 are forecast as a sum group total. Examples of the default method and the manual calculation method are shown in Table 49 on page 173 for comparison.

Example:

- 275 stations at cutover
- 304 stations at two years
- 352 stations at five years

Cutover: 275 * 5.5 (CCS/T) * 2 = 3025 CCS total system load
Two-year: 304 * 5.5 (CCS/T) * 2 = 3344 CCS total system load
Five-year: 352 * 5.5 (CCS/T) * 2 = 3872 CCS total system loadb

Table 49
Default method and manual calculations analysis

	Default method	Manual calculations	Difference
Cutover	3025	2863 CCS	162 CCS
Two years	3344	3162 CCS	182 CCS
Five years	3872	3657 CCS	215 CCS

Calculating number of trunks required

Enter the values obtained through any of the three previous methods in Worksheet A. Add the 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 cutover, two-year, and five-year requirements is determined as shown in the following example.

Example

The customer requires a Poisson 1 percent blocking grade of service (see Reference Table 1). The estimated trunk CCS/T is 1.14 for a DID trunk group. With the cutover, two-year, and five-year number of lines, the total trunk CCS is determined by multiplying the number of lines by the trunk CCS/T:

Cutover: 275 (lines) * 1.14 (trunk CCS/T) = 313.5 CCS
Two-year: 304 (lines) * 1.14 (trunk CCS/T) = 346.56 CCS
Five-year: 352 (lines) * 1.14 (trunk CCS/T) = 401.28 CCS

Use Table 50 on page 188 to determine the quantity of trunks required to meet the trunk CCS at cutover, two-year, and five-year intervals. In this case:

- 17 DID trunks are required at cutover
- 18 DID trunks are required in two years
- 21 DID trunk are required in five years

For trunk traffic greater than 4427 CCS, allow 29.5 CCS/T.

Calculating line, trunk, and console load

Once the quantity of trunks required has been estimated, enter the quantities in Worksheet A for cutover, two-year, and five-year intervals. 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 in "Worksheet A: Growth forecast" on page 208.

Line load

Line load is calculated by multiplying the total number of 500-telephone TNs by the line CCS/T. The number of TNs is determined as follows:

- one TN for every DN assigned to one or more Analog (500/2500-type) telephone
- one TN for every Meridian Digital Telephone without data option
- two TNs for every Meridian Digital Telephone with data option

Trunk load

Trunk load is calculated by multiplying the total number of digital telephone and 500-line TNs which have access to the trunk route by the CCS/T per trunk route.

Console load

Console load is calculated by multiplying the number of consoles by 30 CCS per console.

Calculating Digitone receiver requirements

The NTDK20 SSC card meets all DTR requirements. DTR provisioning methods are provided below for exceptional cases requiring extra DTR capacity.

The Cabinet system has 50 universal card slots when four expansion cabinets are equipped. The maximum possible number of lines is therefore:

50 cards * 16 units/card = 800 lines

Reference Tables 51 through Table 54 are based on models of traffic environments and can be used 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. The number of DTRs must accommodate the highest result.

Some special features are:

- Authorization Code
- Centralized Attendant Service (CAS)
- Charge Account for Call Detail Recording (CDR)
- Direct Inward System Access (DISA)
- Integrated Messaging System Link

From the appropriate reference table (Tables 51 through Table 54), determine the number of DTRs required and the DTR load for cutover, two-year, and five-year intervals. Record this information in Worksheet B on "Worksheet B: Total load" on page 210.

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

Model 1

Table 51 on page 190 is based on the following factors:

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

Model 2

Table 52 on page 191 is based on the following factors:

- the same traffic pattern as Model 1
- Digitone DID trunks or incoming Digitone TIE trunks
- Poisson 0.1 percent blockage grade of service

Model 3

Table 53 on page 192 is based on the following factors:

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

Model 4

Table 54 on page 193 is based on the following factors:

- the same traffic pattern as Model 3
- Digitone DID trunks or incoming Digitone TIE trunks
- Poisson 0.1 percent blockage Grade-of-Service (GoS)

Detailed calculation: Method 1

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

- Digitone receiver traffic is inflated by 30 percent to cover unsuccessful dialing attempts.
- Call holding time used in intra-office and outgoing call calculations is 135 seconds if unknown.
- Digitone receiver holding times are 6.2 and 14.1 seconds for intra and outgoing calls respectively.
- Factor (1 - R)/ 2 in (1) outgoing (incoming calls and outgoing calls are equal). R is the intra-office ratio.

Follow the procedure below for detailed calculation Method 1.

1 Calculate Digitone calls:

$$\text{Intra-office traffic} = \frac{100 * \text{Digitone station traffic (CCS)}}{\text{call holding time in seconds}} * \frac{R}{2}$$

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

Calculate total DTR traffic:

$$\text{Total DTR traffic} = \frac{1.3 * [(6.2 * \text{intra}) + (14.1 * \text{outgoing})]}{100}$$

Calculate average holding time:

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

2 See Table 50 and use the answers from steps 2 and 3 to determine the number of DTRs required.

Detailed calculation: Method 2

This method is used when incoming Digitone trunks are included in the system. This method uses the same assumptions as Method 1, with the DTR holding time assumed to be 2.5 seconds for a DID call. Follow the procedure below for detailed calculation Method 2:

1 Calculate intra-office and outgoing Digitone calls as shown in step 1 of Method 1:

$$\text{DID calls} = \frac{100 * \text{Digitone station traffic (in CCS)}}{\text{call holding time in seconds}}$$

2 Calculate total DTR traffic:

$$\text{DTR traffic} = \frac{1.3 * [(6.2 * \text{intra}) + (14.1 * \text{outgoing})] + (2.5 * \text{DID calls})}{100}$$

3 See Table 57 on page 199 and use the answer from step 2 to determine the number of DTRs required.

Calculating total system load

Total the line, trunk, console and DTR load for each customer to get the total load figure for each customer, two-year and five-year intervals. Enter this figure into "Worksheet B: Total load" on page 210.

Calculating number of loops required

Loop provisioning is not required with Small Systems since each card is automatically assigned to its own loop. By default, the system is non-blocking.

Each cabinet can house up to 10 Intelligent Peripheral Equipment (IPE) cards.

Each chassis can house up to 4 IPE cards.

Calculating number of IPE cards required

Using information from "Worksheet A: Growth forecast" on page 208, enter the number of Meridian Digital Telephone TNs, analog (500/2500-type) TNs, and trunk TNs required at cutover, two-year, and five-year intervals (for all customers) in "Worksheet C: System cabinet/chassis requirements" on page 211.

Divide each entry by the number of TN assignments for each card, round up to the next higher figure, and total the number of cards required.

IPE card slot assignments with IP expansion

If you are using IP expansion cabinets or chassis, then trunk and line cards may be distributed throughout each of the system cabinets or chassis in such a way as to allow for survivable operation. The intent is for a cabinet or chassis equipped with both trunk and line cards in survival mode to still handle calls.

IPE card slot assignments on cabinets without IP expansion

If you are not using IP Expansion cabinets, then trunk and line cards should be placed in the system cabinets in such a way as to allow for future expansion. Line cards are placed in the left-hand slots of the cabinets. If the system is using the default numbering plan and consecutive DN numbering is desired, the line cards should be placed one after another leaving no blank slots in between. Trunk cards are placed in the right-hand slots of the cabinets.

Plan the card slot assignments so that the trunk and line card growth is towards the middle. For example, Figure 25 on page 181 shows the slot assignment plan for systems equipped with two expansion cabinets.

IPE card slot assignments on chassis without IP expansion

Digital trunks cards must be placed in the chassis. Slot 4 must contain the 48-port DLC. Figure 29 on page 183 shows the typical card slot assignment for a chassis.

> ***Note:*** Slot 4 is keyed to prevent accidental insertion of cards other than the 48-port DLC.

IPE card slot assignments on the chassis expander

Any IPE card may be placed in cards slots 7 through 9. Slot 10 can contain any IPE card or the Meridian Mail. Refer to Figure 30 on page 184.

When planning the number of card slots that will be required in a system, the following items must be considered in addition to IPE card requirements:

- Additional SDI/DCHI/ESDI ports
- Tone Detectors (International only)
- Adding Meridian Mail

Figure 24
Card slot assignment plan: one-cabinet system

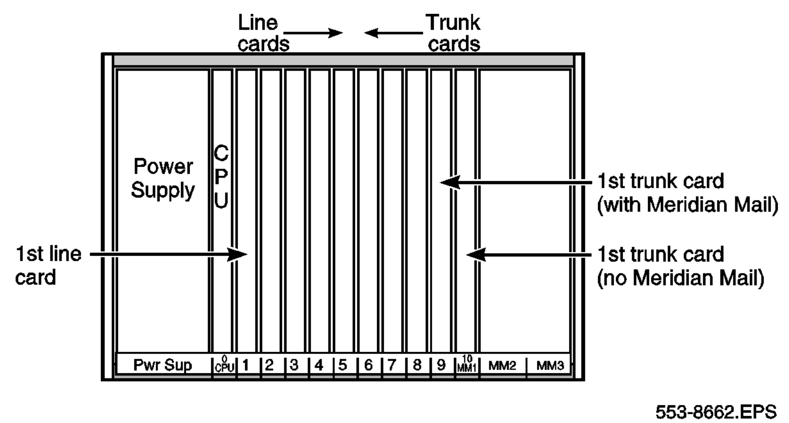


Figure 25
Card slot assignment plan: two-cabinet system without IP expansion

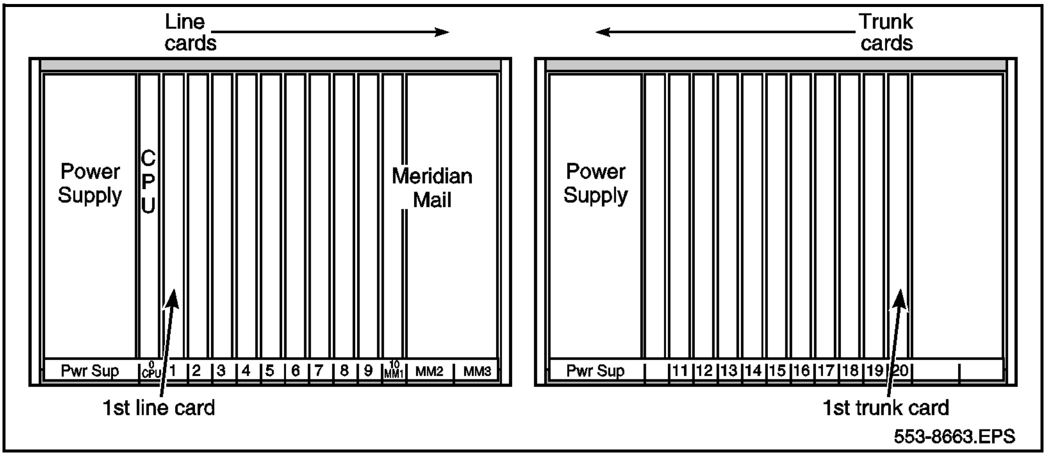


Figure 26
Card slot assignment plan: three-cabinet system without IP expansion

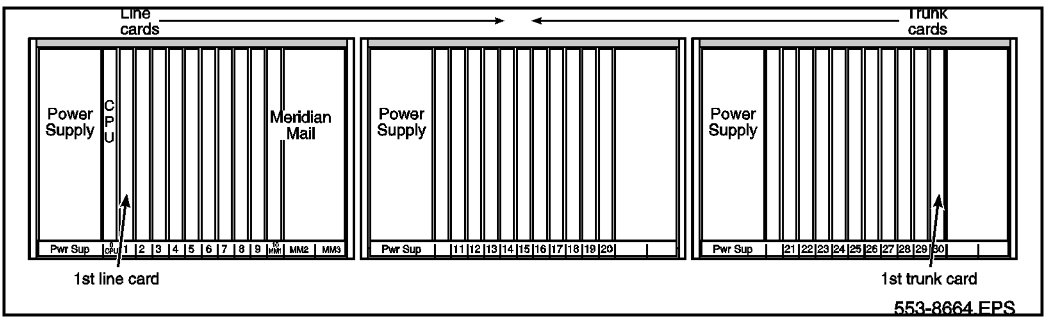


Figure 27
Card slot assignment plan: four-cabinet system without IP expansion

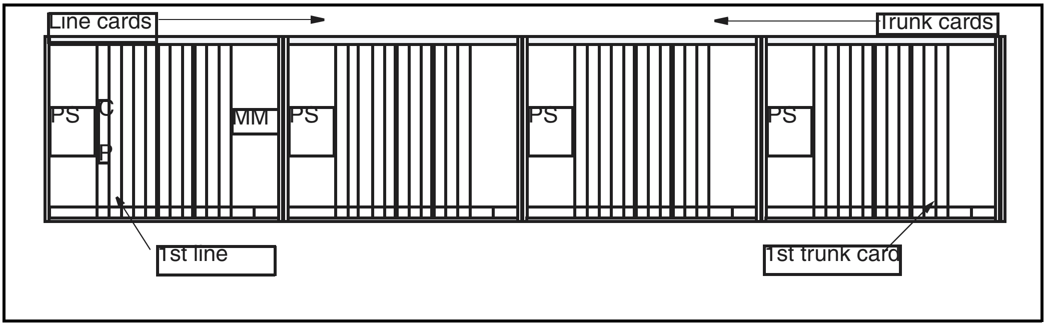


Figure 28
Card slot assignment plan: five-cabinet system without IP expansion

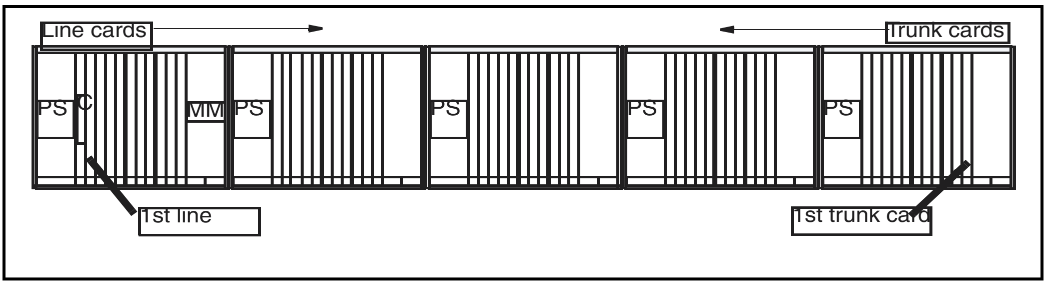


Figure 29
Card slot assignment plan: Option 11C Chassis

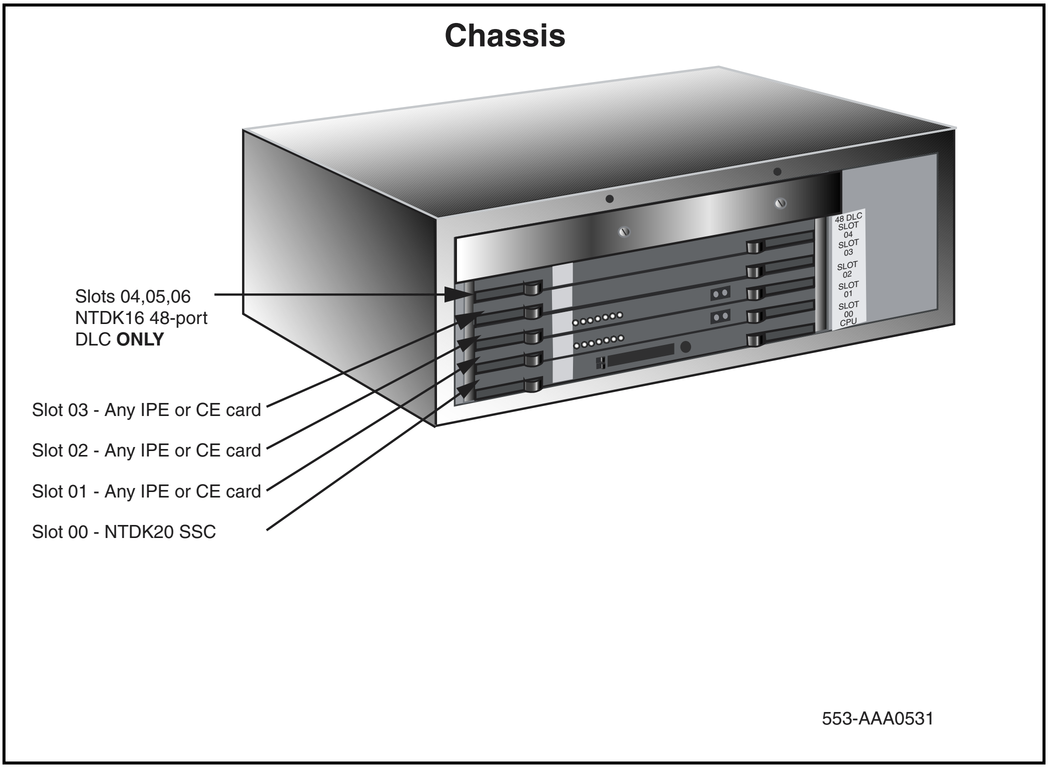
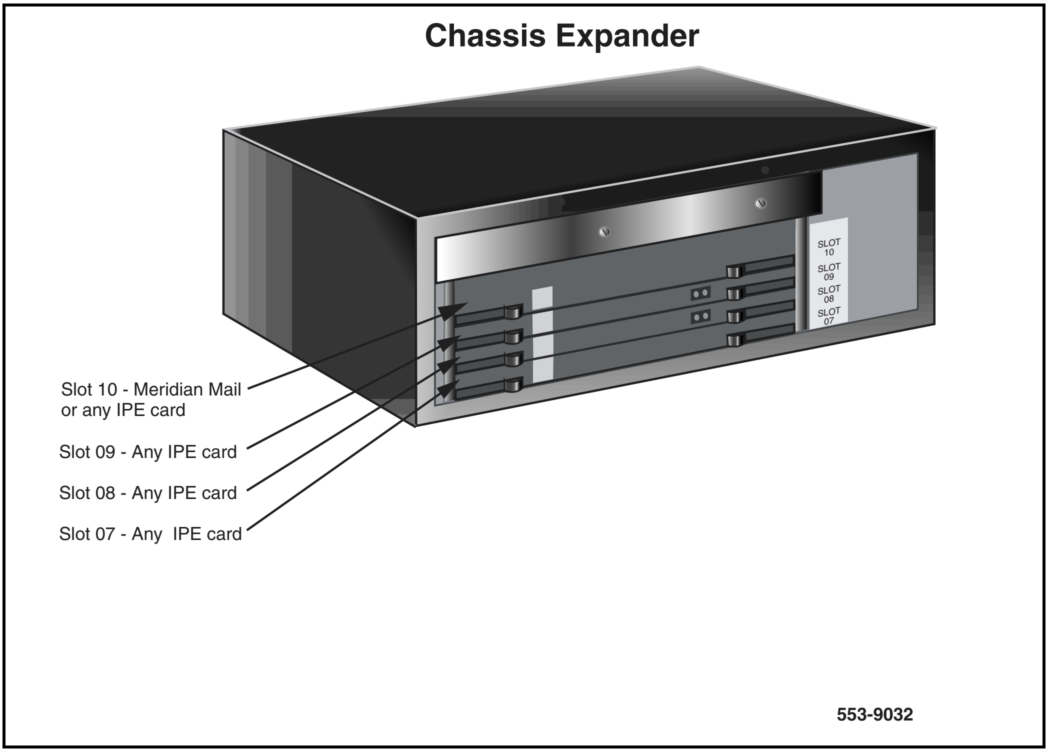


Figure 30
Card slot assignment plan: Option 11C Chassis: Chassis Expander



Provisioning conference/TDS loops

Conference loops

The Conference function is provided by the NTDK20 SSC card.

Each conference loop supports 16 conferees. By default, two conference loops are always active, more become active when the expansion cabinets or chassis are equipped. Therefore, the SSC supports a total of 32 conferees by itself.

Each port on a Fiber Expansion Daughterboard on the SSC card supports an additional conference loop for a total of:

- 48 conferees when equipped with one Fiber Expansion Link
- 64 conferees when equipped with two Fiber Expansion Link
- 80 conferees when equipped with three Fiber Expansion Link
- 96 conferees when equipped with four Fiber Expansion Link

TDS loops

The SSC card has 30 channels of TDS. This should be enough to meet all TDS requirements.

To illustrate this point, two examples are given below.

Example 1

A Cabinet system configured with two expansion cabinets provides 30 slots for trunk and line cards.

The SSC card can support 7260 CCS of call traffic. A digital line card supports 16 units per card. A Universal trunk card supports 8 units per card.

The CCS per card would be:

Digital Line card	16 Units/card x 6 CCS/Unit = 96 CCS/card
Universal trunk card	8 units/card x 22 CCS/Unit = 176 CCS/card

Assume the following:

- An average station generates 6 CCS of traffic.
- A 20 percent trunking ratio.
- An average trunk generates 22 CCS of traffic.

The 30 card slots available can support a system configuration of 384 lines (24 line cards) and 48 trunks (6 trunk cards). The total CCS for this configuration will be:

Total CCS: (24 line cards x 96 CCS/card) + (6 trunk cards x 176 CCS/card)
= 2304 CCS + 1056 CCS
= 3360 CCS

If the number you receive is greater than one, you can add an NTAK03 TDS/DTR card to the system.

Example 2

A system that is more heavily trunked, say a one to one ratio, can support a configuration of 192 lines (12 line cards) and 144 trunks (18 trunk cards):

Total CCS: 12 line cards x 96 CCS/card + 18 trunk cards x 176 CCS/card
= 1152 CCS + 3168 CCS
= 4320 CCS

The SSC card, at 7260 CCS, still provides plenty of TDS capability.

Calculating memory requirements

Use "Worksheet D: Unprotected memory calculations" on page 214 and"Worksheet E: Protected memory calculations" on page 215 to calculate memory requirements. Use the two-year figure for telephones, consoles, and trunks for the calculation. Add 10 percent to the total memory requirements.

Assigning equipment and preparing equipment summary

Use “Worksheet F: Equipment summary” on page 216 to record the equipment requirements for the complete system at cutover. Assign the equipment. The equipment summary may have to be updated as a result of assignment procedures. Use the finalized equipment summary to order the equipment for the system.

Calculating battery backup time

Use this procedure to determine:

- system power consumption
- battery current for customer-provided dc reserve power
- battery backup time for the NTAK75
- battery backup time for the NTAK76

Use the circuit-card power-consumption table and worksheets provided below.

Procedure 1
Calculating battery backup time

1 Determine the circuit card configuration in each system cabinet. Record the card codes against their cabinet slot numbers, on “Worksheet Ga: System power consumption: Main cabinet” on page 219 through “Worksheet Ge: System power consumption: fourth expansion cabinet” on page 223.

2 For each circuit card, transfer the power consumption values from “Worksheet G: System power consumption” on page 217 to the power-consumption column on the corresponding Worksheets Ga - Ge.

3 Calculate the total system power consumption on “Worksheet Gf: Total Cabinet system power consumption” on page 224.

4 If your system is ac-powered, go to “Worksheet H: Battery current and ac line calculation for ac systems using NTAK75 and NTAK76” on page 226. If your system is dc-powered, go to“Worksheet I: Battery current calculation for customer provided dc reserve power” on page 227.

5 Transfer the P*out* (Main) and P*out* (Expan.) values from Worksheet G to Worksheet H or I.

6 Calculate P*in* (Main), I *Batt* (Main), P*in* (Expan), and I *Batt* (Expan) as shown on Worksheet H or I.

7 Calculate I*line* if required, as shown on Worksheet H.

8 Transfer the values calculated for I *Batt* (Main) and I *Batt* (Expan), onto the NTAK75/QBL24A1 and the NTAK76 discharge time graphs.

9 Select the battery unit that provides the most appropriate backup time.

End of Procedure

Use the following reference tables for calculations beginning on page 173.

Table 50
Trunk traffic — Poisson 1 percent blocking (Part 1 of 3)

Trunks	CCS	Trunks	CCS	Trunks	CCS
1	0.4	25	535	49	1231
2	5.4	26	562	50	1261
3	15.7	27	590	51	1291
4	29.6	28	618	52	1322
5	46.1	29	647	53	1352
6	64	30	675	54	1382
7	84	31	703	55	1412
8	105	32	732	56	1443
9	126	33	760	57	1473
10	149	34	789	58	1504
11	172	35	818	59	1534
12	195	36	847	60	1565
13	220	37	876	61	1595

Table 50
Trunk traffic — Poisson 1 percent blocking (Part 2 of 3)

Trunks	CCS	Trunks	CCS	Trunks	CCS
14	244	38	905	62	1626
15	269	39	935	63	1657
16	294	40	964	64	1687
17	320	41	993	65	1718
18	346	42	1023	66	1749
19	373	43	1052	67	1780
20	399	44	1082	68	1811
21	426	45	1112	69	1842
22	453	46	1142	70	1873
23	480	47	1171	71	1904
24	507	48	1201	72	1935
73	1966	97	2721	121	3488
74	1997	98	2752	122	3520
75	2028	99	2784	123	3552
76	2059	100	2816	124	3594
77	2091	101	2874	125	3616
78	2122	102	2879	126	3648
79	2153	103	2910	127	3681
80	2184	104	2942	128	3713
81	2215	105	2974	129	3746
82	2247	106	3006	130	3778
83	2278	107	3038	131	3810

Table 50
Trunk traffic — Poisson 1 percent blocking (Part 3 of 3)

Trunks	CCS	Trunks	CCS	Trunks	CCS
84	2310	108	3070	132	3843
85	2341	109	3102	133	3875
86	2373	110	3135	134	3907
87	2404	111	3166	135	3939
88	2436	112	3198	136	3972
89	2467	113	3230	137	4004
90	2499	114	3262	138	4037
91	2530	115	3294	139	4070
92	2563	116	3326	140	4102
93	2594	117	3359	141	4134
94	2625	118	3391	142	4167
95	2657	119	3424	143	4199
96	2689	120	3456	144	4231
145	4264	147	4329	149	4395
146	4297	148	4362	150	4427

Table 51
Digitone Receiver (DTR) requirements — Model 1 (Part 1 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
2	7	2
3	33	9
4	69	19

Table 51
Digitone Receiver (DTR) requirements — Model 1 (Part 2 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
5	120	33
6	179	49
7	249	68
8	332	88
9	399	109
10	479	131
11	564	154
12	659	178
13	751	203
14	848	229
15	944	255
16	1044	282
Note: See "Calculating Digitone receiver requirements" on page 175 for Model 1 assumptions.		

Table 52
Digitone Receiver (DTR) requirements — Model 2 (Part 1 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
2	2	2
3	21	7
4	52	15
5	90	27
6	134	40

Table 52
Digitone Receiver (DTR) requirements — Model 2 (Part 2 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
7	183	55
8	235	71
9	293	88
10	353	107
11	416	126
12	483	145
13	553	166
14	623	187
15	693	208
16	770	231
Note: See "Calculating Digitone receiver requirements" on page 175 for Model 2 assumptions.		

Table 53
Digitone Receiver (DTR) requirements — Model 3 (Part 1 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
2	5	2
3	22	9
4	50	19
5	87	33
6	132	49
7	180	68
8	234	88

Table 53
Digitone Receiver (DTR) requirements — Model 3 (Part 2 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
9	291	109
10	353	131
11	415	154
12	481	178
13	548	203
14	618	229
15	689	255
16	762	282
Note: See "Calculating Digitone receiver requirements" on page 175 for Model 3 assumptions.		

Table 54
Digitone Receiver (DTR) requirements — Model 4 (Part 1 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
2	4	2
3	18	7
4	41	15
5	72	27
6	109	40
7	148	55
8	193	71
9	240	88
10	291	107

Table 54
Digitone Receiver (DTR) requirements — Model 4 (Part 2 of 2)

Number of DTRs	Max. number of Digitone lines	DTR load (CCS)
11	340	126
12	391	145
13	448	166
14	505	187
15	562	208
16	624	231
Note: See “Calculating Digitone receiver requirements” on page 175 for Model 4 assumptions.		

Table 55
Digitone Receiver (DTR) load capacity — 6 to 15 second holding time (Part 1 of 3)

	Average holding time in seconds									
Number of DTRs	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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	85	84
9	131	125	120	116	113	111	109	107	106	104
10	157	150	144	140	136	133	131	129	127	126

Table 55
Digitone Receiver (DTR) load capacity — 6 to 15 second holding time (Part 2 of 3)

	Average holding time in seconds									
Number of DTRs	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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
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

Table 55
Digitone Receiver (DTR) load capacity — 6 to 15 second holding time (Part 3 of 3)

	Average holding time in seconds									
Number of DTRs	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
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
Note: Load capacity is measured in CCS.										

Table 56
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 1 of 3)

	Average holding time in seconds									
Number of DTRs	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
1	0	0	0	0	0	0	0	0	0	0
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

Table 56
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 2 of 3)

	Average holding time in seconds									
Number of DTRs	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
5	31	31	31	30	30	30	30	30	30	29
6	47	46	46	45	45	45	45	44	44	44
7	64	63	63	62	62	62	61	61	61	60
8	83	82	82	81	80	80	79	79	79	78
9	103	102	101	100	100	99	99	98	98	97
10	125	123	122	121	121	120	119	119	118	118
11	147	145	144	143	142	141	140	140	139	138
12	170	168	167	166	165	164	163	162	161	160
13	193	192	190	189	188	186	185	184	184	183
14	218	216	214	213	211	210	209	208	207	206
15	243	241	239	237	236	234	233	232	231	230
16	268	266	264	262	260	259	257	256	255	254
17	294	292	290	288	286	284	283	281	280	279
18	322	319	317	314	312	311	309	308	306	305
19	347	344	342	339	337	335	334	332	331	329
20	374	371	368	366	364	361	360	358	356	355
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

Table 56
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 3 of 3)

	Average holding time in seconds									
Number of DTRs	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
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	796	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

Note: Load capacity is measured in CCS.

Table 57
Digitone Receiver (DTR) requirements — Poisson 0.1 percent blocking (Part 1 of 2)

Number of DTRs	DTR load (CCS)	Number of DTRs	DTR 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

Table 57
Digitone Receiver (DTR) requirements — Poisson 0.1 percent blocking (Part 2 of 2)

Number of DTRs	DTR load (CCS)	Number of DTRs	DTR load (CCS)
23	395	48	1058
24	419	49	1086
25	444	50	1115

Table 58
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 1 of 3)

	Average holding time in seconds									
Number of DTRs	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
1	0	0	0	0	0	0	0	0	0	0
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	29
6	47	46	46	45	45	45	45	44	44	44
7	64	63	63	62	62	62	61	61	61	60
8	83	82	82	81	80	80	79	79	79	78
9	103	102	101	100	100	99	99	98	98	97
10	125	123	122	121	121	120	119	119	118	118
11	147	145	144	143	142	141	140	140	139	138
12	170	168	167	166	165	164	163	162	161	160
13	193	192	190	189	188	186	185	184	184	183
14	218	216	214	213	211	210	209	208	207	206

Table 58
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 2 of 3)

Number of DTRs	Average holding time in seconds									
	16	17	18	19	20	21	22	23	24	25
15	243	241	239	237	236	234	233	232	231	230
16	268	266	264	262	260	259	257	256	255	254
17	294	292	290	288	286	284	283	281	280	279
18	322	319	317	314	312	311	309	308	306	305
19	347	344	342	339	337	335	334	332	331	329
20	374	371	368	366	364	361	360	358	356	355
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

Table 58
Digitone Receiver (DTR) load capacity — 16 to 25 second holding time (Part 3 of 3)

	Average holding time in seconds									
Number of DTRs	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
35	813	807	801	796	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
Note: Load capacity is measured in CCS.										

Table 59
Digitone Receiver (DTR) requirements — Poisson 0.1 percent blocking (Part 1 of 2)

Number of DTRs	DTR load (CCS)	Number of DTRs	DTR 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

Table 59
Digitone Receiver (DTR) requirements — Poisson 0.1 percent blocking (Part 2 of 2)

Number of DTRs	DTR load (CCS)	Number of DTRs	DTR load (CCS)
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 60
Conference and TDS loop requirements

Network loops required at 2 years	TDS 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
109 - 120	10	10

Table 61
Digitone Receiver provisioning (Part 1 of 4)

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

Table 61
Digitone Receiver provisioning (Part 2 of 4)

DTR CCS	DTR ports	DTR CCS	DTR ports
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

Table 61
Digitone Receiver provisioning (Part 3 of 4)

DTR CCS	DTR ports	DTR CCS	DTR ports
1751-1785	62	2871-2905	94
1786-1820	63	2906-2940	95
1821-1855	64	2941-2975	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		

Table 61
Digitone Receiver provisioning (Part 4 of 4)

DTR CCS	DTR ports	DTR CCS	DTR ports
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		
2836-2870	93		
Note: Provisioning assumes an 11 second holding time.			

Worksheet A: Growth forecast

Customer:__________________________________
Date: ___________________

Prepare one worksheet for each customer and one worksheet for the complete system.

Stations	Cutover	2 years	5 years	CCS/T
Meridian Digital Telephones				
Meridian Digital Telephone TNs				
500 telephones				
500 TNs				
2500 telephones				
2500 TNs				
2-way				
1-way in				
1-way out				
DID				
TIE				
CCSA				
InWATS				
OutWATS				
FX				
Private line				
Dial dictation				

Stations	**Cutover**	**2 years**	**5 years**	**CCS/T**
Paging				
RAN				
AIOD				
DTI				
E&M 2W				
E&M 4W				
CO				

Line CCS/T____________

Total trunk CCS/T____________

Intra CCS/T____________

Worksheet B: Total load

Customer:_______________________________________

Date: ______________

Prepare one worksheet for each customer for cutover, 2-year, and 5-year intervals, and one worksheet for the system for cutover, 2-year, and 5-year intervals.

Line usage

Meridian Digital sets: TN________ x _______CCS/T=___________ CCS

500: TN____________ x _____________ CCS/T=___________ CCS

2500: TN____________ x _____________ CCS/T=___________ CCS

Total line load=___________ CCS

Trunk usage

Number of TNsCCS/T perTotal CCS load

Trunk routeaccessing routetrunk routeper trunk route

____________ ____________ x ____________=____________CCS

____________ ____________ x ____________=____________CCS

____________ ____________ x ____________=____________CCS

____________ ____________ x ____________=____________CCS

____________ ____________ x ____________=____________CCS

____________ ____________ x ____________=____________CCS

Total trunk load=____________CCS

Console usage

Number of consoles____________x 30 CCS

= Total console load=____________CCS

Digitone receivers

Number of DTRs (from tables)____________

= Total DTR load=____________CCS

= Total load =____________CCS

Worksheet C: System cabinet/chassis requirements

Customer:_______________________________________

Date: ______________

Prepare one worksheet for the complete system at cutover, 2-year, and 5-year intervals.

Table 62
IPE card calculations

	Cutover	2 years	5 years
Number of digital line cards = number of digital ports (M2250 uses 2 ports) 16			
Number of analog line cards = number of analog ports in service 16			
Number of analog waiting line cards = number of analog ports with message waiting 16			
Number of universal trunk cards = total number of CO/DID/RAN/paging trunks 8			
Number of E&M trunk cards = total number of E&M/paging/dictation trunks 4			
Total cards			
Note: For higher reliability, do not configure more than one M2250 console on one digital line card. Use paging trunks on universal trunk cards or E&M trunk cards, depending on what combination minimizes the total number of trunk cards required.			

Worksheet C: System cabinet/chassis requirements (continued)

To determine the number of chassis required for a Chassis system, go to "Chassis system calculations" on page 213. To determine the number of cabinets required for a Cabinet system, follow the guidelines below:

Cabinet system calculations without Meridian Mail

The first cabinet provides a total of 9 slots for trunk and line cards:

Number of IPE cards	Number of cabinets required (maximum 5 cabinets)
1-9	1
10-19	2
20-29	3
30-39	4
40-49	5

For systems requiring SDI/DCH cards, subtract one available card slot from the first cabinet for each additional SDI/DCH card required.

Cabinet system calculations with Meridian Mail

Subtract one available card slot from the first cabinet:

Number of IPE cards	Number of cabinets required (maximum 5 cabinets)
1-8	1
9-18	2
19-28	3
29-38	4
39-48	5

Chassis system calculations

The chassis provides a total of 3 locations for trunk and line cards, with the chassis expander providing 4 additional locations:

Number of IPE cards	Number of chassis required (maximum 2 chassis)
1-3	1
4-7[a]	2

a. If you are adding a Meridian Mail card, it must be located in slot 10 of the chassis expander, which reduces the maximum number of IPE cards to 6.

For systems requiring extra TDS/DTR or SDI/DCH cards, subtract one available card slot from the chassis for each additional TDS/DTR or SDI/DCH card required.
Number of chassis required:____________

Worksheet D: Unprotected memory calculations

Customer:_______________________________________
Date: ______________

Prepare one worksheet for the complete system.

	Items	Words	Total
Fixed amount of storage required			
500 and 2500 TNs			
Add-on modules			
Network groups	2		
Trunk units			
Consoles			
Customer groups			
Network loops	30		
Peripheral Signalling	2		
Trunk routes			
SDI cards			
TDS loops			
Conference loops	3		
DTR loops			
Call registers			
Low priority input buffers			
High priority input buffers			

Total from table__________
Total words from table__________

Capacity ______ **64** ___ k words (k = 1024 words)

Worksheet E: Protected memory calculations

Customer: ____

Date: ______________

Prepare one worksheet for the complete system.

	Items	Words	Total
Fixed amount of storage required			
500 and 2500 TNs			
Add-on modules			
Trunk units			
Consoles			
Customer groups			
Trunk routes			
Code restricted trunk routes			
DTR loops (in excess on 1)			
Speed call head table			
Speed call lists (10 numbers)			
Speed call lists (50 numbers)			
TDS loops (in excess of 1)			
History file			
Note: Record totals on the next page.			

Total from table__________

Add 10%__________

Total words from table__________

Capacity ______ **64** ____ k words (k = 1024 words)

Worksheet F: Equipment summary

Customer:____
Date: ______________

Prepare one worksheet for the complete system.

Equipment summary	Quantity	Based on
Line and trunk cards		Cutover
DTRs		2 years
TDS loops		2 years
Call registers		2 years
High priority input buffers		Cutover
Low priority input buffers		Cutover
System cabinets		2 years

Worksheet G: System power consumption

For a Chassis system, go to "Worksheet Gg: Chassis system power consumption: chassis" on page 224.

Table 63
Circuit card power consumption (Part 1 of 2)

Circuit card	Type	% active sets (off-hook)	Power consumption
Mail	Meridian Mail	steady state	35W
NT1R20	Off premise Station analog line card	50%	22W
NT6R16	Meridian Mail Mini	steady state	35W
NT5D26	EXUT Card for ASia Pacific	DID-enabled	28W
NT8D02	Digital line card	100%	25W
NT9D09	Message-waiting line card	50%	26W
NT8D14	Universal trunk card	DID-enabled	28W
NT8D15	E&M trunk card	N/A	29W
NT5K07	Universal Trunk Card	DID-enabled	28W
NT5K19	Extended E&M trunk card	N/A	29W
NT5K82	XCOT Card for Switzerland	DID-enabled	28W
NT5K83	XFEM trunk card for Switzerland	N/A	29W
NTAK02	SDI/DCH card	N/A	10W
NTAK03	TDS/DTR card	N/A	8W
NTAK09	1.5Mb DTI/PRI card	N/A	10W
NTAK10	2.0Mb DTI card	N/A	12W
NTAK79	2.0Mb PRI card	N/A	12W
NTBK22	MISP card	N/A	12W
NTBK50	2.0Mb PRI card	N/A	12W

Table 63
Circuit card power consumption (Part 2 of 2)

Circuit card	Type	% active sets (off-hook)	Power consumption
NTCK16BC	XFCDT Card	DID-enabled	28W
NTDK16	48-port Digital Line Card (chassis only)	100%	75w
NTDK20	SSC card	N/A	15w
NTDK22	10 m Fiber Expansion Daughterboard	N/A	3W
NTDK23	10 m Fiber Receiver card	N/A	3W
NTDK24	3 km Fiber Expansion Daughterboard	N/A	3W
NTDK25	3 km Fiber Receiver card	N/A	3W
NTDK26	Upgrades Daughterboard	N/A	2W
NTDK79	3 km Fiber Expansion Daughterboard	N/A	3W
NTDK80	3 km Fiber Receiver card	N/A	3W
NTDK85	Dual Fiber Expansion Daughterboard	N/A	7.5W
NTRB21	1.5mb TMDI	N/A	12W

Worksheet Ga: System power consumption: Main cabinet

Slot	Circuit card	Type	Power consumption from Table 63
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
		Total	

Worksheet Gb: System power consumption: first expansion cabinet

Slot	Circuit card	Type	Power consumption from Table 63
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
		Total	

Worksheet Gc: System power consumption: second expansion cabinet

Slot	Circuit card	Type	Power consumption from Table 63
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
		Total	

Worksheet Gd: System power consumption: third expansion cabinet

Slot	Circuit card	Type	Power consumption from Table 63
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
		Total	

Worksheet Ge: System power consumption: fourth expansion cabinet

Slot	Circuit card	Type	Power consumption from Table 63
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
		Total	

Worksheet Gf: Total Cabinet system power consumption

P*out* Main (total for slots 1-10 in main cabinet)	
P*out* Expan (total for slots 11-20 in the first expansion cabinet)	
P*out* Expan (total for slots 21-30 in the second expansion cabinet)	
P*out* Expan (total for slots 31-40 in the third expansion cabinet)	
P*out* Expan (total for slots 41-50 in the fourth expansion cabinet)	
Total	

Worksheet Gg: Chassis system power consumption: chassis

Slot	Circuit card	Type	Power consumption from Table 63
1	NTDK20	SSC	15 w
2			
3			
4, 5, 6	NTDK16	48 port DLC	75w
		Total	

Worksheet Gh: Chassis system power consumption: chassis expander

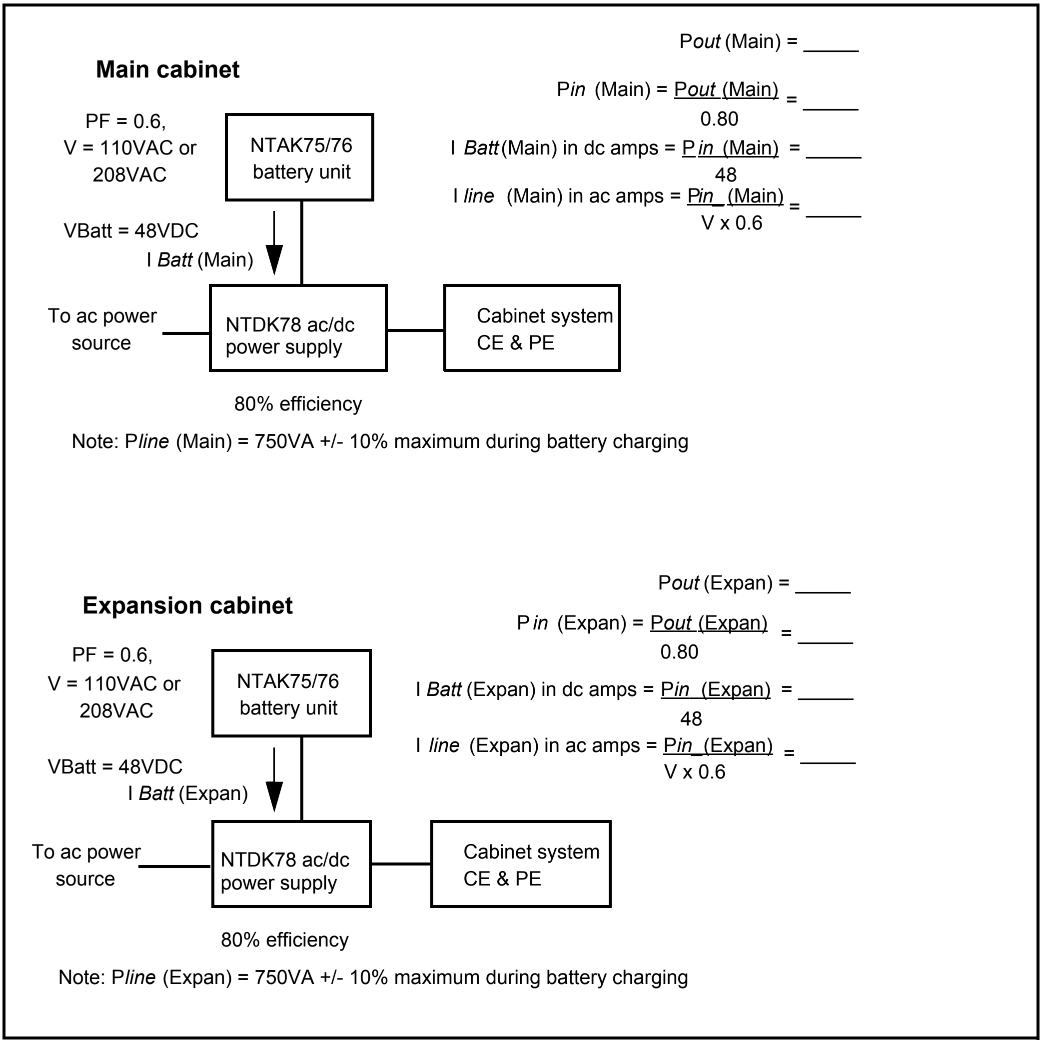
Slot	Circuit card	Type	Power consumption from Table 63
7			
8			
9			
10			
		Total	

Note: For an IP expansion system use the Cabinet system Worksheets.

Worksheet Gi: Total Chassis system power consumption

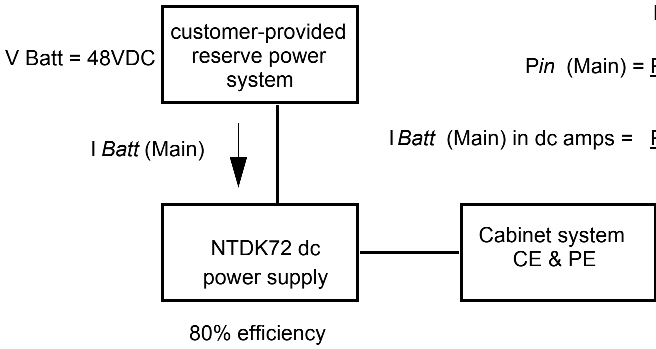
P*out* Main (total for slots 1-6 in chassis)	
P*out* Expan (total for slots 7-10 in the chassis expander)	
Total	

Worksheet H: Battery current and ac line calculation for ac systems using NTAK75 and NTAK76



Worksheet I: Battery current calculation for customer provided dc reserve power

Main cabinet

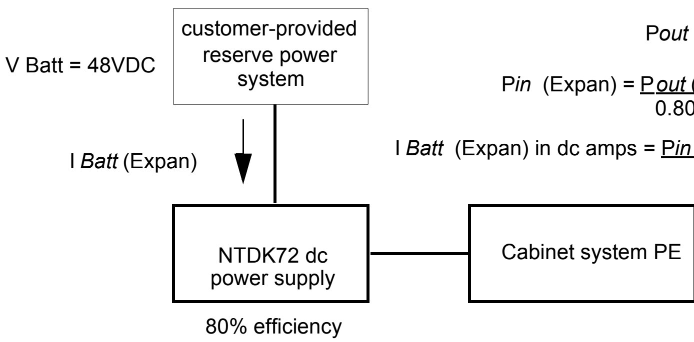


Pout (Main) = _____

Pin (Main) = $\dfrac{P_{out}\,(\text{Main})}{0.80}$ = _____

I *Batt* (Main) in dc amps = $\dfrac{P_{in}\,(\text{Main})}{48}$ = _____

Expansion cabinet V= 48V



Pout (Expan) = _____

Pin (Expan) = $\dfrac{P_{out}\,(\text{Expan})}{0.80}$ = _____

I *Batt* (Expan) in dc amps = $\dfrac{P_{in}\,(\text{Expan})}{48}$ = _____

Figure 31
Discharge Time for the NTAK76 Battery

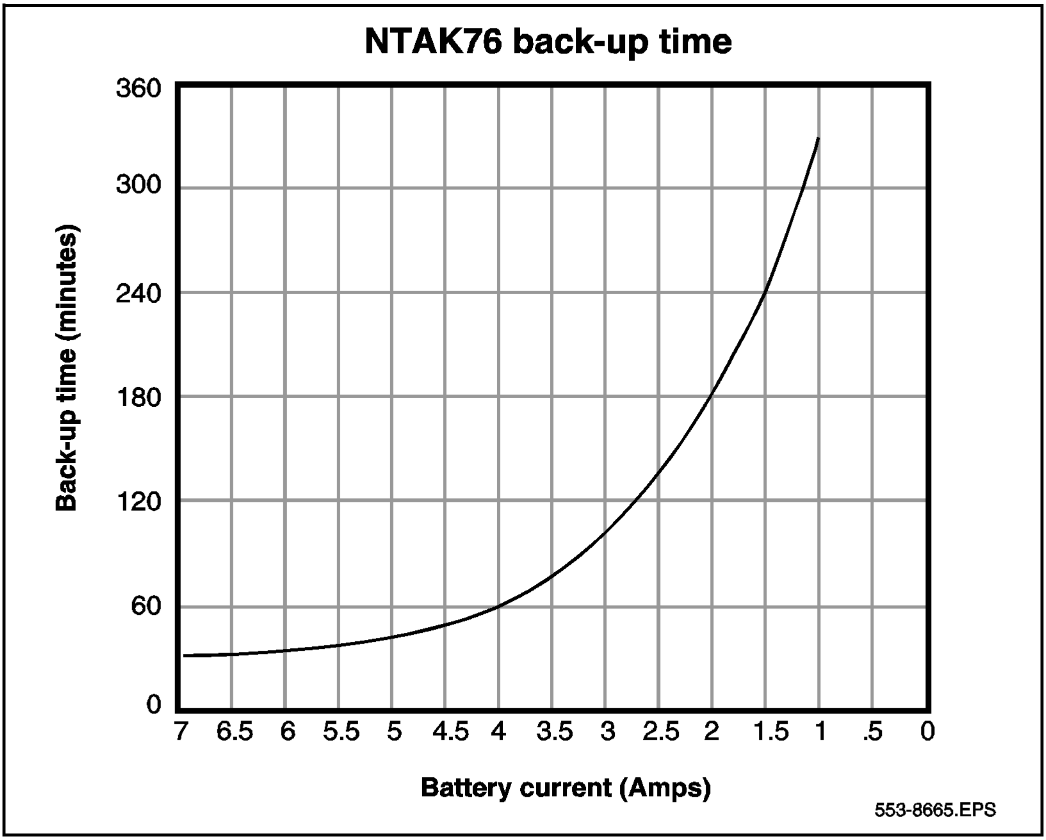
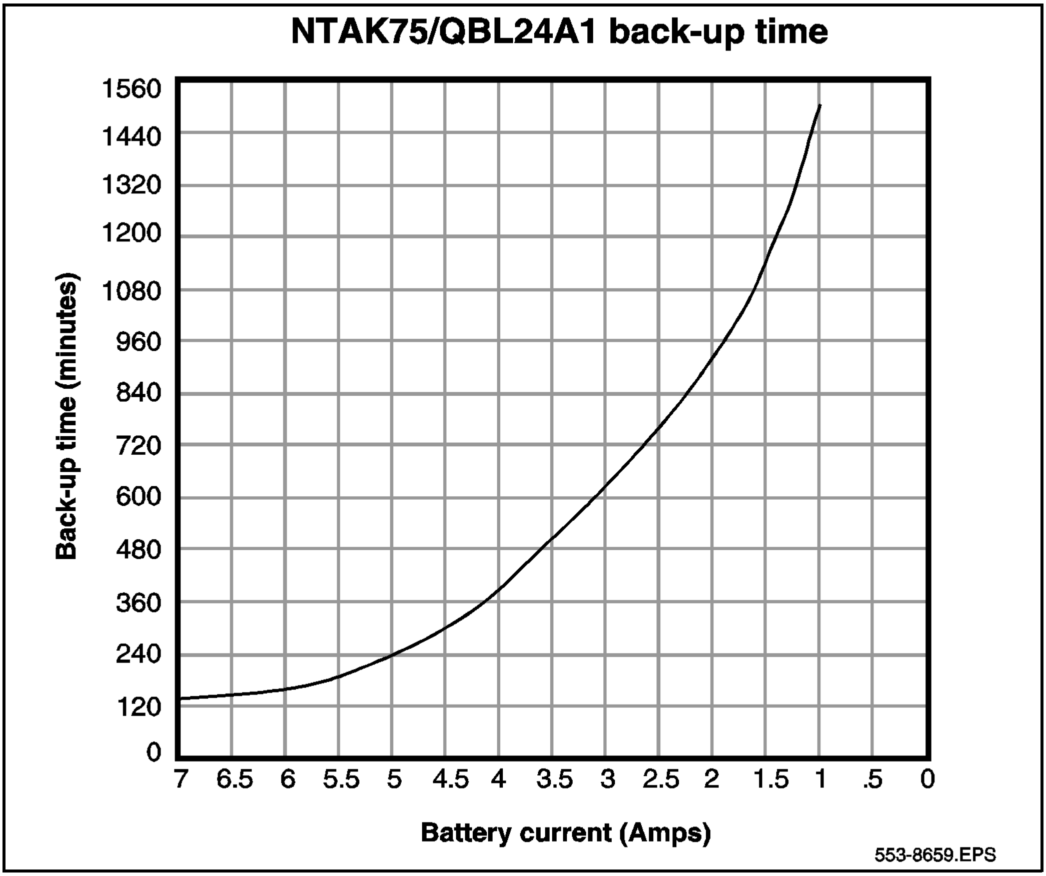


Figure 32
Discharge Time for the NTAK75/QBL24A1 Batteries



Small System distribution over a data network

Contents

This section contains information on the following topics:

Introduction

Small System IP expansion allows connectivity of IP expansion cabinets or chassis either point to point or over a distributed campus data network. The campus data network connectivity is provided through IP daughterboards in the main and IP expansion cabinets or chassis.

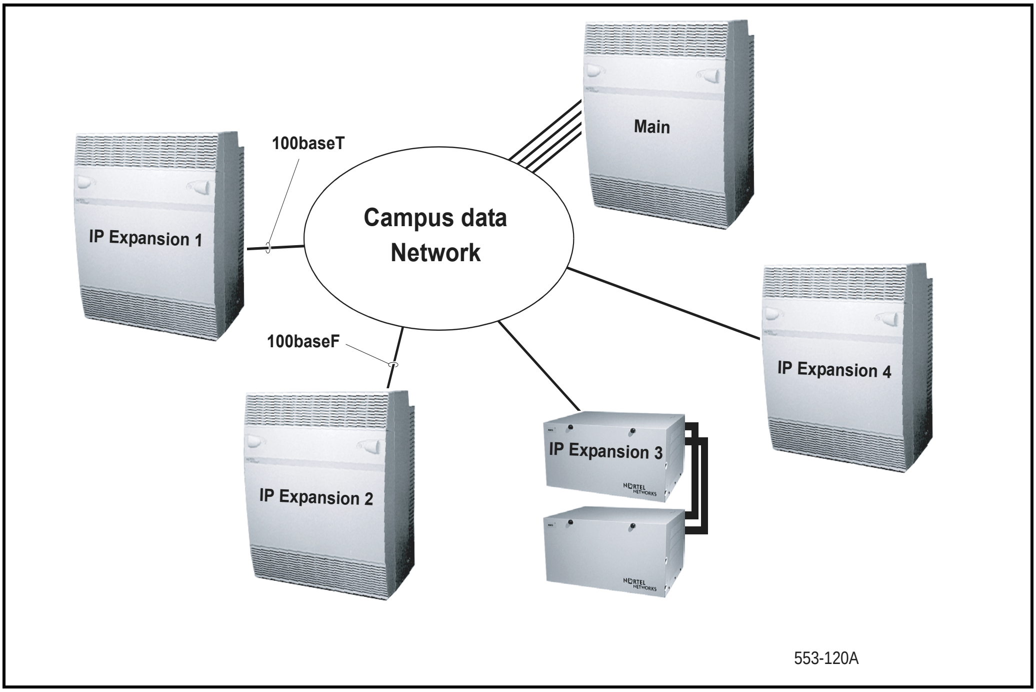
> ***Note:*** This section is not applicable for Succession Signaling Server or Succession Media Gateway cards.

Figure 33 provides an example of main and IP expansion cabinets and chassis connected over a campus data network using both 100BaseT and 100BaseF connectivity.

In order to satisfy PBX voice quality requirements, engineering guidelines are imposed on the campus data network. Refer to "Basic LAN requirements for Excellent Voice Quality" on page 235 and "LAN recommendations for Excellent Voice Quality" on page 238.

> ***Note:*** Contact your local Data Administrator to obtain specific IP information.

Figure 33
IP expansion configuration of cabinets or chassis over a campus data network



Monitoring IP link voice Quality of Service for IP expansion cabinets or chassis

Behavioral characteristics of the network are dependent on factors like Round Trip Delay (RTD), queuing delay in the intermediate nodes, packet loss, and available bandwidth. The service level of each IP link will be measured and maintained on the main cabinet or chassis for IP expansion operation. Information for latency and packet loss will be collected from the hardware and processed.

Based on system configured thresholds, the level of service will be derived and reported to the craftsperson with the **PRT QOS <cab#>** command in LD 117. See *Software Input/Output: Administration* (553-3001-311) and *Software Input/Output: Maintenance* (553-3001-511).

Data Network Ratings (Excellent, Good, Fair, Poor) along with the actual parameter values for network delay are displayed in Table 64.

Table 64
Campus data network voice quality measurements

Voice QoS Rating	Network Round Trip Delay (PDV Max 7.8 ms)	Network Round Trip Delay (PDV Min 0.5 ms)	Network Packet Loss
Excellent	<5 ms	<12 ms	<0.5%
Good	5 - 25 ms	12 - 32 ms	0.5 - 1%
Fair	25 - 45 ms	32 - 52 ms	1 - 1.5 ms
Poor	>45 ms	>52 ms	>1.5%

The values in Table 64 assume that there is no echo cancellation mechanism and no particular mechanism for recovering lost packets.

The command **PRT PDV <cab#>** in LD 117 displays both the current size of the PDV buffer and the number of PDV underflows.

In addition, a warning message is printed when a parameter threshold (or combination of thresholds) is reached. These thresholds are not user configurable.

In LD 117, the command **CHG PDV <port#> <delay>** is used to set Packet Delay Variation (PDV buffer size) on a per link basis. The **<delay>** parameter can take values from 0.5 ms to 8 ms. This value should be initially tested at default settings. Increase the <delay> parameter value by 0.5 ms increments if an unacceptable level of voice quality is experienced ("pops and clicks"). Decrease this value if echo is experienced. The goal is to operate with the smallest buffer possible.

The PDV buffer size for each IP connection is configured at the Main and is automatically downloaded to the IP Expansion cabinet.

Meridian Data

The Small System supports the switching of data through its TDM fabric. This allows for several applications in which the voice network can be used to transport data traffic. One such application would allow a communication device at a given location, such as a PC, to access a server at another location. Speeds up to 64 Kbps can be achieved, as normal voice channels are assigned to a data call for the duration of the session. Connectivity is achieved through data modules which stand alone or exist as modules within digital sets. At the PBX, several card options are supported, including the XDLC. As a result, a highly reliable physical path is achieved through the Meridian 1 TDM fabric. Please refer to *Features and Services* (553-3001-306) for more information.

The reliability of this data application relies on a highly robust layer 1, in this case, the TDM fabric. The above NTP gives the following bit error rate as a measure of this reliability:

- In-house error rate <= 1 error x 10^{-7} (1 error in 10Mbits)
- Trunk error rate <=1 error x 10^{-5} (1 error in 100Kbits)

In the case of IP expansion, a packet loss of < 1% has been quoted to achieve acceptable voice quality. This potentially means 1 error in 100 bits can be fully tolerated for voice, but this is not suitable for Meridian 1 data traffic. Therefore, Meridian 1 data can be transported to the same level of reliability on an IP expansion cabinet or chassis if the customer's LAN can achieve 1 error in 100Kbits. Otherwise, it must be recognized that packet loss could impact any application being transported. The zero bandwidth parameter for the CHG IPR command in LD 117 must be set to NO to ensure that packet loss due to synchronization of the IP link is avoided.

Network Requirements

When a main and an IP expansion cabinet or chassis are connected by a Campus Data Network, the quality of voice depends on the network. The network requirements defined here must be met.

Basic LAN requirements for Excellent Voice Quality

Summary of requirements

- 100Base-Tx/F Layer 2 switch that supports full duplex connection (Layer 3 switching is supported). The Data Port on the Campus Data Network/LAN must have Auto-negotiation disabled and the Speed/ Duplex set to 100 Full Duplex.
- Packet Loss < 0.5%
- Idle System Bandwidth approximately 0 Mbps, Peak Bandwidth under high traffic conditions 14 Mbps, Theoretical Maximum peak bandwidth 24 Mbps
- Network Delay - Round Trip Delay (RTD) < 5 msec (*)

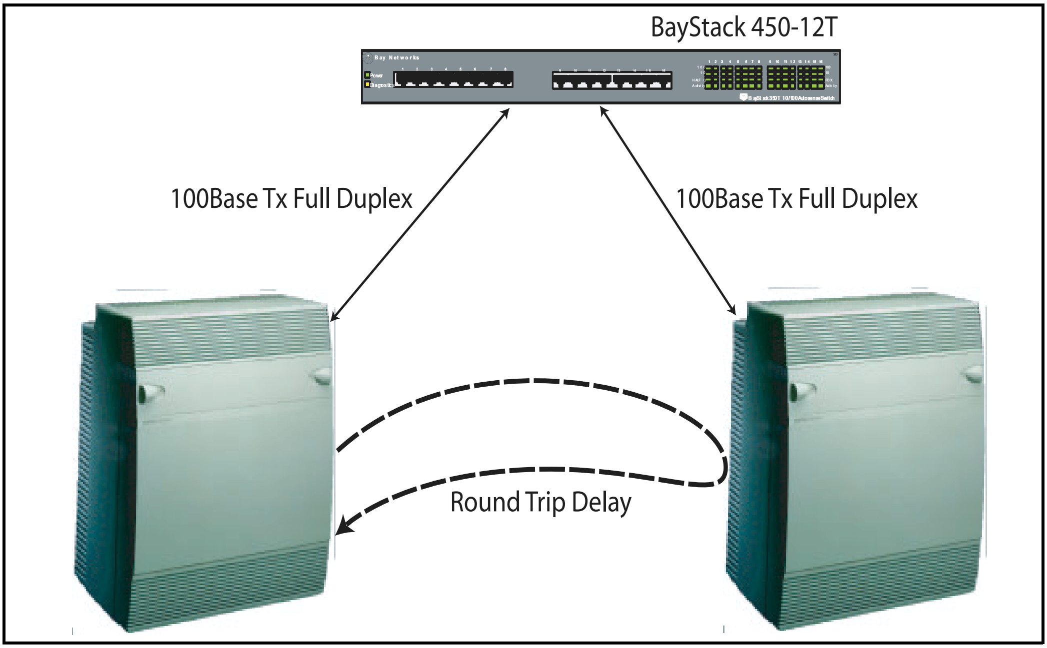
  * with PDV jitter buffer set to maximum, RTD < 5 ms

  * with PDV jitter buffer set to minimum, RTD < 12 ms

- Support of Port Priority Queuing recommended
- Support of VLAN configuration recommended

The network must provide full duplex capability between the main and all IP expansion cabinets or chassis for excellent voice quality. A Layer 2 or Layer 3 switch that supports full duplex connection over 100BaseT/F is required to achieve this minimum network requirement.

Figure 34
Basic LAN Configuration for Excellent Voice Quality



Bandwidth

The IP expansion system is designed for non-blocking transmission between main and IP expansion cabinets or chassis. The throughput of the network must be guaranteed.

When using either a cabinet or a chassis as your main system controller, the idle system bandwidth is approximately 0 Mbps. Under high traffic conditions, a peak bandwidth of 14 Mbps is required for Excellent Voice Quality. The theoretical maximum peak bandwidth is 24 Mbps.

Note: If there is no traffic flow, there are no bandwidth requirements. Only active channels use bandwidth.

Table 65
Bandwidth requirements

Talk Slot	Voice Traffic (Mbps)	Signaling Traffic (Mbps)	Total (Mbps)
320	23.5	0.5	24.0
160	13.3	0.5	13.8
75	7.8	0.5	8.3
40	5.6	0.5	6.1
16	4.1	0.5	4.6
0	0.0	0.11	0.11

PDV jitter buffer

Packet Delay Variation (PDV) jitter buffer is used to smooth out any variations in the arrival rate of the UDP/IP voice packets with respect to the rate at which the voice samples are played. The minimum and maximum values for Excellent Voice Quality are given in Table 64 on page 233.

The PDV jitter buffer is also used to resequence out-of-order voice packets.

Note 1: If you experience buffer underflow errors or clicking and popping noises on a voice call, the size of the PDV buffer needs to be increased.

Note 2: Increase the PDV buffer as little as possible (0.5 ms) in order to keep the round trip delay as short as possible. The goal is to operate with as small a buffer as possible to keep the round trip delay as short as possible.

WARNING

Excessive delay will cause a degradation in voice quality in the form of echo.

LAN recommendations for Excellent Voice Quality

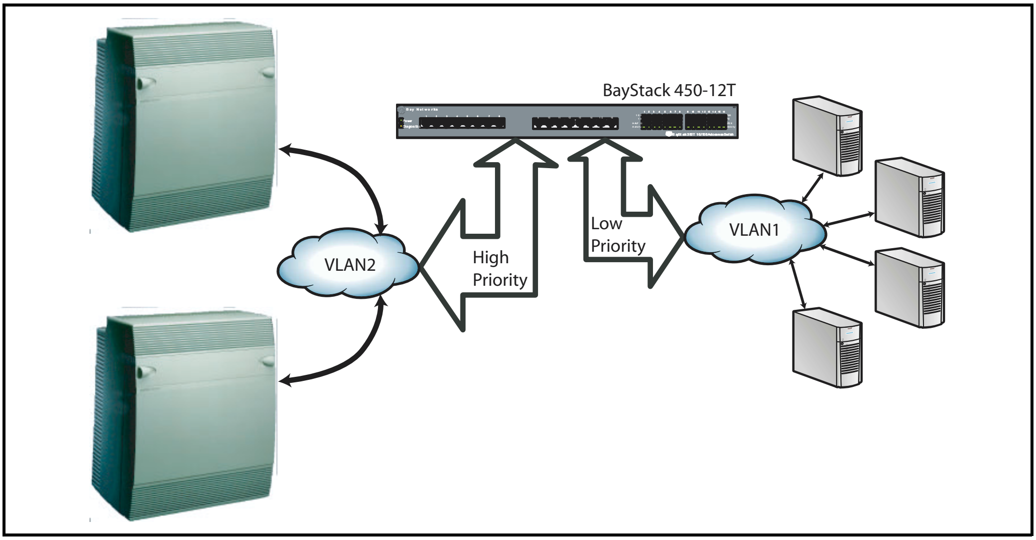
It is recommended that the Port Based Virtual LAN (VLAN) feature should be utilized to isolate the Small System from the broadcast domain of the customer's LAN equipment. This will reduce the risk of link outages due to broadcast storms.

Packet prioritizing scheme

The packet prioritizing scheme can be used to effectively utilize bandwidth. However, the network delay requirement that the one-way trip delay not exceed 2.5 ms must be met. Support of priority queuing is recommended.

Port priority queuing will help maintain Excellent Voice Quality during heavy usage or congestion. Refer to Figure 35 on page 239 for an example of port priority queuing.

Figure 35
Example of port priority queueing configuration



Media conversion devices

Third-party media conversion devices can be used to extend the range of the 100BaseT and 100BaseF IP solutions. One such device, the IMC Networks Ethernet Compatible Media Converter with a McLIM Tx/Fx-SM/Plus module, provides acceptable transmission between cabinets or chassis located up to 40 km apart. This solution is illustrated in Figure 36 on page 240. However caution must be used when extending the length of cable used in the point-to-point configuration. The round trip delay parameters specified in Table 65 on page 237 must not be exceeded.

Figure 36
Example of third-party media device used with 100BaseT hardware

IP Security

IP security in IP expansion configuration is addressed in two ways:

- Filtering to protect CPU integrity and call processing stability.
  - ARP Filtering - ARPs are filtered when the IP link between main cabinet or chassis and IP expansion cabinet or chassis is up.
  - IP Filtering - Only packets from/to M1 nodes (cabinet or chassis) IP addresses are processed when the IP link between the main cabinet or chassis and IP expansion cabinet or chassis is up.

  Note: IP expansion cabinets or chassis, during IP link up mode, cannot be "pinged" from other data network nodes. However, the main cabinet or chassis can ping IP expansion cabinets or chassis and vice-versa.

- Voice Channels Security (Privacy)
  - Multiplexed Voice Channels Packets - PCM samples from all active channels are packetized every 125 mu-lawsec. There is no single voice packet associated with the call as with standard VoIP protocols.
  - Dynamic Allocation of the channel in the packet — Channel position in the packet is dynamically allocated on a per call basis. Therefore, Set A has different channels allocated for different calls.

Power supplies

Contents

This section contains information on the following topics:

Introduction

This chapter describes the Cabinet system ac/dc power supplies (NTDK70 (ac), NTDK72 (dc), and NTDK78) reserve power requirements, and the operation of the Power Failure Transfer Unit (PFTU). The NTDK15 power supply for the chassis is described on page 251.

Features of the Cabinet system power supply

Dimensions and weight

The ac/dc and dc power supplies measure approximately 12.5 inches (305 mm) high, 5 inches (127 mm) wide, and 10 inches (245 mm) deep.

The ac power supply weighs approximately 12 lb (5.5 kg), while the dc power supply weighs approximately 8 lb (3.5 kg).

Ac/dc power supply features

The NTDK70 and NTDK78 ac/dc power supply has the following features:

- A current limiting circuit which limits the surge of current on the input line when the system is first switched on.
- Accommodates a reserve power system. The system continues to operate on dc reserve power in case of ac power failure.

  Note: The NTDK70 or NTDK78 ac/dc power supply cannot power up on battery alone. If the NTDK70 or NTDK78 is powered down while operating on dc reserve power, then ac power is required to power up the system.

- Battery charging for the reserve power system. Charging current in a worst-case scenario (when Call Pilot is installed) is 1.0 amp.
- Power (± 15V) for one attendant console.
- Generation of a system line transfer signal and power (-52V) for the Power Failure Transfer Unit (250 MA maximum).

- Differential mode and common mode EMI filtering of input.
- Input power (-52VDC) for the Call Pilot power supply (NTAK13).

Dc power supply features

The dc power supply has the following features:

- Power (± 15V) for one attendant console.
- Generation of a system line transfer signal and power (-52V) for the Power Failure Transfer Unit (250 MA maximum).

Voltage

The ac/dc power supply and the dc power supply provide +5.1, +8.5, +15, -15V, -150V, -52V power supplies and filtered -48V.

There is a 1.0 second start-up delay on the +5V rail.

Ringing generator

The ac/dc power supply and the dc power supply provide the ringing generator for telephones:

- Ringing voltage: 70, 75, 80, 86V.
- Ringing frequency: 20, 25, 50 Hz, switch selectable.
- Ring sync: A pulse 500 us wide, 6 or 11 ms (±3 ms) before the positive going zero crossing of the ringing waveform (11 ms for 20/25 Hz).
- Power: The output capability is 8VA which is capable of ringing 8CA4 ringers.

Power supply LED

The LED on the power supply faceplate labeled “dc” will be turned off whenever there is a problem with the power supply.

Under-voltage

Under-voltage to the ac/dc or dc power supply will result in partial failure of the system. The faceplate LED labeled “dc” will be turned off.

WARNING

Under-voltage, in the case of +5.1V, will result in the complete shutdown of the system.

Table 66 outlines the nominal and under-voltage limits of the power supply.

Table 66
Nominal and under-voltage limits of NTDK70, NTDK72, and NTDK78 power supplies

Nominal	Under-voltage limit	Power supply status
+5.1V	+3.8V	Complete Shutdown
8.5V	+6.4V	Partial failure
-150V	-100.0V	Partial failure
+15V	+11.2V	Partial failure
-15V	-11.2V	Partial failure
-48V	-36.0V	Partial failure
Ring (Pk V)	70V	Partial failure
-52V	-45V	Partial failure

Over-voltage

An OVP (Over-Voltage Protection) circuit will shut down the power supply if the output voltage exceeds the limits given in Table 67.

Table 67
Nominal and over-voltage limits of NTDK70, NTDK72 and NTDK78 power supplies

Nominal voltage	Overvoltage limit	Power supply status
+5.1V	+6.4V	Complete Shutdown
+8.5V	+10.6V	Complete Shutdown
-150V	-187.5V	Complete Shutdown
+15V	+18.7V	Complete Shutdown
-15V	-18.7V	Complete Shutdown
-48V	N/A	N/A
Ring (Pk V)	150V	Complete Shutdown
-52V	-58V	Complete Shutdown

All outputs in a shutdown state are reset by the Small System Controller (SSC) card.

The system power will not automatically reset when there is over-voltage on the -52V dc output. Manual intervention is required. The manual int button is located on the faceplate of the SSC card.

Temperature sensor

The power supplies are sensitive to the temperature of the cabinet and the system power. A thermostat is located at the top of the power supply unit. The ac or dc input breaker will be tripped for temperatures higher than 80°C (176°F).

Reserve power LED

The NTDK70 and NTDK78 ac/dc power supplies oversee the status of the reserve power system. When the breaker on the NTAK28, NTAK75, or NTAK76 breaker assembly trips, the “Batt” LED on the NTDK70 or NTDK78 faceplate is turned off.

PFTU operation

Power is switched over to the Power Failure Transfer Unit (PFTU) during any of the following conditions:

- The CPU sends a signal to the PFTU.
- A power failure occurs.
- A CPU failure occurs.
- The PFTU is manually activated.
- The fiber link to an expansion cabinet fails (PFTU for that cabinet only).

The Cabinet system power supply connects to the PFTU through the AUX connector at the bottom of the main cabinet, and in each expansion cabinet. Table 68 provides the pinouts at the cross-connect terminal for the Auxiliary cable.

Table 68
Auxiliary cable pinouts (Part 1 of 2)

Cable	Signal
BL-W 1 Dot	BRTN
BL-W 2 Dot	BRTN
O-W 1 Dot	-48 V AUX
O-W 2 Dot	PFTS
G-W 1 Dot	-15V AUX
G-W 2 Dot	+15V AUX

Table 68
Auxiliary cable pinouts (Part 2 of 2)

Cable	Signal
BR-W 1 Dot	-
BR-W 2 Dot	-

Reserve power

Discharge requirements

Reserve batteries must be able to provide 500 watts of power to each cabinet. This is a worst-case figure based on the maximum power consumption per cabinet.

Backup options

The options available when backing up the ac-powered Cabinet system are as follows:

- Use customer-supplied batteries along with the NTAK28 breaker assembly.
- Connect an Uninterrupted Power Supply (UPS) to the system.
- Use Nortel Networks supplied NTAK75 or NTAK76 battery units.

WARNING

Always follow the manufacturer's instructions when installing batteries.

Customer-supplied reserve batteries with NTAK28

Customer-supplied batteries can be used as long they meet the requirements set out in Table 69 on page 250. One NTAK28 breaker assembly is required per cabinet.

NTAK75 or NTAK76 battery units

Two battery units are available. The NTAK75 supplies a minimum of two hours backup at full load, while the NTAK76 supplies a minimum of fifteen minutes backup at full load.

Table 69
Reserve battery requirements

Sealed cells	Cell float voltage	String float voltage
23	2.30 – 2.36	52.95 – 54.25
24	2.20 – 2.26	52.95 – 54.25

Uninterrupted Power Supply (UPS)

A 750VA Uninterrupted Power Supply (UPS) may be connected to ac-powered systems in order to provide a continuous supply of ac power.

If two cabinets are equipped, two 750VA UPSs or one 1.5KVA UPS can be used.

Battery charging in ac-powered systems

During normal operation, the ac/dc power supply (NTDK70 or NTDK78) provides a constant float voltage to the reserve batteries. This charger voltage is not adjustable and will not provide equalization voltages. See Table 70.

Table 70
NTDK70 or NTDK78 ac/dc power interface to reserve power systems

	Minimum	Nominal	Maximum
Float Voltage	52.95 Volts	53.6 Volts	54.50 Volts
Charge Current	1.0 Amps	—	7.0 Amps
Note: The charge current available to the reserve batteries depends on the system configuration and the line size.			

Reserve time

Table 71 outlines the Ampere hours required (AHR) per cabinet during a power failure. The reserve times are based on nominal load for a typical installation.

Table 71
Reserve time

Duration of Power Failure	AHRs required per Cabinet system cabinet
30 – 40 minutes	6 AHR
1.5 – 2 hours	12 AHR
3 – 4 hours	25 AHR

Chassis system power supply features

This section describes the Chassis system NTDK15 ac power supply.

Dimensions and weight

The Chassis ac power supply is factory installed in the chassis and is not accessible. The power supply measures approximately 1.75 in. (44 mm) high, 8 in. (203 mm) wide and 10 in. (254 mm) deep, and weighs approximately 3 lb (1.4 kg).

Ac power supply features

The Chassis ac power supply has the following features:

- A current limiting circuit which limits the surge of current on the input line when the system is first switched on.
- All outputs fully regulated.
- Universal 100-240 VAC input.
- 363 Watt total output power.
- Meets CISPR B emission per EN 55022.

- Power status indicator LED is located on the top front left corner of the chassis.

  The green LED indicates all voltages are within specification. The LED is off when one or more voltages are not within specification.

- Ringing voltage: 70, 75, 80, or 86 Vrms depending on DIP switch settings.
- Ringing frequency: 20, 25, or 50 Hz depending on DIP switch settings.

  Note: The DIP switch discussed here is located on the front top plate of the chassis, and can only be accessed with the chassis faceplate removed.

- Cooling is provided by a fan mounted inside the chassis.
- Power: The output capability is 5VA which is capable of ringing 5C4A ringers.
- Provides ring synchronization (zero current crossing) signal.
- Power on/off switch.
- Power status output to CPU.

Voltage

The chassis ac power supply provides +5.1, +8, +15, -15, and -48V. -120V/-150V is selected or disabled by DIP switch settings.

There is a 1.0 second start-up delay on the +5V rail.

Over-voltage

An OVP (Over-Voltage Protection) circuit will shut down all outputs if the +5 V output voltage exceeds the over-voltage threshold.

Under-voltage

An under-voltage protection circuit will shut down all outputs if +5V output is below the under-voltage threshold.

There is a 1.0 minute recovery delay from an under-voltage condition.

Circuit cards

Contents

This section contains information on the following topics:

IP Line card

The IP Line card supports the i2002 and i2004 Internet Telephone and the i2050 Soft Phone. It provides a communication gateway between the IP data network and the Small System. The Internet Telephone translates voice into data packets for transport using Internet Protocol (IP). The Internet Telephone uses the customer's IP network (TLAN) to communicate with the IP Line card and the optional Dynamic Host Configuration Protocol (DHCP) server. A DHCP server is used to provide the required information needed to enable the Internet Telephone network connection and to connect it to the IP Line card.

There are three types of IP Line cards:

- ITG-P 8-port line card
- ITG-P 24-port line card (occupies 2 slots)
- Succession Media Card 8-port or 32-port line card (occupies 1 slot)

These cards running the IP Line 3.00 application are referred to as Voice Media Gateway Cards.

The IP Line card plugs into the Small System's main or IP expansion cabinet or chassis. The IP Line card communicates with the Small System Controller (SSC) card over the ELAN using 10BaseT connectivity.

The IP Line card is administered using multiple management interfaces including:

- IP Line 3.00, a Graphical User Interface (GUI) provided by Optivity Telephony Manager (OTM) 2.00
- Command Line Interface (CLI)
- Administration and maintenance overlays
- Web browser interface provided by Element Manager

Refer to *IP Line: Description, Installation, and Operation* (553-3001-365) and *Circuit Card: Description and Installation* (553-3001-211) for further information about Voice Gateway Media Cards and the IP Line Application.

System Controller cards

Contents

This section contains information on the following topics:

Introduction

This chapter describes the Small System Controller (SSC) card — the NTDK 20 Succession System Controller card.

NTDK20 Succession System Controller card

The NTDK20 Succession System Controller (SSC) card controls call processing, stores system and customer data, and provides various expansion interfaces (see Figure 40 on page 263). The NTDK20 SSC card is comprised of the following components and features:

- Flash daughterboard memory, DRAM and backup memory
- Two expansion daughterboard interfaces
- One PC card socket
- Three Serial Data Interface (SDI) ports

- 32 channels of Conferencing (64 if two single-port expansion daughterboards are present, or 96 if two dual-port expansion daughterboards are present)
- One Ethernet (10 Mbps interface) port
- 30 channels of tone and digit switch (TDS) and a combination of eight Digitone receivers (DTR) or dial tone detectors (XTD)
- Networking and Peripheral Signaling
- Additional tone service ports (four units of MFC/MFE/MFK5/MFK6/ MFR or eight DTR/XTD units)

Memory

The majority of system and customer-configured data is both controlled and stored on the NTDK20 SSC card's flash ROM. An active and backup copy of customer data is also kept on the flash ROM.

Additional memory, referred to as DRAM on the NTDK20 SSC card, stores and processes temporary automated routines and user-programmed commands. The NTDK20 SSC card also retains a copy of customer files in the event of data loss, in an area called the backup flash drive.

The NTDK20 SSC card's flash daughterboard (the NTTK13) performs a significant portion of system software storage and data processing for the Small System.

NTTK13 Software Daughterboard

The NTTK13 is a 48 Mbyte daughterboard comprised of flash ROM and primary flash drive.

- The flash ROM holds 32 Mbytes of ROM memory, comprising operating system data and overlay programs.
- The primary flash drive resides on the remaining 16MB of flash space, which provides 14.7MB of formatted storage. This is used to store customer data, patches, log files and other system data.

The boot code on existing SSC cards must be NTDK34FA Release 7 or later to support the NTDK81 or NTTK13 Flash Daughterboards. It is recommended that the boot code be upgraded to the latest issue every time the software is upgraded. The boot code can be found on the programmed PC card.

> ***Note:*** New Small Systems will have the latest version of software preprogrammed on the Software Daughterboard.

Other system data, such as the Secure Storage Area (SSA), also resides in the flash drive. The SSA holds data that must survive power-downs.

Boot ROM is a 2 Mbyte storage device located on the NTDK20 SSC card's motherboard. It is comprised of boot code, system data, patch data, and the backup copy of the primary flash drive's customer database.

The NTDK20 SSC card is equipped with 16 Mbytes of temporary memory space called DRAM. DRAM functions much like RAM on a computer system, whereby system and user files are stored while the system is up and running. DRAM on the Small System stores operating system files, overlay data, patch codes, and the active copy of the customer database.

Expansion daughterboards

Expansion daughterboards mounted on the NTDK20 SSC card (Figure 40 on page 263) allow the connection of the main cabinet or chassis to expansion cabinets or chassis in multi-cabinet/chassis Small Systems. Each port on each daughterboard also provides an additional 16-channel conference loop and up to 3 SDI ports on the expansion cabinet or chassis. Table 72 on page 259 provides the ports, cables, and connection data on the expansion daughterboards. A description of and purpose for each daughterboard is given below:

- The NTDK22 Fiber Expansion Daughterboard is used when the expansion cabinet or chassis is within 10 m (33 ft) of the main cabinet or chassis. It connects to one A0618443 plastic cable. One of these boards is required for each fiber expansion cabinet or chassis located within 10 m (33 ft) of the main cabinet or chassis that is to be connected using the A0618443 Fiber Optic plastic cable.

- The NTDK84 Fiber Expansion Daughterboard has the same features as the NTDK22 except that it can interface with two expansion cabinets or chassis.
- The NTDK24 Fiber Expansion Daughterboard is used when the expansion cabinet or chassis is up to 3 km (1.8 mi) of the main cabinet or chassis. It connects to one glass multi-mode fiber optic cable which is dedicated to the Small System.
  One NTDK24 daughterboard is required for each expansion cabinet or chassis located up to 3 km (1.8 mi) of the main cabinet or chassis.
- The NTDK85 Fiber Expansion Daughterboard has the same features as the NTDK24 except that it can interface with two expansion cabinets or chassis.
- The NTDK79 Fiber Expansion Daughterboard provides the same functions as the NTDK24 except that it connects to single mode glass fiber optic cable.
- The NTDK99 (single-port) and NTDK83 (dual-port) 100BaseT IP Expansion Daughterboards provide connectivity to IP expansion cabinets or chassis located within 100 m.
- The NTTK01 (single-port) and NTTK02 (dual-port) 100BaseF IP Expansion Daughterboards provide connectivity to IP expansion cabinets or chassis located within 2 km.

  Note: Third-party media conversion devices can be used to extend the range of IP expansion cabinets or chassis from the main cabinet or chassis. Refer to later in this chapter for more information.

A sample of these daughterboards is shown in Figure 37 on page 260.

Table 72
Expansion Daughterboards

Daughterboard	Number of ports	Cable type	Max. distance between main and expansion cabinets/chassis
NTDK22	one	A0618443 fiber optic plastic cable	10 m (33 ft)
NTDK84	two		
NTDK24	one	glass fiber optic cable	3 km (1.8 mi)
NTDK85	two		
NTDK79	one	single mode glass fiber optic cable	
NTDK99	one	100baseT cable (see “EMC grounding clip” on page 259)	100 m (328 ft.), or over 20 km (12 mi) with a third party converter
NTDK83	two		
NTTK01	one	100baseF fiber optic cable	2 km (1.2 mi), or over 20 km (12 mi) with a third-party converter
NTTK02	two		

EMC grounding clip

Cabinets and chassis connected with 100BaseT IP connectivity must route the cables though the EMC grounding clip. This ensures electrical contact between the ground rail and 100BaseT cable for EMC containment.

The NTDK41AA EMC grounding clip is used on the Cabinet system on each IP expansion cabinet.

The NTTK43AA EMC grounding clip is used on the chassis and IP expansion chassis.

Figure 37
Expansion Daughterboards

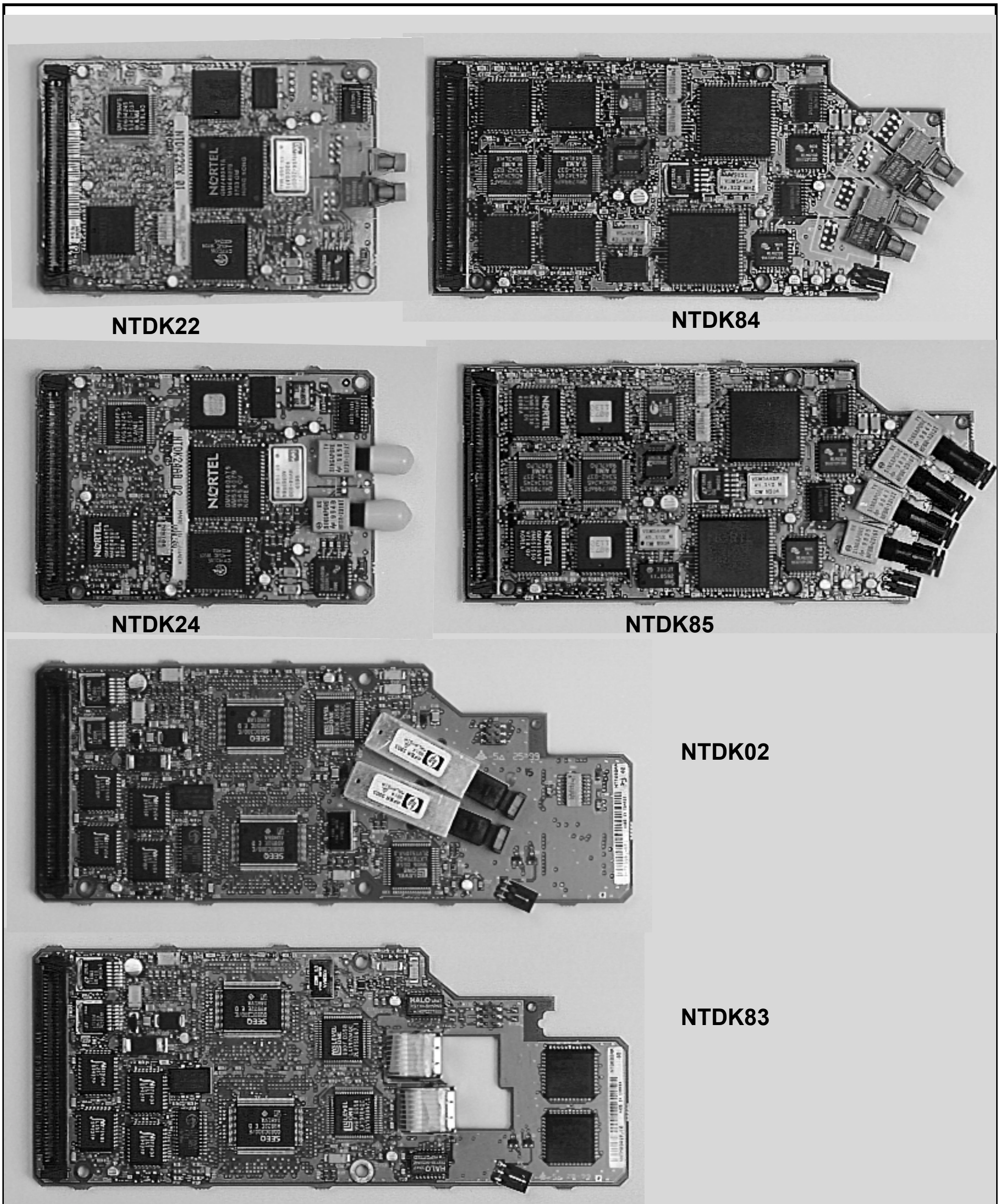


Figure 38
EMC grounding clip on main cabinet

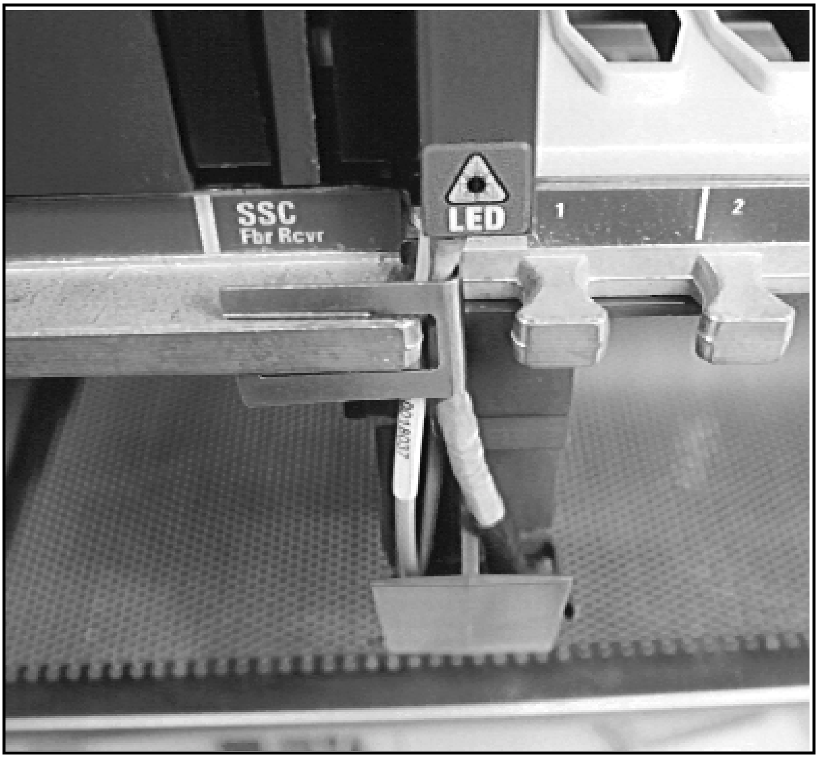
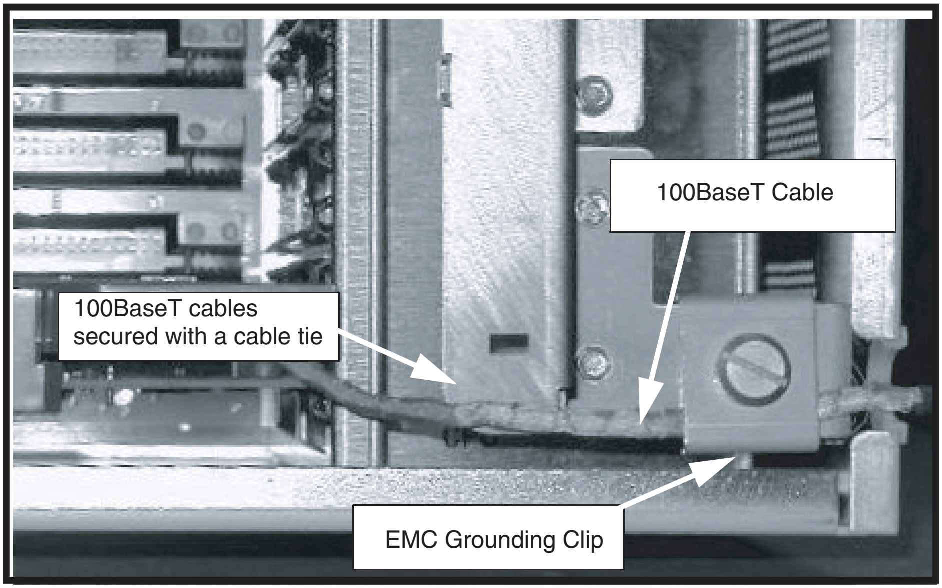


Figure 39
EMC grounding clip on chassis

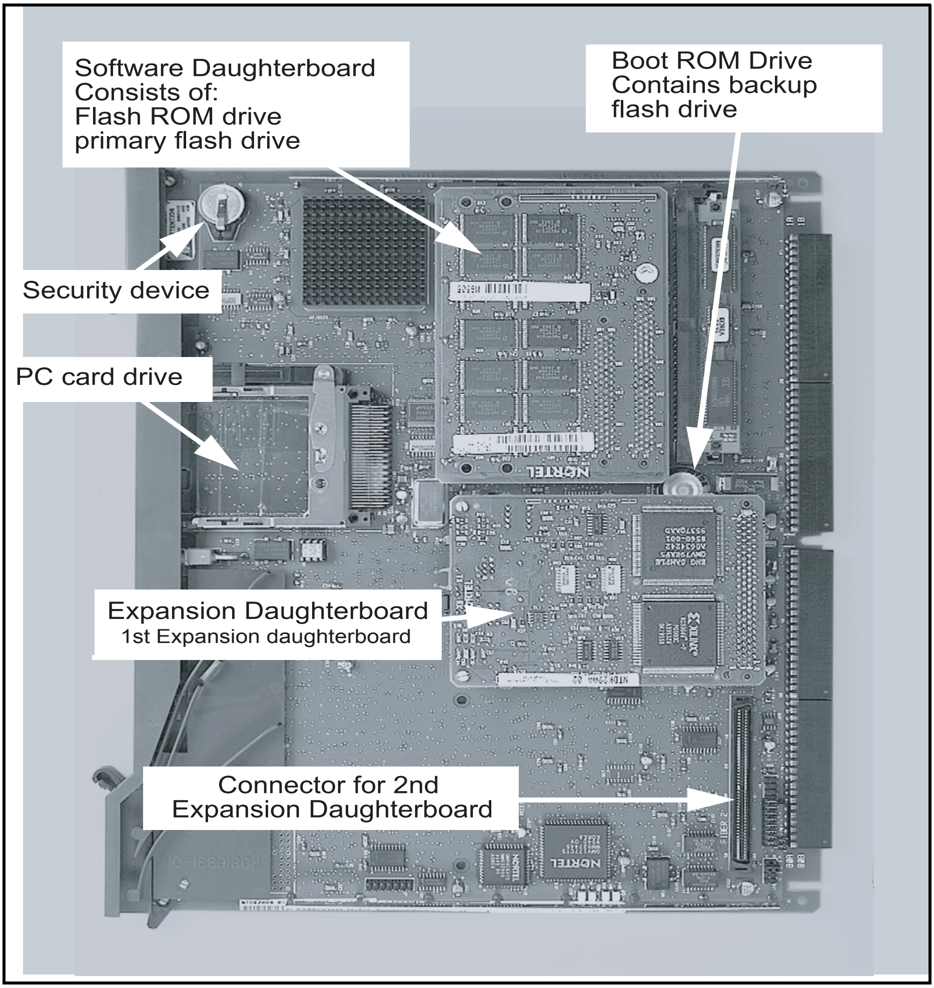


WARNING

Use of the EMC grounding clip is required for EMC compliance.

For further information or installation instructions, refer to *Small System: Installation and Configuration* (553-3011-210).

Figure 40
NTDK20 SSC card and expansion daughterboard



Fiber Receiver cards

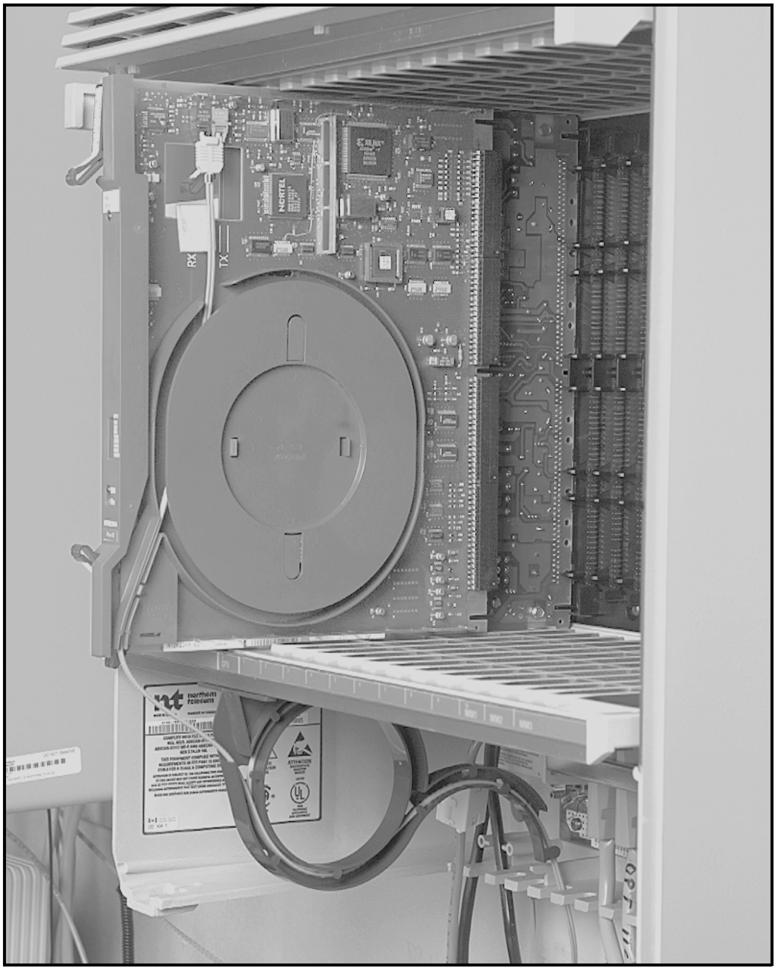
Fiber Receiver cards in fiber expansion cabinets or chassis allow for fiber connectivity between the main cabinet or chassis and up to four fiber expansion cabinets/chassis.

There are three versions of the Fiber Receiver card, each of which has a corresponding fiber daughterboard:

1. The NTDK23 Fiber Receiver card is used when the expansion cabinet or chassis is within 10 m (33 ft) of the main cabinet or chassis. It connects to one A0618443 fiber optic plastic cable.
2. The NTDK25 Fiber Receiver card is used when the expansion cabinet or chassis is between 10 m (33 ft) and 3 km (1.8 mi) of the main cabinet or chassis. It connects to one glass multi-mode fiber optic cable which is dedicated to the Small System.

The NTDK80 Fiber Receiver card provides the same functions as the NTDK25 except that it connects to single mode fiber optic cable and is used for connections over 3 km.

Figure 41
Fiber Receiver card in fiber expansion cabinet (NTDK23 shown)



PC card interface

The NTDK20 SSC card has a PC card interface through a socket located on its faceplate. The PC card socket can accommodate a Software Delivery card used for software upgrading and as backup media.

Security device for the IP expansion

The SSC card on the Small System must contain an NTDK57AA security device, which is keycoded to match the NTDK57DA security device on each IP expansion.

This maintains the requirement of a single keycode for each Small System with survivable IP expansion cabinets or chassis. The main objectives of this security scheme are the following:

1 Allow the system to operate as a single system when all links are up.

2 Allow the survivable IP expansion cabinet or chassis to continue operating with its existing configuration in the event of a failure of the main cabinet or chassis, or of the link to the main.

3 Prevent users from configuring or using more TNs or features than have been authorized.

The IP expansion cabinet or chassis security device provides the following capabilities at the expansion cabinet or chassis:

- System software can be installed but no calls will be processed or features activated until communication with a main has been established and a match between the security ID of the main and the IP expansion cabinet or chassis has been confirmed.
- System software can be upgraded.
- Local datadump is not permitted, as well as all LD 43 and LD 143 commands.

SDI ports

The NTDK20 SSC card contains three SDI ports used to connect on-site terminals or remote terminals through a modem. The default settings on the ports are as follows:

Table 73
Default SDI port settings on the NTDK20 SSC card

TTY Port	Baud rate	Data bits	Stop bits	Parity	Use
0	Set by a DIP switch	8	1	None	MTC/SCH/BUG
1	1200	8	1	None	MTC/SCH/BUG
2	1200	8	1	None	MTC/SCH/BUG

Conferencing

Thirty-two conference channels are provided by the NTDK20 SSC card's conference devices. Conference capability can be increased by mounting expansion daughterboards on the NTDK20 SSC card. Each daughterboard increases the total number of conference channels by 16: the maximum number of conference ports is 64.

Each conference device provides 16 ports of conferencing capabilities (one conference participant for each port). A conference call can have three to six participants. To illustrate, you can have a maximum of five 3-party conferences for each device, or two 6-party conferences plus one 3-party conference. It is not possible to conference between conference devices.

IP expansion 10BaseT port

The Small System provides one 10 Mbps Ethernet connection to a Local Area Network (LAN). The 10BaseT Ethernet port available on the SSC of an IP expansion cabinet or chassis is functional. However, the Ethernet port on the IP expansion cabinet or chassis does not have a default IP configuration. This means that the IP port configuration must be performed before it can be used.

It is not recommended to use the remote 10BaseT port in normal mode, as maintenance or alarm management are not available. In survival mode it assumes the system-level configuration of the main cabinet or chassis port.

External connection to the Ethernet port is provided by a 50-pin connector located in the main cabinet. An NTDK27 Ethernet Adaptor cable adapts this 50-pin connector to the standard 15-pin AUI interface for a Medium Access Unit (MAU).

The chassis system has a standard 15-pin AUI interface for a MAU to be connected.

Network Switching and signaling on the Cabinet system

The Cabinet System has thirty DS-30X loops. The main cabinet accommodates the first ten loops, the first expansion cabinet accommodates the second ten loops, the second expansion cabinet provides the third ten, the third expansion cabinet provides the fourth ten, and the fourth expansion cabinet provides the fifth ten.

Each IPE circuit card has a loop entirely dedicated to it. Every group of four IPE card slots is programmed as an individual superloop. The superloop configuration is as follows:

Table 74
Cabinet system superloops

Main Cabinet			First Expansion Cabinet			Second Expansion Cabinet			Third Expansion Cabinet			Fourth Expansion Cabinet		
CS	CL	SL	CS	CL	SL	CS	CL	SL	CS	CL	SL	CS	CL	SL
1	20	0	11	—	8	21	—	32	31	—	40	41	—	64
2	21	0	12		8	22		32	32		40	42		64
3	22	0	13		12	23		32	33		44	43		64
4	23	0	14		12	24		32	34		44	44		64
5	24	4	15		12	25		36	35		44	45		68
6	25	4	16		12	26		36	36		44	46		68
7	26	4	17		16	27		36	37		48	47		68
8	27	4	18		16	28		36	38		48	48		68
9	28	8	19		16	29		40	39		48	49		72
10		8	20		16	30		40	40		48	50		72
CS = Card Slot, CL = CE Loop, SL = Super Loop														

There are a total of 640 timeslots (channels) for each Cabinet system. Each superloop provides 120 timeslots, while an IPE slot provides 30 timeslots.

Tone services

The NTDK20 SSC card incorporates the functions of the existing NTAK03 TDS/DTR, NT5K20 XTD, and NT5K48 XTD cards.

SDI ports

Contents

This section contains information on the following topics:

Introduction

This chapter describes the ports on the Small System. Serial Data Interface (SDI) ports are used to connect devices, such as terminals and modems to the Small System. The two types of SDI ports supported are:

- Data Terminal Equipment (DTE); typically a TTY or computer
- Data Communication Equipment (DCE); typically a modem

SDI ports are found on the SSC card, the optional TDS/DTR card, and the optional SDI/DCH card. An additional SDI port is located on the Fiber Receiver card to allow remote TTY access.

The possible Small System SDI port configurations are summarized in Table 75.

Table 75
SDI Port configurations

Circuit Card	Number of Ports	DTE	DCE	RS232	RS422
SSC NTDK20	3	Yes	No	Port 0	No
TDS/DTR NTAK03	2	Ports 0/1	No	Ports 0/1	No
SDI/DCH NTAK02	4	Ports 0/1/ 2/3	Ports 0/1/ 2/3	Ports 0/1/ 2/3	Ports 1/3
NTDK23 Fbr Rcvr card	1	Yes	No	Yes	No
NTDK25 and NTDK80 Fbr Rcvr card	1	Yes	No	Yes	No

System controller cards

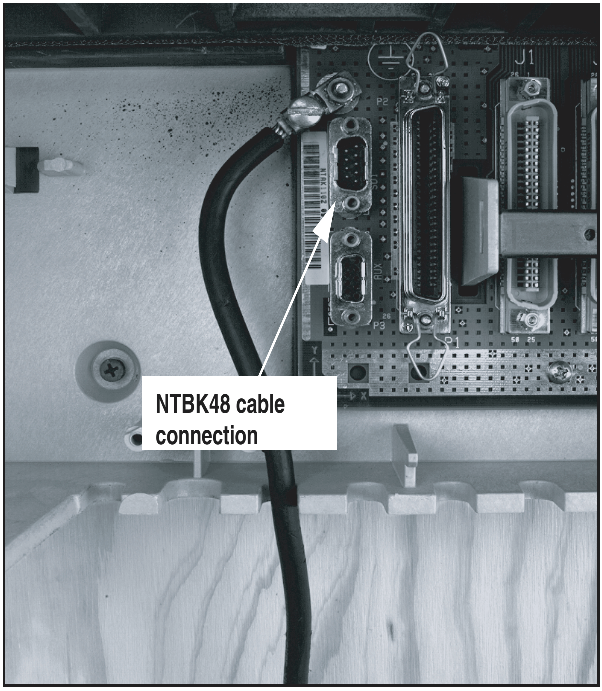
The NTDK20 Small System Controller card (used with Cabinet and Chassis systems) is equipped with three SDI ports.

Each port can be used to connect a modem or terminal to the system. If connection to a terminal is desired, an A0378652 NO modem (NULL modem without hardware handshaking) is required.

For the Cabinet system, the SDI port connector is located at the bottom rear of the cabinet next to the connectors to the cross-connect terminal. (An

NTBK48 three-port cable is required to connect to system equipment.) Refer to Figure 42.

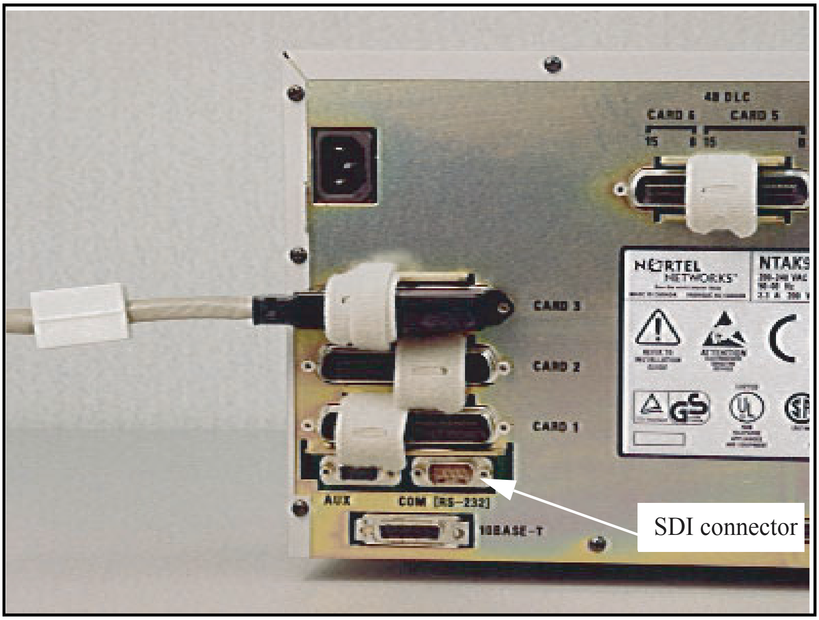
Figure 42
Cabinet SDI cable connector



For the Chassis System, the SDI port connector is located on the bottom left side at the rear of the chassis.

The baud rate for port 0 is selected by setting switches on the faceplate of the SSC card. Baud rates for ports 1 and 2 are set using overlay programs.

Figure 43
Chassis SDI cable connector



The baud rates available on all three ports are 300, 600, 1200, 2400, 4800, and 19200 baud.

Table 76
Default port configuration

TTY Number	Card	Port	Use	Configuration
0	0	0	MTC/SCH/BUG	1200/8/1/NONE
1	0	1	MTC/SCH/BUG	1200/8/1/NONE
2	0	2	CTY	1200/8/1/NONE

NTAK03 TDS/DTR card

Table 77 shows the default settings.

Table 77
Default port configuration

TTY Number	Card	Port	Use	Configuration
0	0	0	MTC/SCH/BUG	1200/8/1/NONE
1	0	1	MTC/SCH/BUG	1200/8/1/NONE
2	0	2	CTY	1200/8/1/NONE

The NTAK03 TDS/DTR card is replaced by the NTDK20 SSC card in Small Systems. However, it is still supported and can be retained to gain access to extra ports.

Connecting to the ports

The methods by which external devices can be connected to the TDS/DTR card are:

- Use the NTAK19EC two-port SDI cable. The NTAK19EC cable does not have to be terminated at the cross-connect terminal since it is equipped with connectors.
- Use the NE-A25-B cable and terminate it at the cross-connect terminal. Tables 78 and 79 give the pinouts for the TDS/DTR card.

Table 78
NTAK03 connections at the cross-connect terminal— Port 0

Pair	Color	Signal	Designations I=input O=output
1T 1R	W-BL BL-W	DSR DCD	I I
2T 2R	W-O O-W	- DTR	- O
3T 3R	W-G G-W	RTS CTS	O I
4T 4R	W-BR BR-W	RX TX	I O
5T 5R	W-S S-W	SG -	O -

Table 79
NTAK03 connections at the cross-connect terminal— Port 1 (Part 1 of 2)

Pair	Color	Signal	Designations I = input O = output
6T 6R	R-BL BL-R	DSR -	I -
7T 7R	R-O O-R	- DTR	- O
8T 8R	R-G G-R	RTS CTS	O I
11T 11R	BK-BL BL-BK	RX TX	I O

Table 79
NTAK03 connections at the cross-connect terminal— Port 1 (Part 2 of 2)

Pair	Color	Signal	Designations I = input O = output
13T 13R	BK-G G-BK	- DCD	- I
22T 22R	V-O O-V	SG -	O -

Other pertinent information on the TDS/DTR ports is given below:

- **Baud rates**: 00; 600; 1200; 2400; 4800; 9600; 19,200
  Default 1200.
- **Data bits**: 5, 6, 7, 8
  Default 8.
- **Parity**: none, odd, even.
  Default none.
- **Stop bits**: 1, 1.5, 2
  Default 1
- **Flow control**: none, XON/XOFF, CTS/RTS
  Default none.

NTAK02 SDI/DCH card

The optional SDI/DCH card provides a maximum of four serial I/O ports, which are grouped into two pairs:

- port 0 and port 1
- port 2 and port 3

Ports 1 and 3 may be configured as DCH or ESDI. Ports 0 and 2 may only be configured as SDI. Each pair is controlled by a switch, as shown in Table 80.

Table 80
Switch settings

Port 0	Port 1	SW 1-1	SW 1-2
SDI	DCH/DPNSS	OFF	OFF
SDI	DCH/DPNSS	OFF	ON
—	ESDI	ON	ON

Port 2	Port 3	SW 1-3	SW 1-4
SDI	DCH/DPNSS	OFF	OFF
SDI	DCH/DPNSS	OFF	ON
—	ESDI	ON	ON

In the UK, Digital Private Network Signaling System (DPNSS) can replace the DCH function.

Two ports offer the option for DTE/DCE configuration. This option is selected from a jumper on the card. Table 81 shows the jumper settings:

Table 81
Jumper settings

Port	Jumper location	Strap for DTE	Strap for DCE	Jumper location	RS422	RS232
0	J10	C - B	B - A			
1	J7 J6	C - B C - B	B - A B - A	J9 J8	C - B C - B	B - A B - A
2	J5	C - B	B - A			
3	J4 J3	C - B C - B	B - A B - A	J2 J1	C - B C - B	B - A B - A

Connecting to the ports

The methods by which external devices can be connected to the SDI/DCH card are:

- Use the NTAK19FB four-port SDI cable. This cable does not have to be terminated at the cross-connect terminal since it is equipped with connectors.
- Use the NE-A25-B cable and terminate it at the cross-connect terminal. Tables 82 through 85 give the pinouts for the SDI/DCH card.

Table 82
NTAK02 pinouts — Port 0 at the cross-connect terminal

RS232					
Cable		Signal		Designations I = input O = output	
Pair	Color	DTE	DCE	DTE	DCE
1T 1R	W-BL BL-W	0 DTR	0 DCD	- O	- I
2T 2R	W-O O-W	DSR DCD	CH/CI DTR	I I	O O
3T 3R	W-G G-W	RTS CTS	CTS RTS	O I	I O
4T 4R	W-BR BR-W	RX TX	TX RX	I O	O I
5T 5R	W-S S-W	- SG	- SG	- -	- -

Table 83
NTAK02 connections at the cross-connect terminal — Port 1

RS422						RS232			
Cable		**Signal**		**Designations** **I = input** **O = output**		**Designations** **I = input** **O = output**		**Signal**	
Pair	**Color**	**DTE**	**DCE**	**DTE**	**DCE**	**DTE**	**DCE**	**DTE**	**DCE**
5T 5R	W-S S-W	SCTEA -	SCTA -	O -	I -	O -	I -	SCT -	SCT -
6T 6R	R-BL BL-R	SCTEB DTR	SCTB DCD	O O	I I	- -	- -	CH/CI DTR	- DCD
7T 7R	R-O O-R	DSR DCD	CH/CI DTR	I I	O O	I I	O O	DSR DCD	CH/CI DTR
8T 8R	R-G G-R	RTS CTS	CTS RTS	O I	I O	O I	I O	RTS CTS	CTS RTS
9T 9R	R-BR BR-R	SCRA SCTA	SCTEA RXCA	I I	O O	I I	O O	SCR SCT	SCT -
10T 10R	R-S S-R	SCRB SCTB	SCTEB RXCB	I I	O O	- -	- -	- -	- -
11T 11R	BK-BL BL-BK	RXDA TXDA	TXDA RXDA	I O	O I	I O	O I	RXD TXD	TXD RXD
12T 12R	BK-O O-BK	RXDB TXDB	TXDB RXDB	I O	O I	- -	- -	- -	- -
25T 25R	V-S S-V	SG -	SG -	- -	- -	- -	- -	SG -	SG -

Table 84
NTAK02 connections at the cross-connect terminal — Port 2

RS422						RS232			
Cable		Signal		Designations I = input O = output		Designations I = input O = output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
13T 13R	BK-G G-BK			- -	- -	- O	- I	- DTR	- DCD
14T 14R	BK-BR BR-BK			- -	- -	I I	O O	DSR DCD	CH/CI DTR
15T 15R	BK-S S-BK			- -	- -	O I	I O	RTS CTS	CTS RTS
16T 16R	Y-BL BL-Y			- -	- -	I O	O I	RX TX	TXD RXD
17T 17R	Y-O O-Y			O -	I -	O -	I -	- SG	- SG

Table 85
NTAK02 connections at the cross-connect terminal — Port 3 (Part 1 of 2)

RS422						RS232			
Cable		Signal		Designations I = input O = output		Designations I = input O = output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
17T 17R	Y-O O-Y	SCTEA -	SCTA -	O -	I -	O -	I -	SCT -	SCT -

Table 85
NTAK02 connections at the cross-connect terminal — Port 3 (Part 2 of 2)

RS422						RS232			
Cable		Signal		Designations I = input O = output		Designations I = input O = output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
18T 18R	Y-G G-Y	SCTEB DTR	SCTB DCD	O O	I I	- -	- -	CH/CI DTR	- DCD
19T 19R	Y-BR BR-Y	DSR DCD	CH/CI DTR	I I	O O	I I	O O	DSR DCD	CH/CI DTR
20T 20R	Y-S S-Y	RTS CTS	CTS RTS	O I	I O	O I	I O	RTS CTS	CTS RTS
21T 21R	V-BL BL-V	SCRA SCTA	SCTEA RXCA	I I	O O	I I	O O	SCR SCT	SCT -
22T 22R	V-O O-V	SCRB SCTB	SCTEB RXCB	I I	O O	- -	- -	- -	- -
23T 23R	V-G G-V	RXDA TXDA	TXDA RXDA	I O	O I	I O	O I	RXD TXD	TXD RXD
24T 24R	V-BR BR-V	RXDB TXDB	TXDB RXDB	I O	O I	- -	- -	- -	- -
25T 25R	V-S S-V	- SG	- SG	- -	- -	- -	- -	SG -	SG -

Characteristics of the low-speed port

Ports 0 and 2 are asynchronous, low-speed ports. They transfer data to and from the line one bit at a time.

The characteristics of the low-speed port are as follows:

- **Baud rate:** 300; 600; 1200; 2400; 4800; 9600; 19,200
  Default 1200.

- **Parity:** Odd, even, none.
  Default none.
- **Stop bits**: 1, 1.5, 2
  Default 1
- **Flow control**: XON/XOFF, CTS, none.
  Default none.
- **Duplex:** Full.
- **Interface**: RS-232-D
- **Data bits**: 5, 6, 7, 8
  Default 8.

Characteristics of the high-speed port

Ports 1 and 3 are synchronous, high-speed ports with the following characteristics:

- **Baud rate**: 1200; 2400; 4800; 9600; 19,200; 56,000; 64,000.
- **Data bit**: Transparent (1).
- **Duplex**: Full.
- **Clock**: Internal or external.
- **Interface**: RS-232-D, RS-422-A.

ESDI settings

Port 9 is preprogrammed as an ESDI port and supports Meridian Mail and Call Pilot. It functions as a Command Status Link with settings as shown in Table 86.

Table 86
ESDI settings (Part 1 of 2)

Setting	Code
ESDI	YES
SYNC	YES

Table 86
ESDI settings (Part 2 of 2)

Setting	Code
DUPX	FULL
BPS	4800
CLOK	EXT
IADR	003
RADR	001
T1	10
T2	002
T3	040
N1	128
N2	08
K	7
RXMT	05
CRC	10
ORUR	005
ABOR	005
USER	CMS

NTDK23, NTDK25, and NTDK80 Fiber Receiver cards

The NTDK23, NTDK25, and NTDK80 Receiver cards used in Small System support one SDI port.

Parameter settings

Baud rates are selected by setting switches located in the faceplate of each Fiber Receiver card. The available settings are:

- 150, 300, 600, 1200, 2400, 4800, 9600 and 19200 baud

Other RS232 parameters are fixed as shown in Table 87.

Table 87
Fixed parameter settings

Parameter	Setting
Parity	None
Mode	Asynchronous
Stop Bits	1
Data Bits	8

The port can be used for MTC/SCH/BUG modes.

Connection to external equipment

The connection to external devices (such as TTYs, modems and so on) is achieved through the nine-pin SDI connector located in the expansion cabinet. It is extended to the external equipment with an NTAK1118 single-port SDI cable.

Cable specifications and interfaces

Contents

This section contains information on the following topics:

Introduction

This chapter describes the fiber optic cable interface equipment used with Small Systems.

Through the use of fiber optic cable and fiber optic cable interfaces, the expansion cabinets or chassis can be located at various distances from the main cabinet or chassis. The expansion cabinets or chassis can be located up to 3 km (1.8 mi) from the main cabinet.

With the use of dual port Fiber Expansion Daughterboards, up to four expansion cabinets or chassis can be supported. These dual port Fiber Expansion Daughterboards are also available in two versions for local and remote location expansion configurations.

Note 1: The distance between cabinets or chassis is determined by the length of the fiber optic cable.

Note 2: With 100baseF Expansion Daughterboards and third party converters, the distance can be extended to more than 20 km.

Small System fiber optic cable interfaces

Fiber optic interface hardware consists of Fiber Expansion Daughterboards mounted on the NTDK20 Small System Controller (SSC) card in the main cabinet or chassis and Fiber Receiver cards mounted in the expansion cabinets or chassis.

Note 1: Any reference to cabinets in this section equally applies to chassis if you are using them in your fiber or IP expansion system.

Note 2: The MFI and EFI units used with Option 11E to interface with fiber optic cable cannot be used with the Small System.

Fiber Expansion Daughterboards

Fiber Expansion Daughterboards mounted on the NTDK20 SSC card allow the connection of fiber optic cables from the main cabinet to expansion cabinets in multi-cabinet systems. Each daughterboard also provides an additional 16-channel conference loop and one SDI port at the expansion cabinet. There are five types:

- The NTDK22 Fiber Expansion Daughterboard
- The NTDK24 Fiber Expansion Daughterboard
- The NTDK79 Fiber Expansion Daughterboard
- The NTDK84 Fiber Expansion Daughterboard
- The NTDK85 Fiber Expansion Daughterboard

NTDK22 Fiber Expansion Daughterboard

The NTDK22 Fiber Expansion Daughterboard is used when the expansion cabinet is within 10 m (33 ft) of the main cabinet. It connects to one A0632902 Fiber Optic cable (multimode).

One of these boards is required for each expansion cabinet located within 10 m (33 ft) of the main cabinet.

NTDK24 Fiber Expansion Daughterboard

The NTDK24 Fiber Expansion Daughterboard is used when the expansion cabinet is up to 3 km (1.8 mi) of the main cabinet. It connects to one glass multimode fiber optic cable which is dedicated to the system.
One of these boards is required for each expansion cabinet located up to 3 km (1.8 mi) of the main cabinet. The NTDK24 Fiber Expansion Daughterboard works in conjunction with an NTDK25 Fiber Receiver card in the expansion cabinet.

> ***Note:*** The NTDK24 supports only Multimode glass fiber optic cable.

NTDK79 Fiber Expansion Daughterboard

The NTDK79 Fiber Expansion Daughterboard has the same features as the NTDK24 except that:

- it requires Single Mode glass fiber optic cable
- it works in conjunction with an NTDK80 Fiber Receiver card in the expansion cabinet instead of an NTDK25 card.

> ***Note:*** The NTDK79 supports only Single Mode glass fiber optic cable.

NTDK84 Fiber Expansion Daughterboard

The NTDK84 Fiber Expansion Daughterboard has the same features as the NTDK22 except that it can interface with two expansion cabinets.

NTDK85 Fiber Expansion Daughterboard

The NTDK85 Fiber Expansion Daughterboard has the same features as the NTDK24 except that it can interface with two expansion cabinets.

Fiber Receiver cards

Fiber Receiver cards installed in the Fbr Rx slot (slot 0) of expansion cabinets allow the connection of fiber optic cables from the main cabinet. There are three types:

- The NTDK23 Fiber Receiver card
- The NTDK25 Fiber Receiver card
- The NTDK80 Fiber Receiver card

NTDK23 Fiber Receiver card

The NTDK23 Fiber Receiver card is used when the expansion cabinet is within 10 m (33 ft) of the main cabinet. It connects to one A0618443 Fiber Optic cable.

One of these cards is required for each expansion cabinet located within 10 m (33 ft) of the main cabinet. The NTDK23 Fiber Receiver card works in conjunction with either an NTDK22 or an NTDK84 Fiber Expansion Daughterboard in the main cabinet.

NTDK25 Fiber Receiver card

The NTDK25 Fiber Receiver card is used when the expansion cabinet is located up to 3 km (1.8 mi) of the main cabinet. It connects to one multimode glass fiber optic cable which is dedicated to the system. One of these cards is required for each expansion cabinet located up to 3 km (1.8 mi) of the main cabinet, connected by multimode fiber optic cable. The NTDK25 Fiber Receiver card works in conjunction with either an NTDK24 or an NTDK85 Fiber Expansion Daughterboard in the main cabinet.

> ***Note:*** The NTDK24 supports only Multimode glass fiber optic cable.

NTDK80 Fiber Receiver card

The NTDK80 Fiber Receiver card has the same features as the NTDK25 except that:

- it requires Single Mode glass fiber optic cable
- it works in conjunction with an NTDK79 Fiber Expansion Daughterboard in the main cabinet instead of an NTDK24 card.

Note: The NTDK80 supports only Single Mode glass fiber optic cable.

SDI Port

Each Fiber Receiver card supports one Serial Data Interface (SDI) port allowing remote TTY access.

Expansion Daughterboards for IP connectivity

- The NTDK83 dual port 100baseT IP daughterboard
- The NTDK99 single-port 100baseT IP daughterboard
- The NTTK01 single-port 100baseF IP daughterboard
- The NTTK02 dual port 100baseF IP daughterboard

NTDK83 dual port 100baseT IP daughterboard

The NTDK83 dual port 100baseT IP daughterboard has two 100BaseT IP ports, and can be used to connect Point to Point or to a campus data network.

NTDK99 single-port 100baseT IP daughterboard

The NTDK99 single-port 100baseT IP daughterboard has one 100BaseT IP port, and can be used to connect Point to Point or to a campus data network.

NTTK01 single-port 100baseF IP daughterboard

The NTTK01 single-port 100baseF IP daughterboard has one 100BaseF IP port, and can be used to connect Point to Point or to a campus data network with glass fiber optic cable. This is the glass fiber optic cable version of the NTDK99 described above.

NTTK02 dual port 100baseF IP daughterboard

The NTTK02 dual port 100baseF IP daughterboard has two 100BaseF IP ports, and can be used to connect Point to Point or to the campus data network with glass multimode optic cable. This is the glass fiber optic cable version of the NTDK83 described above.

Fiber optic cable

Cabinets can be located up to 3 km (1.8 mi) from the main cabinet by using fiber optic cable. There are three types of connections:

- Plastic Fiber Optic cable
- Glass Fiber Optic cable
- IP connector cables

Plastic fiber optic cable (Multi-mode)

The A0632902 fiber optic cable is a 10 m (33 ft) plastic fiber cable which is used when the expansion cabinet is located 10 m (33 ft) or less from the main cabinet. This cable comes equipped with a connector on each end which connect to either the NTDK22 or NTDK84 Daughterboard in the main cabinet and to the NTDK23 Fiber Receiver card in the expansion cabinet. Excess cable is stored by means of cable management devices in the cabinets. This cable, which is the only cable that can be used for this purpose, is not intended to be cut or altered in the field.

Glass Fiber Optic cable

Glass fiber optic cable (Multimode or Single Mode, depending on interface cards) is required when the cable length between the main cabinet and an expansion cabinet is up to 3 km (1.8 mi).

> ***Note:*** The distance between the main cabinet and expansion cabinet is determined by the length of the fiber optic cable — not by linear distance.

This glass fiber cable, which is supplied by a local telephone company or other facilities provider, must be dedicated to the system cannot be shared with other services).

A connector is required on each end of the cable to connect to the NTDK24 (Multimode), NTDK85 (Multimode), or NTDK79 (Single Mode) Daughterboard in the main cabinet and to the NTDK25 (Multimode) or NTDK80 (Single Mode) Receiver card in the expansion cabinet. Excess cable is stored by means of cable management devices in the cabinets.

Note: The Small System fiber optic link for distances up to 3 km (1.8 mi) uses the industry standard 62.5/125 µm glass multimode duplex cable or 8/125 µm glass single mode cable with ST-type connectors.

The type of cable used depends on the type of installation and any local building codes.

Table 88 lists the minimum optical requirements for Multimode and Single Mode glass fiber optic cable.

Table 88
Multimode glass optical cable requirements

Parameter	Minimum	Typical	Maximum	Units
Glass Fiber Cable Length			3.0 (see Note)	km
Cable Attenuation @1300 nm		1.5	2.0	dB/km
Modal Bandwidth @1300 nm	200	500		MHz * km
Chromatic Dispersion @1300 nm		6		ps/nm * km
Typical 3dB Optical Bandwidth		180		MHz * km
Splice Attenuation		0.1	0.2	dB
Coupler Attenuation		0.5	0.5	dB
Power Budget			8	dB

Note: The fiber link should be limited to a maximum length of 3 km, even though with many optical cables the optical power budget could support greater lengths. To guarantee reliable operation, a bandwidth of 150% should be maintained. If the link is increased beyond the 3 km length, the 150% margin deteriorates resulting in a possible link malfunction.

Table 89
Single mode glass optical cable requirements

Parameter	Minimum	Typical	Maximum	Units
Cable Attenuation		0.4	0.5	dB/km
Splice Attenuation		0.1	0.2	dB
Coupler Attenuation		0.2	0.5	dB
Power Budget			5	dB
Glass Fiber Length			3 (see Note)	km
Note: The fiber link should be limited to a maximum length of 3 km, even though with many optical cables the optical power budget could support greater lengths. To guarantee reliable operation, a bandwidth of 150% should be maintained. If the link is increased beyond the 3 km length, the 150% margin deteriorates resulting in a possible link malfunction.				

IP connector cables

IP-expanded systems require the following cables.

Table 90
IP connector cables

Daughterboards	Cable	Cable description
NTDK83 and NTDK99 100baseT IP	NTTK34AA / AO793725	10m RJ45 CAT 5 cable
	NTDK8305 / AO781621	2m STP CAT 5 extension cable
NTTK01 and NTTK02 100baseF IP	AO817052	5 m MT-RJ to ST cable.
	A0346816	ST fiber coupler
	AO817055	10m MT-RJ to MT-RJ fiber extension cable

Environment

The Fiber Expansion Daughterboards and Fiber Receiver cards are subject to the environmental conditions shown in Table 91.

Table 91
Environmental conditions

	Operating	Storage
Ambient temperature	0° C to 50° C (32° F to 122° F)	-45° C to 70 ° C (-49° F to 158° F)
Relative Humidity	5% to 95%	0% to 95%

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Small System

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